A Public Policy Patch:
Cigarettes, Addiction and the Role of Self-Control

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This paper examines the role of self-control in price elasticity of cigarette demand. Recent theories of addiction have introduced deviations from rationality into the rational addiction framework. They have proposed that increased taxes on addictive goods could function as state-imposed self-control mechanisms. However, if individuals are unresponsive to cigarette taxes and continue to smoke in the presences of increases taxes, then these taxes will only act as a burden on those prone to temptation. Using data from the National Longitudinal Survey of Youth, I find that while overall response to cigarette taxes is quite small, individuals with self-control are significantly more responsive to prices than individuals without self-control, providing evidence towards models of addiction that incorporate human error and suggesting that taxes alone will not be sufficient in decreasing smoking among young adults.

Use doth breed a habit – William Shakespeare, "The Two Gentlemen of Verona"[1]

1. Introduction

Many habits of everyday life can be described as addictive. People can become addicted not only to traditionally addictive goods such as cigarettes, alcohol and caffeine, but can also become addicted to activities such as eating, working, exercising, watching television and practicing religion. The degree of an addiction varies from habit to habit and from person to person but addictive goods and activities all meet two conditions required for addiction. First, addictive goods are reinforcing, meaning that the more the agent consumes a good or engages in an activity, the more they want to continue doing so; and second, users develop a tolerance, meaning that the more the agent engages in the activity or good today, the less utility he or she will derive from a given amount of the activity or good in the future.[2]

Until the mid 1980s, economists modeled addictive activities with simple models of habit formation, or deemed these activities irrational and largely excluded them from standard economic analysis. In 1988, Becker and Murphy developed a model of rational addiction in which consumption of addictive goods is consistent with optimization according to stable preferences. Even though addiction appears to be the antithesis of rational behavior, Becker and Murphy (1988) posit that individuals do recognize the full price of consuming the addictive good or engaging in the addictive activity but choose to consume or pursue it anyway because the current gains outweigh any costs. More recently, many extensions of the model have emerged that in some way incorporate human error and deviations from rationality. Some models focus on "time inconsistency," where current and future selves make different optimal decisions and where due to self-control problems, people are unable to consume the optimal amount of the addictive goods. Other models focus on the cue-triggered impulsive use of addictive goods in which agents exist in "hot" and "cold" states and are driven by visceral urges to deviate from rationality and consume the addictive good as soon as the "hot" state is triggered.

[1] Adopted from Becker and Murphy (1988)
[2] Gruber and Koszegi (2001)

These differing models of addiction lead to starkly different policy prescriptions; therefore, understanding the underlying behavioral motivations is paramount to effectively altering consumption. Becker and Murphy's model of rational addiction calls for small taxes to correct for externalities associated with the addictive behavior. Just as with non-addictive goods, taxes in this context are welfare reducing for the user. However, models with time-inconsistency emphasize the potential self-control benefits of taxation wherein taxes can function as state-imposed commitment devices. These models call for much larger taxes on addictive behaviors, and, under certain circumstances, may even be welfare improving. Alternatively, models that focus on cue-triggered addiction predict that there will be very little behavioral change in response to taxation and therefore, taxes are likely to be welfare reducing and a fee on those prone to visceral temptation. Optimal behaviors in this model include policies such as smoking restrictions or illegalization that decrease the environmental triggers for the "hot" state.

This study relates to the emerging literature that examines deviations from rational addiction, extensions to the rational addiction model, and the role that self-control plays in addictive behaviors. I examine these underlying behavioral models using the case of cigarette consumption. Cigarette consumption is ideally suited for this analysis because: it is undeniably addictive due to its nicotine content; it is legal, and therefore self-reported measures will be more reliable than other drug use; prices are easily available; and it is the most widespread addictive behavior in today's society.[3] Tobacco is responsible for an estimated 400,000 annual deaths and over 8.5 million Americans live with a serious illness caused by tobacco use, making it the single largest preventable cause of premature death and disability in the United States.[4] Therefore, reducing the incidence of smoking is a pressing public health concern.

In the past two decades, aggregate smoking has actually declined significantly. This effect has been achieved through a web of tobacco control policies including dissemination of health information, anti-smoking advertising, restrictions on smoking in public places and increased excise taxes. Specifically, higher cigarette prices have emerged as a mainstay effort to decrease smoking and from 2000-2006, in addition to

[3] Chaloupka (1991)
[4] Fletcher, Deb and Sinclair (2009) and Chaloupka (1991).

federal cigarette tax hikes, 43 states enacted a total of 70 cigarette excise tax increases.[5] In January 2009, Congress raised the federal cigarette tax from $0.39 per pack to $1.01 per pack. Most recently, in the summer of 2010, New York state increased taxes by $1.60, pushing the average price per pack of cigarettes to $9.20 and making it the highest cigarette tax in the country. In order to determine the impact these policies will have on smoking behavior, it is crucial to understand addictive behavior.

Specifically, this study uses data from the National Longitudinal Survey of Youth (NLSY) to investigate whether an individual's degree of self-control plays an important role in his or her response to cigarette taxation. The graphs below, derived from the NLSY data, show clearly that self-control is an important factor in smoking behavior. People with self-control smoke less and the gap appears to widen with age.

Figure 1A. Smoking Participation vs. Age

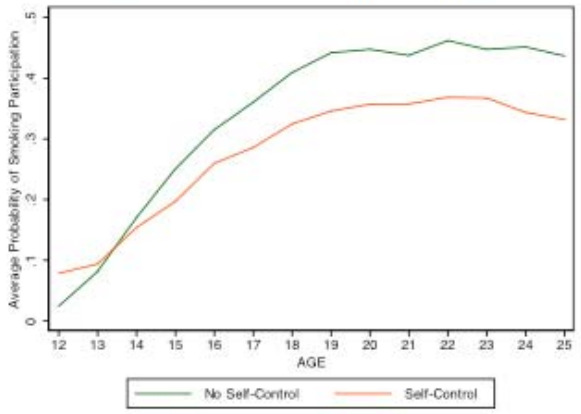
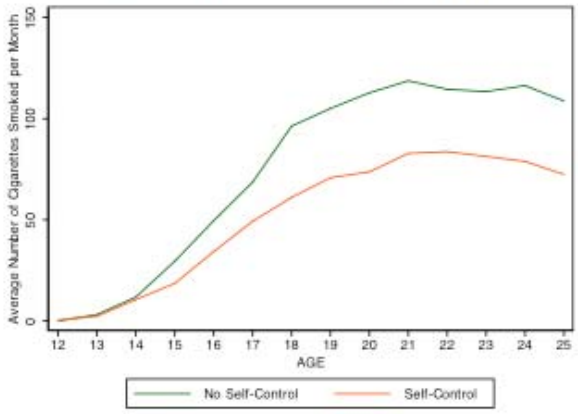


Figure 1B. Monthly Consumption vs. Age



However, the importance of self-control by itself does not provide much insight into the differing underlying models of addiction; to begin to explore the behavioral models, I attempt to examine whether or not this variation in self-control results in differing responses to price. Under the rational addiction model, self-control would not be an important determinant in response to changes in price; while it may affect the initial decisions whether to smoke and how much to smoke, self-controlled and non self-controlled agents both behave as rational addicts and therefore factor price changes into their utility maximization problem similarly. However, if people with self-control

[5] DeCicca, Kenkel and Mathios (2008)

problems are less responsive to price than people without self-control problems, there is evidence toward models of addiction that incorporate some deviations from rationality.

In order to isolate a causal effect of taxes on smoking behavior and to estimate the role of self-control in consumer responsiveness to taxes, this study uses a fixed effects model. I find that while overall, people are generally not very responsive to prices, there is a significant difference in the price response between people with and without self-control. People without self-control are largely unresponsive to changes, while people with self-control decrease both the probability that they will smoke as well as their smoking intensity. Similarly, while people without self-control show no response, people with self-control are less likely to start smoking and are more likely to quit with an increase in prices. Additionally, I find that the price changes affect only initiation decisions immediately but take some time to affect other smoking behaviors, and as price increases recede farther into the past, self-control becomes a more important determinant in price response. While the results of this study do not rigorously test the variations in the underlying models, they do provide evidence supporting the behavioral models that incorporate deviations from rationality. Still, inferring evidence for the underlying models of addiction must be done with caution. By testing the differential response to a non-addictive good, I find that at least part of the effect I am detecting is a general attentiveness to prices. These findings nevertheless have important implications for public policy and imply that increased taxes alone will not be sufficient in reducing cigarette consumption for over half of the smoking population.

This paper will proceed as follows. Section 2 will provide a detailed review of both the theoretical foundations of models of addiction and their implications for policy as well as an overview of the extensive literature on the challenges of estimating cigarette demand. Section 3 discusses the data used in this study and Section 4 describes the empirical methods - fixed-effects models first examining aggregate responsiveness to price to compare to the literature and then exploring the heterogeneity in responsiveness due to the degree of self-control. Empirical results are presented in Section 5 and are discussed and related to the theoretical models in Section 6.

2. Background Literature

2.1 Models of Addiction

2.1.1 The Rational Addict

The path-breaking concept of rational addiction was introduced by Becker and Murphy in 1988. In their model, agents are rational in that they follow a consistent plan to maximize utility over time, subject to the constraint of their budgets. They are assumed to recognize the full price of consuming addictive goods – the current and future monetary costs, the long-term health costs, and the future increases in consumption due to today's consumption of the addictive good - and make rational utility-maximizing decisions accordingly. In the case of cigarettes, smokers choose to smoke today because the gains from an additional pack of cigarettes exceed any current and future costs. The addictive nature of the good in this model is captured by the effect that past consumption has on consumer's current consumption choice: a higher stock of past consumption leads to a greater marginal utility from consuming today**.** This rational framework was critical in our understanding of addictive goods, as it brought them into the standard economic analytic framework of utility maximization.

Becker and Murphy's 1988 model of rational addiction has several implications for public policy. The model predicts that because agents are already optimizing as rational forward-looking consumers, they will respond to the implementation of a tax on the addictive good by decreasing consumption. The tax on the addictive goods increases both the present and future monetary costs of consumption and therefore the consumer adjusts current consumption downwards to balance the current benefit of consumption and all future costs. This decrease in the consumption of an addictive good due to price increases would be larger than the change in consumption of a non-addictive good because consumers of addictive goods take into account the implied increase of all future prices as well as the change in the current price. Additionally, because today's consumption choice is linked to future consumption, agents will respond today to future changes in price. As with non-addictive goods, the introduction of the tax decreases the consumer's present discounted utility because the good he or she enjoys is now more expensive. Since consumption of the addictive good is still very similar to that of any

other good, it is optimal in this framework to impose a small tax, meant only to correct for any externalities associated with the consumption of the addictive good.

Empirical tests of the Becker and Murphy (1988) model have largely supported rational addiction, although they have been difficult to interpret conclusively. Becker, Grossman and Murphy (1994) use aggregate sales data to examine the effect of past and future prices on current cigarette consumption. They find support for three of the model's main predications: 1) consumption in different periods are complements and therefore cross price effects are negative, 2) long run responses exceed short run responses and 3) permanent price effects exceed temporary price effects. They estimate that a 10 percent permanent increase in the price of cigarettes will lead to a 4 percent short-term decrease in consumption and a 7.5 percent long-term decrease in consumption, illuminating the intertemporal linkages in cigarette demand predicted by the model. Chaloupka (1991) uses micro data to develop cigarette demand equations derived from the Becker and Murphy model and finds estimates that support the model's incorporation of an individual's addictive stock to determine current consumption, as well as the model's hypothesis that increasing the price of cigarettes will reduce smoking.[6] The study finds additional support for the model with estimates that more myopic, or more addicted, individuals were more responsive in the long run to changes in price.[7] Gruber and Koszegi (2001) critique previous empirical tests of the model that implicitly assume that consumers are able to forecast future cigarette prices as much as a year in advance when evidence shows that few changes in cigarette prices are also announced that far in advance. They present an alternative test using monthly data on cigarette consumption and examine consumer responsiveness to tax changes that have been enacted but are not yet effective. Their results also show support for forward-looking behavior. However, Auld and Grootendorst (2004) questioned the validity of the model by presenting a falsification test using the demand for milk, a known non-addictive good. They showed that when the rational addiction model is applied directly to aggregate data, it can yield

[6] Specifically, Chaloupka (1991) estimates doubling the federal excise tax would lead to a 15 percent increase in price and a 4 to 6 percent decrease in consumption of cigarettes.

[7] More myopic individuals would be more responsive to changes in price because the effect of the price change is magnified farther. Because the more addictive individual has a larger addictive stock, their future implied consumption is greater and therefore the increase in future prices implied by a price increase today is larger for more addicted individuals.

spurious results. Using the standard rational addiction model, they even found that milk is more addictive than cigarettes and concluded that aggregate time series data is insufficient to differentiate rational addiction from serial correlation in consumption patterns.

2.1.2 Alternative Models of Addiction

Since the introduction of the rational addiction model, many researchers have developed extensions to the model that in some way incorporate consumer error and the subsequent deviations from rationality. In 2001, Gruber and Koszegi present a model that incorporates time-inconsistent preferences into Becker and Murphy's rational addiction model. Gruber and Koszegi (2001) argue that people demonstrate intrapersonal conflict over decisions that have implications for the future, as evidenced by people's need to turn to commitment devices or self-control techniques to reduce consumption, as well as by smokers' demonstrated inabilities to actualize intended future smoking levels. To capture the individual's time-inconsistency when in the rational addiction framework, their model specifically assumes hyperbolic discounting preferences. They assert that because individuals lack perfect self-control and have a bias for the present, they are unable to achieve optimal levels of consumption.

This model of addiction has starkly different implications for public policy than Becker and Murphy's model of rational addiction. In the time-inconsistency model, the agents will also decrease their consumption of the addictive good in response to an increase in taxation, as taxation raises the present and future price of consumption. However, because the agents suffer from low self-control and are unable to consume as little as is optimal, the decrease in their consumption due to taxation would be less than in the rational addiction model. Because they discount the future more than is optimal, agents do not incorporate the full cost of higher future prices in their assessment of the cost of consumption today; their optimal consumption after a tax change would therefore be higher than a fully rational addict. In this framework, individuals with self-control problems would be less sensitive to price than individuals without self-control problems. Gruber and Koszegi (2001) further suggest that optimal taxation is in fact much larger than in the rational addiction framework, as it functions not only to correct externalities,

but also to correct the "internalities" that agents impose on themselves. Taxes in this framework function as a self-control device for agents who are unintentionally deviating from rationality due to poor self-control. They argue that the optimal tax should be at least $1 higher than in the rational addiction framework, and could even be as high as $30 per pack.[8] In subsequent analysis, Gruber and Koszegi (2004) show evidence that if low income individuals have small short term discount factors, the self-control benefit of taxation can exceed the monetary costs, meaning that taxation of addictive goods in this case is less regressive than in other models and could even be progressive under certain parameters.

Since Gruber and Koszegi's model yields predictions of forward-looking behavior very similar to the rational addiction model for sufficiently addictive goods, the previous empirical tests of the Becker and Murphy (1988) model, including those discussed above, are unable to distinguish the rational addiction model from this alternative. Gruber and Koszegi (2004), however, find evidence for their model by examining the welfare implications of taxation. They use the General Social Survey's self-reported measure of happiness to show that smokers were better off with the implementation of a tax on cigarettes, a prediction consistent with their model and the self-control benefit of taxation.

Bernheim and Rangel (2004) develope a different behavioral model of demand for addictive goods that builds on the rational addiction model but in which agents are driven to deviate from optimal consumption because of visceral urges. Their model derives from three psychological observations: that use of addictive goods among addicts is usually a mistake; that experience sensitizes individuals to environmental cues that trigger mistakes; and that addicts can manage their susceptibilities. In this model, consumers exist in two states – "hot" and "cold." In the "cold" states, agents act as Becker and Murphy's rational consumer, choosing levels of consumption that maximize utility. However, when triggered by environmental cues such as an advertisement for cigarettes or someone smoking next to them in a bar, agents move into the "hot" state, in which they short circuit the rational process, their decisions and preferences diverge, and the agents consume more of the addictive good than they would have in the cold state.

[7] This estimate comes from the calculation that a pack of cigarettes costs $30.45 in terms of life expectancy.

With regard to public policy, Bernheim and Rangel (2006) argue that in their model for addictive goods, there is almost no price sensitivity in consumption choice: because individuals in the "hot" state have abandoned the rational choice model, they will consume the addictive good no matter the cost (within reason). In this situation, taxes would optimally not exist at all, as they are ineffective at correcting either externalities or internalities, introduce distortions into the market, and are a very regressive form of revenue. Bernheim and Rangel (2006) suggest that optimal public policy should be aimed at averting mistakes and ameliorating the burdens on the addicted. They even suggest that under certain conditions, it could be optimal to subsidize addictive goods: the "subsidy to rehabilitation" is optimal only in a situation when consumption is mistakenly triggered and when the likelihood of use rises with the stock of past consumption. When the good is sufficiently inexpensive (as in the case of cigarettes) and when the likelihood of use decreases with past stock of consumption, then a small tax is optimal.

Fletcher, Deb and Sinclair (2009) find results consistent with the cue-triggered theory of addiction, or any model in which self-control is an important determinant of consumption. As explored in this paper, their study examines differential cigarette tax elasticities in adolescents and finds that the individual's degree of self-control and future discounting is strongly related to the agents' responsiveness to taxation. Specifically, they find that consumers with self-control problems are more likely to be unresponsive to changes in price. Their results indicate that self-control is a significant contributing factor in tobacco consumption and suggest that taxation alone will not be successful in reducing the incidence of smoking in teenagers. However, their study uses pooled cross sections and does not control for state-specific effects such as anti-smoking sentiment and is, therefore, likely subject to omitted variable bias.

Gul and Pesendorfer (2004) offer yet another model of demand for addictive goods that focuses on agents' inability to resist temptation. In this model, consumers are assumed to have a preference for commitment, and because self-control can be costly, their welfare can actually increase when options are eliminated. The consumer's utility depends not only on actions chosen but also on actions available but not chosen, called temptations. For example, if agents are not allowed to smoke, they receive a certain utility from not smoking. However, if they are allowed to smoke and have to use their

self-control to choose not to smoke, their utility from not smoking will be less than in the previous case. The agent's choice is a trade-off between the commitment utility - what he would have done in the absence of alluring choices – and temptation. An agent displays addictive behavior if his consumption does not maximize his commitment utility, but is rather distorted by temptation.

2.2 Taxation as a commitment device

Behavioral economics has only recently begun to examine taxation, not only as a method to raise revenue, correct market failures, or internalize externalities, but also as a self-control mechanism to help agents control consumption. O'Donoghue and Rabin (2006) re-examine optimal sin taxes in the presence of self-control problems. They conclude that because sin taxes on unhealthy goods counteract the over-consumption of consumers with low self-control and naturally redistribute income to those without self-control problems who don't consume as much of the taxed good, sin taxes can actually benefit everyone. Hersch (2005) finds evidence to support this idea of sin taxes as a beneficial self-control mechanism. She finds that smokers who are trying to quit are more in favor of smoking regulations than other smokers, supporting the theory that smokers can use the discipline imposed by the cigarette tax to reduce the private costs of quitting.

The self-control function of taxation may be least controversial when applied to youths, who are widely believed to have trouble both with self-control and assessing long-term costs (Casey et al. 2008). Adolescence is a developmental phase associated with suboptimal decisions and low impulse control, leading to increased incidence of risky behavior (Casey et al. 2008). For example, in a sample of high-school seniors, 67% of established smokers had a declared serious intention to quit. However, in a follow-up survey a year later, while 60% had attempted to quit in the preceding year, only 21% of those who attempted to quit were still abstaining a year later, and only 3% had quit beyond 12 months (Burt and Peterson, 1998). This study suggests that teenagers in particular experience problems committing to plans to quit, and therefore could benefit more than their older counterparts from a program that aids their self-control.

Alternatively, Bernheim and Rangel (2005) discuss the shortcomings of taxation as a self-control mechanism. They argue that if the consumption of addictive goods is

largely compulsive rather than fully rational, the imposition of a tax has no effect on the consumption decision of most users. They propose alternative policies such as criminalization, prescriptions for the addictive good, restrictions on advertising, and the creation of counter-cues. These policies could be better mechanisms of self-control than taxation because they decrease the occurrence of environmental cues while being minimally inconvenient to the users. Camerer et al. (2003) coined the phrase "asymmetric paternalism" to describe the implementation of regulatory policies such as these that greatly benefit those who make mistakes and do little harm to those who are fully rational. In their paper, they use the example of driver licensing to illustrate the concept: if it is relatively costless to administer, then it imposes little burden on good drivers but is a legitimate obstacle to those who are incompetent and should remain off the road. Any public policy towards addictive goods that functions as a self control mechanism could be classified similarly as a kind of asymmetric paternalism – it acts a barrier to those who are over-consuming due to low self-control, but does not greatly burden those who do not consume.

Smoking bans in offices, bars and restaurants are an example of one such policy. These bans impose little burden on non-smokers but present a large obstacle for smokers, who literally must remove themselves from the premises to have a cigarette. The cue-triggered model of addiction would suggest that the removal of other smokers from social settings would decrease environmental triggers and reduce the chances that individuals enter their "hot" state. Evans, Farrelly and Montgomery (1999) study the smoking ban in offices and find that smoking rates were 4 percent to 6 percent lower in work places with bans than in work places without bans.[9] They estimate that taxes would have to increase by 400% to induce a similar change in smoking behavior. Similarly, Wakefield et al. (2000) explore the effect of smoking restrictions specifically on teenage smoking, and estimate that stronger restrictions on smoking in public places reduced the chance of transitioning from an experimenting smoker into an established smoker by 10 percent.[10] Chaloupka and Grossman (1996) also find that relatively strong restrictions on smoking

[8] These results were found with a simple regression model. Similar results were found with a simultaneous equation model, suggesting that the model is not subject to bias from omitting a measure of the institutions overall healthiness.

[9] Fichtenberg and Glantz estimate that in order to achieve the same decrease in smoking participation and consumption, taxes in the United States would need to increase by 300 percent.

significantly reduce the probability that a youth will smoke.

2.3 Estimating the Price Elasticity of Cigarette Demand

Federal and State taxes on cigarettes have been one of the most politically popular policies employed to decrease smoking. However, the vast literature on price elasticity of demand for cigarettes has recently called into question the effectiveness of taxes. Many early studies use aggregate data to estimate the effect of state taxes on cigarette supply, controlling for demographic factors, income, and other tobacco policies. These studies generally produce estimates of price elasticitiy of demand in a narrow range centered around -0.4. However, studies using time-series data are potentially subject to large biases due to the high correlation among the key independent variables and price. Including these variables in the model results in multicollinearity and extremely sensitive estimates; however, excluding them from the regression produces biased estimates for the effect of price. Additionally, because prices, aggregate demand, and aggregate supply of cigarettes are simultaneously determined, analysis using aggregate data is likely subject to simultaneity bias. Studies of aggregate demand are limited to examining aggregate or per capita consumption and therefore are unable to explore the heterogeneity in the responsiveness to taxes. Lastly, a more technical problem with using aggregate studies is the inaccuracy of the measurement of cigarette consumption. In most studies, the measure of aggregate smoking is derived from the state-level tax paid cigarette sales. Since prices vary significantly by state, there are incentives to smuggle cigarettes from high-price states to low-price states. Tax-paid sales data is likely to overestimate consumption in low-tax states and underestimate consumption in high tax states, creating an upward bias on the effect of tax on cigarette consumption.

More recently, studies have explored the use of micro-level data to measure the effect of prices on the demand for cigarettes. In general, the estimates of price elasticities from these studies are negative, significant, and similar to those using aggregate data. However, using micro-data has several advantages. Because individual consumption probably will not affect the market price of cigarettes, simultaneity bias is unlikely, and therefore, price is more easily treated as exogenous. Similarly, individual-level income and socio-economic measures are less correlated with price and other policy variables

than similar aggregate level variables. Additionally, micro level data allows for the separation of the effect of price on the probability that an individual smokes from the average consumption among smokers. With longitudinal data, researchers can also examine the effect of prices on smoking initiation and cessation decisions. Lastly, micro-data can also be used to explore heterogeneity in response to prices, allowing for differential responses by age, gender, race, etc.

Some problems still arise when using micro-level data to estimate the price elasticity of cigarette demand. Again, failing to account for the interstate smuggling of cigarettes due to differences in cigarette prices will again bias results, although this time the bias will be towards zero. This is because while the measure of reported cigarette consumption per person will be unaffected, the price assumed for each individual may overstate the price they actually pay. Many studies with individual level data have attempted to capture this cross-border smuggling in a variety of ways. Some studies restrict the sample to people who do not live near a lower price range (Lewit and Coate 1982); some have computed an average price based on the price in their region and nearby regions (Chaloupka1991); and other have included in their models a measure of price differential between their region and surrounding regions. As with state tax-paid data, there is also the possibility that self-reported cigarette consumption is inaccurate. Warner (1978) compared individually reported consumption to aggregate sales data and found that self-reported consumption significantly under-reported actual consumption.

Lastly, one of the largest problems with using micro-level data and relying on cross-state tax differences for identification of causal effect is controlling for hard-to-observe characteristics such as anti-smoking sentiment. Because state taxes are not exogenously set but rather are the result of a political process, it is likely that taxes are correlated with the public's demand for anti-smoking policies. Since state-wide or even individual anti-smoking sentiment is very likely correlated with smoking decisions within that state or individual, failing to account for this factor would lead to significant omitted variable bias. Even in the absence of a causal effect, anti-smoking sentiment could produce a negative spurious relationship between prices and smoking consumption. This significant omitted variable bias has been addressed in the literature in several different ways. Some studies attempt to directly control for anti-smoking sentiment in various

ways; some include an indicator for whether the state grows tobacco, where the anti-smoking sentiment is assumed to be low. Others include lagged aggregate consumption measures or control for the average religious attendance of the state. To the extent that these proxies for anti-smoking sentiment capture the attitudes of the individuals within the state, inclusion of these control variables should decrease the omitted variable bias. One of the most interesting strategies to directly control for this omitted variable was employed by DeCicca et al. (2008), who explicitly construct a measure of anti-smoking sentiment using responses to questions in the Tobacco Use Supplement to the Current Population Survey. They construct a factor of anti-smoking sentiment for individuals based on their answers to nine anti-smoking attitudinal questions and then averaged them across each state to construct a measure of state anti-smoking sentiment. In fact, once DeCicca et al. (2008) control for anti-smoking sentiment using their constructed measure, they find that prices no longer have a significant effect on smoking behavior

Alternatively, several other studies have used repeated cross sections and rely on within state variation in cigarette taxes for identification, rendering cross-state differences in anti-smoking sentiment irrelevant. To the extent that anti-smoking sentiment does not change over time or vary significantly within the state, this methodology should purge the model of the anti-smoking sentiment biases. Results using fixed effects models are mixed. Gruber and Zinman (2001) use longitudinal data and employ state and year fixed effects to examine the effect of cigarette prices on youth and found that prices have a significant negative effect on cigarette consumption of older adolescents but have no significant effect on younger youth. Similarly, Carpenter and Cook (2008) use a two-way fixed effects model to examine the smoking behavior of youth and find that increases in taxes are associated with decreases in both youth smoking participation and frequency of smoking. However, DeCicca (2002) uses longitudinal data and state and time fixed effects and find that once state fixed effects are controlled for, prices have no significant effect on smoking initiation among youth. Few published studies in the literature employ individual fixed effects models. If anti-smoking sentiment varies on the individual level rather than the state level, then failing to account for this could be another source of bias within the literature.

2.4 Smoking in Adolescents

As this study uses data on adolescent smoking behavior, it is important to note that adolescent smoking decisions and behavior may differ from those of adult smokers. While the prevalence of adult smoking declined by almost 20% in the late half of the 20th century, throughout the early 1990s, the incidence of adolescent smoking steadily increased from 28% to 37% (Center for Disease Control 2009). In fact, in 1997, the youth smoking rate was about 50% greater than the adult smoking rate (Gruber and Zinman 2001). From 1997-2003, the youth smoking rate declined sharply to 21% but stagnated at that level through the rest of the decade. Since adolescence is when most smokers begin their habits and form addictive patterns and since youth smoking often leads to adult smoking in a way that is underestimated by the youth themselves, public policy aimed at decreasing smoking in adolescents has become a primary concern for both researchers and politicians.[11]

Higher cigarette prices, achieved through taxation, have been the main mechanism through which the government has tried to discourage adolescent smoking. Much research has been conducted on the adolescent response to changes in prices and the effectiveness of tax policy. An inverse relationship between price and age was first supported by Lewit et al. (1981) who estimate a price elasticity of demand for 20-25 year olds that was almost double that of persons over 26. They also conclude that men were very responsive to price while women were generally unresponsive to price. Gruber and Zinman (2001) find that out of all the determinants of smoking among older teens, price is the most important. In 1998, the U.S. Treasury Department proposed an estimated youth price elasticity of smoking of -0.7 percent, meaning that a ten percent increase in the price of cigarettes will lead to a decrease in the youth participation rate of 7 percent. In fact, the majority of studies throughout the late 1990s that examined youth smoking habits estimated adolescent price elasticities that are at least as high as those estimated for adults.[12]

[10] The NHSDA showed in 1991 that among adult smokers, 89 percent had had their first cigarette and 71.2 percent were already daily smokers by the age of 18 (U.S. Department on Health and Human Services 1994)

[11] Decicca et al, 2002

Youth smoking could be more sensitive to price than adult smoking for many reasons. Lewit et al. (1981) suggest that because cigarettes are addictive and adults are longer-term smokers, they are likely to adjust more slowly to changing prices than youth, who have only recently begun consuming the addictive good. Lewit at al. (1981) also propose that because adolescents are easily influenced by their peers, the effect of changing prices may be multiplied. Higher prices can decrease youth smoking both directly and indirectly by reducing the cigarette consumption of peers. Grossman and Chaloupka (1996) suggest that youths are also likely to be more sensitive to price because they spend a higher fraction of their disposable income on cigarettes.

However, the inverse relationship between price elasticity and age is not consistent in the literature. Wasserman et al. (1991) use a generalized linear model and find that price has an insignificant effect on youth smoking but that the demand became more elastic as their sample aged. Similarly, using micro longitudinal data, DeCicca et al. (2002) find only weak or nonexistent responsiveness to tax changes among eighth and twelfth grades. DeCicca et al. (2004) look at the variation in effective tax prices faced by youths who moved across state lines in the sample years compared with those who stayed, and again find no association between youth cigarette consumption and cigarette prices. They suggest that this result may be explained by the influence of peers. Rather than having a reinforcing effect, the desire for peer acceptance may decrease the youth sensitivity to price. If youth smoking behavior is determined largely by a desire for peer acceptance and there are few other substitutes for cigarettes in terms of peer acceptance, the price of cigarettes may be only a very small share of the total cost of peer acceptance, resulting in a relatively inelastic demand for cigarettes with respect to price. Chaloupka (1991) examines cigarette demand in the Becker and Murphy (1988) rational addiction framework and also finds that youth are less responsive to price than their adult counterparts. Under the rational addiction model, because of the forward looking behavior of addicts, more addicted and therefore more myopic individuals are more responsive to long run changes in prices than their less addicted and therefore less myopic counterparts. Since youth behave more myopically than their more educated adult counterparts, Chaloupka's findings that youth are less responsive are consistent with the rational addiction model.

2.5. Smoking Cessation and Initiation

Adolescent smokers are different than adults not only in their sensitivity to price, but also in their initial decision to smoke at all. Very few people start smoking over the age of 22 and therefore increases in taxes incentivize adults to quit smoking or decrease their dependence. However, tax increases mainly deter youths from starting and incentivize them to abstain from smoking altogether.[13] If tax incentives have a different effect on starting and quitting, then the effect of taxation would necessarily be different for youth and adults.

A tangential economic literature on the price elasticity of smoking initiation and cessation has emerged in the last few decades. Douglas and Hariharan (1994) employ micro level data and a split population model to estimate the effect of taxes on the probability that teenagers will begin smoking. They find that after they control for standard control variables including age, gender, race, family income, and marital status, taxes have no effect on the decision to initiate smoking. Similarly, DeCicca, Kenkel and Mathios (2008) examine smoking initiation patterns in youth using the National Education Longitudinal Study and find no evidence that higher taxes reduce smoking initiation. However, DeCicca, Kenkel and Mathios (2008) did find some evidence that higher taxes were associated with increased cessation. Similarly, Tauras and Chaloupka (1999) use longitudinal data and duration modeling to find that increases in cigarette prices lead to significant increases in smoking cessation among both male and female youths. They estimate a price elasticity of smoking cessation of 1.12 for males and 1.19 for females. They also find that stronger restrictions on workplace smoking would increase smoking cessation among employed females.

Despite the vast research committed to estimating cigarette demand, it remains unclear whether taxes have a true causal effect on smoking behavior. This study begins by adding another estimate of the price responsiveness of cigarette demand. I then attempt to relate these findings to the behavioral economics literature on models of addiction and explore if this effect varies across individuals depending on their degree of

[12] DeCicca et al. (2002).

self-control. Does cigarette taxation act as a self-control mechanism as Gruber and Koszegi (2000) would argue, or is it merely a fee on those prone to visceral motivations?

3. Data Description

This study uses National Longitudinal Survey of Youth 1997 Geocode Data (NLSY97) from 1997 to 2008.[14] The National Longitudinal Survey of Youth 1997 is a longitudinal survey that follows an original cohort born between 1980 and 1984 (aged 12-16 in round 1 of the interview process). The survey is designed to document the transition from adolescence into adulthood and includes comprehensive questionnaires on a wide range of activities. In the first round of the survey, both the respondents and their parents participated in an hour-long survey and received a detailed questionnaire on demographics and family background. The respondents continue to be interviewed annually but parent interviews were administered only until round 5 (2001). The NLSY97 was administered using a computer-assisted personal interview system, which automatically guides respondents through questions depending on their age and previous answers. Sensitive questions, including those on cigarette use, were administered through a computer assisted self-administered interview technology, allowing respondents to enter their answers without the interviewer knowing the answers. Interviews are administered continually throughout the year. The survey contains two subsets – one sample of 6,748 individuals that is representative of the population demographics in 1997 and another sample of 2,236 individuals, which is designed to over-sample Hispanic and Black populations. This study will restrict its analysis to the cross-section representative sample.[15] Like most longitudinal data, this panel is unbalanced as the retention rate in the first 12 rounds was 83.3 percent. Reasons for non-interview included death, illness, inability to locate the subject, and refusal. This is a concern only if the reasons for dropping out of the survey are related to our parameters of interest which is unlikely.

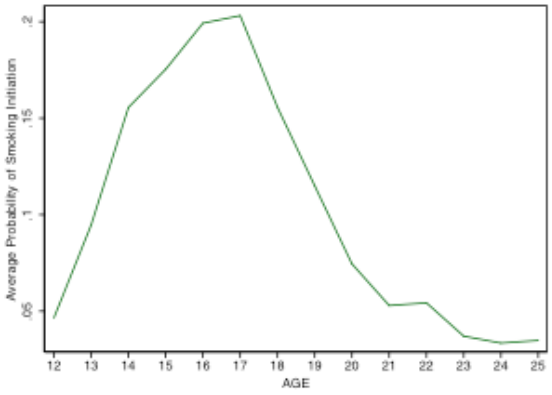
In this study, I examine multiple measures of cigarette consumption. To construct a measure of smoking intensity, I capture monthly cigarette consumption by combining the answers to the following two questions: "During the past 30 days, on how many days

[14] The data was obtained through special license through the Bureau of Labor Statistics.
[15] However, when analysis is repeated on the full sample, the difference is trivial.

did you smoke a cigarette?" and "When you smoked a cigarette during those past 30 days, how many cigarettes did you usually smoke each day?" From these questions, I construct two different measures of smoking intensity. One measure is the monthly consumption of smokers in the sample in each year. For the second, I replace monthly consumption for non-smokers with zero to get the monthly consumption of both smokers and non-smokers.[16] I also analyze smoking participation with an indicator variable that is one if the respondent reports any positive value for the answer to the question "During the past 30 days, on how many days did you smoke a cigarette?" This measure captures somewhat regular smoking, as the respondent must have smoked in the 30 days prior to interview rather than just at some point in the previous year. This is beneficial for examining the effect of price on cigarette consumption as many light smokers borrow most of the cigarettes from friends (DeCicca 2002). I then break this measure of smoking participation down further into initiation and cessation behavior. A smoker is defined as having initiated smoking in that year if he or she reported that he or she smoked a positive number of days in the previous 30 days but had not reported smoking a positive amount in any previous survey year. Therefore, the sample in each year is all respondents who have never smoked or just started in that year. Conversely, a smoker is defined as having quit smoking in that year if he or she reports having smoked in the 30 days prior to interview in the preceding year but not in the current year. It is important to note that these measures of smoking cessation and initiation only capture first time initiation and first time cessation, and do not capture any subsequent relapses or failed attempts to quit.[17] This study will assume, as with most other studies using survey data, that underreporting is proportional across characteristics of interest and therefore will not systematically bias results.[18]

[16] I drop the top 1% of observations to correct for the biases introduced by large outliers.
[17] This specification of initiation and cessation is done to follow DeCicca (2008).
[18] Chaloupka (1999)

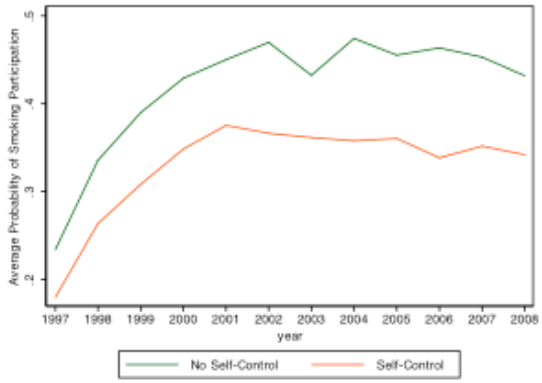
Figure 2A: Smoking Initiation by Age



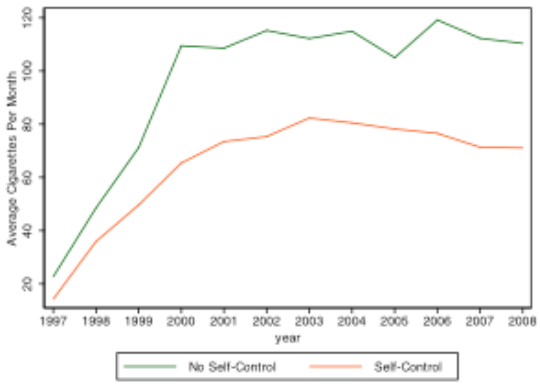
As seen in Figure 1 in the introduction, smoking increases significantly with age – 4.9% of 12 year olds smoke, 15% of 14 year olds, 28% of 16 year olds, and 41% of 20 year olds smoke. Above, Figure 2A shows that the probability that an adolescent will begin smoking decreases dramatically after age 17: for people who smoked some time during their lifetimes, the probability that they began at age 14 is 0.15, the probability that they began at 17 is 0.20 but the probability that they began at 20 is 0.07 and the probability that they began smoking at 24 is just 0.03. Additionally, Figure 3 below shows that over the sample period, smoking within an age cohort increases as the population ages.

Figure 3: Time trend of Respondents Age 15 in 1997

A. Participation



B. Monthly Smoking



I merge data on cigarette taxes at the state level using *The Tax Burden on Tobacco 2009.*[19] I use measures of both cigarette excise taxes and final prices. Figure 4 shows that excise taxes and prices increased steadily over my sample period. To account for changes in relative prices over time, the taxes are adjusted to 2010 dollars using the national Consumer Price Index published by the Bureau of Labor Statistics.[20] The state taxes are reported as of June 30 of that year. Because the survey is continuously administered throughout the year and tax changes become effective also at different times in different states, I do not make any adjustments for the timing of the tax change and the implementation of the tax.[21] It may be important to note that during the sample period (1997-2008), there were two increases in federal taxes – in 2000, the federal tax increased from 12 cents per pack to 17 cents per pack, and in 2002, it increased again to 19.5 cents per pack**.**

Figure 4A: Average State Cigarette Excise

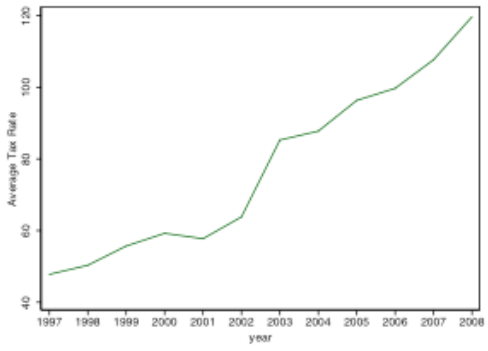
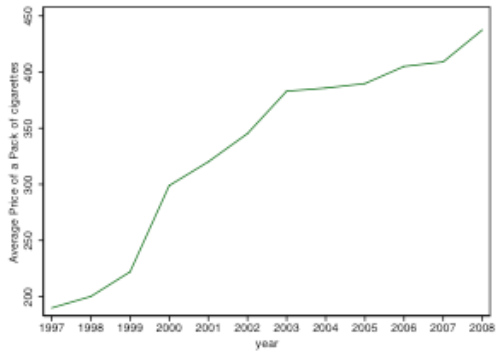


Figure 4B: Average State Cigarette Prices



The key independent variable in this analysis is the respondent's degree of self-control, which I proxy with the respondent's degree of conscientiousness. The link between conscientiousness and self-control is extensively studied in psychological literature. John and Srivastava (1999) label conscientiousness one of the "Big Five" individual personality factors and argue that it "describes socially prescribed impulse control" and "facilitates task- and goal-directed behaviors, such as thinking before acting,

[19] The state variable is only available in the restricted NLSY Geocode data.
[20] However, robustness of results is checked also using the final cigarette price inclusive of federal and state taxes but exclusive of local taxes, also adjusted to 2010 dollars. Once I control for state fixed effects, the difference between the two measures is trivial.
[21] This generalization is potentially one source of measurement error. If taxes change at the end of the fiscal year and the survey was administered to a respondent at the beginning of the fiscal year, then I may be ascribing the wrong tax rate to the respondent.

delaying gratification, following norms and rules, and planning, organizing, and prioritizing tasks" (121). In the field of economics, Ameriks et al. (2004) compare the EI gap – the difference between expected and ideal consumption – to the agent's degree of conscientiousness, and show that conscientiousness is a good predictor of whether or not individuals have self-control problems. They also demonstrate that a high degree of conscientiousness is correlated with fewer incidences of over-consumption and under-consumption. Following Ameriks et al. (2004) and Costa and Widiger (1994), I measure conscientiousness using the respondent's self-reported degree of organization, using the answer to the question "How much do you feel that disorganized describes you as a person?" This question was only asked in 2002 to respondents who were 14 or younger in 1996. The answer is reported on a scale from 1 to 5, with 1 being organized and 5 being disorganized.[22] From this I create an indicator which is zero for responses 1 or 2 and zero otherwise. Because self-control, conscientiousness and organization are generally static personality traits, I do not allow for it to vary with time.[23] The survey also includes a question that directly asks for the respondent's degree of conscientiousness: "How much do you feel that conscientious describes you as a person?" I use a respondent's degree of organization rather than the more direct degree of conscientiousness for two reasons. First, the degree of organization has marginally more observations; and second, it is likely more accurately reported. Because conscientiousness is a more intangible character trait, it may be more difficult for respondents, especially younger ones, to assess their own conscientiousness. However, because organization has easily observable results – messy rooms, ordered notebooks in school, etc, - it is likely to be an easier question to answer accurately. However, I check robustness of results using the self-reported degree of conscientiousness and find the difference is marginal.

Following Fletcher, Deb and Sinclair (2009), DeCicca (2002) and Chaloupka (1996), I also explore a comprehensive set of control variables in my analysis. I include a set of respondent characteristics, including gender, race, age and household income. To capture the respondent's educational achievement, I use a dummy variable indicating if

[22] The computer was set such that the respondent had to slide a bar to activate the answer. Therefore, it is possible that option 3 is underreported.

[23] As adolescence is a developmental stage in which self-control may be either developed and learned, this assumption may not hold in some cases. However, the question is only asked in 2002 and I therefore assume conscientiousness is constant over time for each individual.

the respondent completes high school over the course of the survey.[24] I also include an indicator of the percent of each respondent's peers who smoked in 1997, ranging from one (almost none) to four (almost all)[25] to capture some measure of the respondent's propensity to smoke, as well as a measure of the respondent's religious attendance which may capture the respondent's taste for risky activity. In addition to a set of respondent characteristics, I also include a set of variables to capture parental characteristics that may have an effect on the respondent's smoking behavior, including the father's educational achievement and a measure of household stability captured by whether or not the child lives in a two-parent household.[26]

Data on smoking restrictions (Clean Indoor Air Laws) come from the Center for Disease Control State Tobacco Activities Tracking and Evaluation (STATE) system.[27] The data was used to construct four indicator variables for state level restrictions on smoking in bars, restaurants, government workplaces and private workplaces. Additionally, this information was used to construct a variable that captures the magnitude of each state's clean indoor air laws.[28] This indicator takes the value three for extensive smoking restrictions if in that year the state regulates smoking in private workplaces. It takes the value two for moderate restrictions if it regulates smoking in restaurants or bars but not private workplaces. It takes the value one for basic restrictions if it limits smoking in government workplaces but not restaurants or bars or private workspaces. Finally, it takes the value zero if the state has no smoking restrictions. I also explore the effect of whether the state produces tobacco or not, which may capture state anti-smoking sentiment, and also comes from the STATE system. Data on state aggregate smoking consumption comes from the Tax Burden on Tobacco and is adjusted to be in packs per capita using population estimates from the US. Census Bureau Population

[24] I impose a constant education achievement because the respondent's years of education continually changes throughout the sample and therefore may not be exogenously determined**.** This measure of educational achievement captures a characteristic of the individual rather than the effect additional years of schooling on smoking behavior.
[25] This question was only asked in 1997 of people 14 or younger at the end of 1996.
[26] The father's education is measured in 1997. I use a father's education rather than mother's education because mother's education is not well reported.
[27] The data is measured as of the 4th quarter.
[28] This methodology follows Tauras and Chaloupka (1999), who followed the classification scheme in the Surgeon General Report 1989.

Division. Lastly, data on state sales taxes from 2000-2008 comes from the Tax Foundation and data from 1997-1999 comes from The Book of States.

Table 1 includes summary statistics of all of the independent and dependent variables used throughout the analysis. I lose 4,127 respondents who do not have self-control information (all respondents who were older than 15 at the end of 1996), and another 3,569 observations that are missing state identifiers.

Table 1: Summary Statistics and Variable Description

Variable	Obs	Mean	Std. Dev.	Min	Max
Smoking Variables					
Smoking Participation	70,204	0.36	0.48	0	1
Smoker Intensity	23,595	240.31	237.26	1	1200
Monthly Smoking	68,862	79.39	171.26	0	900
Smoking Initiaiton	36,636	0.12	0.32	0	1
Smoking Cessation	20,609	0.14	0.34	0	1
Smoking Policy Variables					
Imputed Cigarette Price	70,204	383.69	89.57	213.50	613.52
State Excies Tax	70,204	76.30	58.27	2.89	278.52
Grows tobacco	70,204	0.37	0.48	0	1
Index of restrictions	70,204	0.44	0.80	0	3
Bans in bars	70,204	0.08	0.27	0	1
Bans in restaurants	70,204	0.10	0.31	0	1
Bans in private worksites	70,204	0.12	0.32	0	1
Bans in gov. worksites	70,204	0.28	0.45	0	1
Agg. Consumption	70,204	65.97	54.11	2.5	275
Individual Covariates					
Organized	41,313	2.45	1.01	1	5
Self Control from organized	41,223	0.51	0.50	0	1
Conscienscious	41,223	3.44	1.08	1	5
Self-Control from Conscienscious	41,313	0.56	0.50	0	1
Age	70,204	20.23	3.76	12	29
Black	70,204	0.17	0.37	0	1
Hispanic	69,957	0.14	0.34	0	1
Father completed HS	63,280	12.98	2.78	1	20
Completed highschool	70,204	0.77	0.42	0	1
Income (in 1,000)	70,204	37.98	55.90	0	425.59
Lives in urban setting	67,836	0.75	0.43	0	1
Two parent household	62,559	0.61	0.62	0	3
Pct. peers who smoke	69,342	2.60	1.28	1	5

Note: Numbers represent the represetative cross-section

4. Empirical Methods

4.1 Dependent Variables

This study looks at four different measures of smoking behavior. The total number of cigarettes smoked is a composition of two effects – changes in participation and changes in smoking intensity [see Chaloupka and Grossman (1996), Gruber and Zinman (2001) and Evans, Farrelly and Montgomery (1999)]; therefore, first, I use both linear probability and logit models to estimate the effect of prices on smoking participation and then use ordinary least squares to estimate the average monthly cigarette consumption.[29] To explore the effect of taxes and self-control on smoking intensity decisions, I look at two measures of smoking intensity – monthly smoking among just smokers, and total monthly consumption, with non-smoker's monthly consumption replaced with zero.[30]

Because cigarettes are addictive by nature, it may also be important to distinguish initiation from cessation within participation. Without this distinction, there is no empirical difference between the decision to initiate and the decision not to quit; however, taxes may actually affect these two decisions differently. The model for the effect of prices on transitions between smoking and not smoking (cessation and initiation behavior) is motivated by a latent variable.[31] In the rational addiction model, non-smokers ($S_{t-1} = 0$) choose to begin smoking ($S_t = 1$) based on the utility gains from initiating smoking:

$$Y^{I*} = u(S_t = 1, S_{t-1} = 0) - u(S_t = 0, S_{t-1} = 0) \qquad (1)$$

where the consumer's utility from smoking in time t is determined by $u(S_t, S_{t-1})$. Similarly, a smoker ($S_{t-1} = 1$) decides to stop smoking ($S_t = 0$) based on the utility gain from quitting:

[29] Smokers in this context are defined to be any respondent who reported having smoked at least one cigarette in the 30 days before interview.
[30] This definition follows Evans, Farrelly and Montgomery (1999).
[31] This study uses a variation on an empirical model developed by DeCicca, Kenkel and Mathios (2008).

$$Y^{Q*} = u(S_t = 0, S_{t-1} = 1) - u(S_t = 1, S_{t-1} = 1) \qquad (2)$$

These utility changes are unobserved latent variables that motivate the discrete smoking initiation and cessation outcomes. I assume that the utility function from smoking in any given time period is a function of current price, other time varying factors (X), an environmental factor (F) such as anti-smoking sentiment and an error term.

$$Y^{I*} = \beta_0 + \beta_1 Price_t + \beta_2 F + \beta_3 X_t + e^I \qquad (3)$$

$$Y^{Q*} = \alpha_0 + \alpha_1 Price_t + \alpha_2 F + \alpha_3 X_t + e^Q \qquad (4)$$

Therefore, the smoking cessation and initiation decision will rely on whether $y^{*I} > 0$ or $y^{*Q} > 0$ and can be determined by the following equations:

$$P(I_t = 1 \mid S_{t-1} = 0) = G(\beta_0 + \beta_1 Price_t + \beta_2 F + \beta_3 X_t + e^I) \qquad (5)$$

$$P(Q_t = 1 \mid S_{t-1} = 1) = G(\alpha_0 + \alpha_1 Price_t + \alpha_2 F + \alpha_3 X_t + e^Q) \qquad (6)$$

$$P(S_t = 1) = G(\delta_0 + \delta_1 Price_t + \delta_2 F + \delta_3 X_t + e^P) \qquad (7)$$

I_t is an indicator of smoking initiation taking the value one if the smoker begins smoking in time t, Q_t is an indicator of smoking cessation taking the value one if the smoker stops smoking at time t and S_t is the decision to smoke at time t. This model captures the addictive nature of smoking by conditioning on the smoker's past smoking decisions.

4.2 Fixed Effects Demand Models

One critical issue throughout the literature has been how to deal with unobserved state and individual anti-smoking sentiment. State cigarette taxes and consequently prices are not randomly determined but rather are the result of a political process that reflects many characteristics of the state, including the public anti-smoking sentiment. If individual smoking sentiment is an important determinant of either smoking participation or conditional smoking intensity, then failing to account for it will lead to biased

estimates of the effect of price on cigarette smoking behavior. In order to explore the effect of this unobservable factor and illuminate the importance of controlling for it, I estimate three basic models, progressively controlling more rigorously for anti-smoking sentiment.

I begin with a simple cross-sectional model that attempts to directly control for anti-smoking sentiment with two proxies for anti-smoking sentiment: an indicator of whether or not the state is a tobacco producing state and a measure of intensity of restriction**.**

$$Y_{ist} = \beta_0 + \beta_1 sc_i + \beta_2\, price_{ist} + \beta_3 price_{ist} * sc_i + \sum_{j=4}^{k} \beta_j X_{jist} + \delta t + \varepsilon_{ist} \qquad (M1)$$

Here, i indexes individuals, s indexes states and t indexes years (t = 1…..12). Y_{it} is a measure of either smoking participation, initiation, cessation or conditional smoking intensity for individual i in time t. I use the natural logarithm of smoking intensity to account for the possibility that taxes affect smoking intensity differently at different levels of smoking.[32] sc_i is a measure of self-control, price is the state cigarette price inclusive of taxes in time t inflated to 2010 dollars, t is a set of time dummies, and X_{ist} is a complete set of individual control variables including gender, race, log of household income, an indicator if the respondent completes high school over the course of the sample and for whether the respondent live in an urban or rural setting, a measure of religious attendance, a measure of the respondent's father's education, whether or not the respondent lived with both parents, and the percent of their peers who smoked in 1997. Importantly, included in X_{ist} is a dummy variable that indicates whether the respondent resides in a state that grows tobacco and a measure of the intensity of smoking restrictions.

The coefficients of interest in this model are β_2 and β_3. β_2 captures the relative effect on state cigarette prices on youth smoking behavior for those individuals without self-control by comparing the smoking outcome of those individuals in a state with price changes to the smoking outcomes of individuals in states without price changes in each

[32] I actually use the log(1 + monthly smoking) to account for zero consumption.

year. β_3 captures the additional changes in smoking behavior due to changes in prices in each year for those individuals with self-control. For the measure of smoking participation, initiation and cessation, I estimate the model with both a linear probability model and a logit model. For the conditional smoking intensity, I use ordinary least squares. Robust standard errors are used throughout.

I then follow the literature and attempt to better control for the likely omitted variable bias by including a complete set of state fixed effects[33]:

$$Y_{ist} = \beta_0 + \beta_1 sc_i + \beta_2\, price_{ist} + \beta_3 price_{ist} * sc_i + \sum_{j=4}^{k} \beta_j\, X_{jist} + \delta t + \lambda S + \varepsilon_{ist} \qquad (M2)$$

where δt is a year fixed effect, and λS is a state fixed effect. All other variables are as those described above. Including state fixed effects removes from the regression any time invariant cross state effect, namely differences in anti-smoking sentiment. To the extent that anti-smoking sentiment does not vary within states or over time, this method should remove the omitted variable bias. I again estimate linear probability models and logit models for regressions with smoking participation, initiation and cessation and ordinary least squares for smoking intensity. Robust standard errors are used and clustered at the state level to allow for the possibility that standard errors are correlated over time within a state.[34] The variables of interest are again β_2, which captures responsiveness of smoking behavior to price by comparing variation in cigarette consumption over time within states with price changes to variation in consumption over time within states without price changes, and β_3, which captures the difference in responsiveness of those with self control and those without self-control.

Lastly, to account for the possibility that hard-to observe characteristics may vary on the individual level, I estimate an individual fixed effects model:

$$Y_{ist} = \beta_0 + \alpha_i + \beta_1 sc_i + \beta_2\, price_{ist} + \beta_3 price_{ist} * sc_i + \sum_{j=4}^{k} \beta_j\, X_{jist} + \delta t + \lambda S + \varepsilon_{ist} \qquad (M3)$$

[33] A similar method was used by Carpenter and Cook (2008) and Gruber and Zinman (2000)
[34] Standard errors are clustered at the state level. See Bretrand, Delfo and Mullainathan (2004).

α_i is an individual fixed effect, δt is a year fixed effect, and λS is a state fixed effect. In this model, all time-varying variables are transformed into their deviation from individual specific means and therefore any time constant variables drop out of the equation. This model exploits variation in individual consumption over time in states subject to price increases and compares it to variation in cigarette consumption of individuals not subject to price increases. I estimate a linear probability model for smoking participation, cessation and initiation and use ordinary least squares for smoking intensity.[35] Again, robust standard errors are used throughout but clustered this time at the individual level.[36]

In order to create models that I can directly compare to the models from previous studies, I first estimate each model above by examining the effect of price by itself on total consumption. I then add the interaction term to see if the effect varies with the individual's degree of self-control.

However, two potential concerns remain even with the individual fixed effects model. The identifying assumption in all of these models is that variations in price both within and across states are not themselves a function of smoking behavior. If tobacco companies are engaging in state-specific pricing, then prices may be endogenous to smoking behavior. Gruber and Koszegi (2000) estimate that 80% of the variation in prices within a state over time is driven by changes in cigarette excise a tax, which means that 20% is driven by demand.[37] Additionally, if taxes are not completely passed through to the consumer, then increases in excise taxes on cigarettes could also affect the pre-tax price of cigarettes. I therefore instrument total price with the cigarette excise tax, which provides identification only though tax-induced changes in price.

The identifying assumption then becomes that within-state changes in tobacco excise taxes are not themselves determined by smoking behavior. Because cigarette taxes are a large source of revenue for states, it is possible that taxes may be higher in states

[35] I attempted to use a conditional logit model in this case however, there was not enough variation in the variables and I did not get viable results, especially for participation and initiation. Like in the cross section case, the LPM model has the problem of reporting values above one and below zero and in the fixed effects extension, it has the additional problem that is constrains the fixed effect by the predicted values.
[36] Bretrand, Delfo and Mullainathan (2004).
[37] This simultaneous bias is also less of a concern with micro-data than with aggregate data. However, if smoking within the sample and prices are both correlated with aggregate smoking, then simultaneity bias may still be present.

with higher cigarette consumption. Alternatively, even if states legislators wish to decrease smoking in their states, they may increase taxes in response to an increase in smoking within the state. Although it is difficult to completely expel this endogeneity concern, I attempt to address this issue below and explain the methodology for doing so in section 5.4.

5. Results

5.1 Price Elasticity

In order to compare baseline estimates of price elasticity with pre-existing literature, I begin the empirical analysis by estimating the effect of changes in state cigarette prices on general smoking behavior. Regression results in column 1 of Table 2A show that without any control for state anti-smoking sentiment, prices have a significant negative effect on smoking participation. When prices increase by 100%, the probability that people smoke decreases by 0.042. The marginal effect from the logit model is almost identical to the estimate from the linear probability model.[38] Table 2A shows that without a proxy for anti-smoking sentiment, prices have no significant effect on conditional consumption. However, because results also show that prices have a significant negative effect on smoking participation, this measure of smoking intensity must be interpreted with caution. If lower-consuming smokers are more likely to quit when prices increase, then the composition of smokers will be different before and after the price change, leading to sample selection bias. To more accurately capture the changes in the demand for cigarettes in both intensity and on the margin, I look at the measure called monthly consumption, in which non-smokers are given a monthly consumption of zero. Results, presented in column 2, show that prices have a significant negative effect on total monthly consumption.[39] When prices double, monthly smoking decreases by 21%, or in other words, the price elasticity of cigarette demand is -0.21. Due to the difficulties with interpreting the conditional consumption of smokers, I will, for the remainder of the

[38] I use a logit model rather than a probit model to produce comparable results to Cook and Carpenter (2008).
[39] A month is defined to be 30 days.

Table 2: Baseline Estimates for Price Response to Cigarette Taxes

A. Cross Section with Proxy for Anti-Smoking sentiment (2SLS)

	Dependent Variables							
	Participation				**Monthly Smoking**			
	OLS		logit		Total Sample		Smokers	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
log(price)	-0.04194**	-0.00915	-0.04400**	-0.00675	-0.20814**	0.02745	-0.17276	0.08233
	(0.020)	(0.023)	(0.017)	(0.020)	(0.099)	(0.119)	(0.127)	(0.149)
Grows Tobacco		0.01845***		0.01937***		0.15700***		0.23558***
		(0.006)		(0.006)		(0.030)		(0.042)
Index of Restrictions		-0.00567		-0.00518		-0.01055		0.05219**
		(0.004)		(0.003)		(0.019)		(0.024)
self-control	-0.05546***	-0.05500***	-0.05484***	-0.05440***	-0.30697***	-0.30409***	-0.24738***	-0.24503***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.024)	(0.024)	(0.036)	(0.036)
	Initiation				**Cessation**			
	OLS		logit		OLS		logit	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
log(price)	-0.04272***	-0.02944*	-0.04193**	-0.02738	0.01949	0.01686	0.01199	0.00564
	(0.015)	(0.018)	(0.017)	(0.020)	(0.028)	(0.034)	(0.028)	(0.034)
Grows Tobacco		0.00822		0.00743		-0.00343		-0.00508
		(0.005)		(0.005)		(0.009)		(0.010)
Index of Restrictions		-0.00112		-0.00094		-0.00212		-0.00144
		(0.003)		(0.004)		(0.006)		(0.006)
self-control	-0.01110**	-0.01095**	-0.01154***	-0.01150***	0.03689***	0.03702***	0.03886***	0.03896***
	(0.005)	(0.005)	(0.004)	(0.004)	(0.008)	(0.008)	(0.008)	(0.008)

* Regression results are from Two Stage Least Squares Regressions, using state tax in cents as an instrument for price

*Regression includes year dummies, as well as controls for age, age squared, gender, race, highschool education, urban setting, household composition, religious attendance, log(income), father's education and an index of the state's smoking restrictions

Logistic regression values are the marginal effects evaluated at the mean

Robust standard errors in parentheses, clustered at the state level

*** p<0.01, ** p<0.05, * p<0.1

paper, examine smoking intensity by focusing on monthly smoking among all respondents.

Table 2A also shows that in both the logit and linear probability models, prices have a significant negative effect on smoking initiation – when prices increase by 100%, the probability that someone begins smoking decreases by 0.043 and the probability that someone quits increases by 0.012**.** These baseline estimates are similar to, although smaller than, those found in the literature: by way of comparison, Fletcher, Deb and Sinclair (2009) use a similar cross section specification and find that when price increases by 100%, consumption would decrease by 5.7 cigarettes a month.

Once I include an indicator for whether the state grows tobacco and an index of the extent of state smoking restrictions, both intended to be loose proxies for anti-smoking sentiment, the estimated effect of price decreases significantly and the included proxy for whether or not the state grows tobacco is generally significant at 1%. A 100% increase in price decreases the probability of participation by 0.009 and the estimated responsiveness

of smoking intensity disappears completely.[40] These estimates are also similar to estimates from comparable models in the literature. By way of comparison, DeCicca et al. (2002) finds that increasing taxes by about 100% decreases the probability that twelfth graders smoke by 1.7% and Chaloupka and Grossman (1996) find that a 100% increase in taxes leads to a drop in participation of 1.2%.[41] This extreme sensitivity of the price coefficient to the inclusion of a loose proxy for anti-smoking sentiment strongly suggests that simple cross section analyses are subject to significant omitted variable bias.

Table 2B shows that once state fixed effects are included, the estimated effect of prices on smoking behavior is no longer statistically significant for any aspect of smoking behavior. The marginal effects of price on smoking participation and initiation in the logit model are both negative although small and statistically insignificant. While this finding that people are largely unresponsive to price is at odds with much of the cigarette demand literature using fixed effects [Gruber and Zinman (2001) and Carpernter and Cook (2008)], DeCicca (2002) and DeCicca (2004) also found that once they controlled for fixed effects, youth smoking has no association with state cigarette prices. DeCicca (2006) again found that with a fixed effects model, prices had no significant effect on youth smoking initiation.

Figure 2C shows that when I include individual fixed effects, the effect of prices on initiation, monthly smoking and initiation increases. In both variations of the individual fixed effects model presented in Table 2C, the effect of prices on smoking behavior remains largely negative but statistically insignificant.[42] The only exception is smoking initiation with state and time fixed effects, which becomes significant at 10%. This finding that initiation reacts differently than cessation suggests that the distinction between smoking initiation and cessation is empirically important and useful, as there is a behavioral difference between initiating smoking and failing to stop smoking. The results of this model suggest that anti-smoking sentiment and other unobservable characteristics vary not only by state but also by individual. Therefore, controlling for individual fixed effects is important.

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[40] Both of these numbers come from the logit marginal effects.
[41] They assume full pass through of the tax.
[42] I also check results with state specific time trends although results were largely the same so they are not included in the tables.

What does this mean for the effect of an increase in taxes? The first stage regression in Table 2D shows that a 1 dollar increase in excise taxes lead to a 13% increase in prices and therefore a 0.2% decrease in monthly smoking and a 0.0028 decrease the probability of smoking. To put this estimate in perspective, the average number of cigarettes smoked per month per smoker is about 80 cigarettes, so this means a monthly decrease of about 0.16 cigarettes per smoker per month. This makes these results economically small as well as statistically insignificant.

Table 2: Baseline Estimates for Price Response to Cigarette Taxes

B. State and Time Fixed Effects

	Dependent Variable						
	Participation		Monthly Smoking	Initiation		Cessation	
	OLS	logit	OLS	OLS	logit	OLS	logit
log(price)	0.00067	-0.00876	0.07898	-0.02364	-0.03635	0.06523	0.05274
	(0.113)	(0.112)	(0.483)	(0.048)	(0.068)	(0.098)	(0.104)

C. Individual Fixed Effecs

	Dependent Variable			
	Participation	Monthly Smoking	Initiation	Cessation
Time FE	-0.00634	-0.01050	-0.05815	-0.03666
	(0.037)	(0.123)	(0.040)	(0.130)
State FE	-0.02754	-0.02014	-0.09727*	-0.03666
	(0.053)	(0.236)	(0.057)	(0.130)
No. Obs	32,348	31,998	17,945	8,454

D. First Stage Regressions for Baseline Estimates

	log(price)				
	No Proxy	Proxy	State and Time FE	Individual FE	
				Time	State and Tim
excise tax	0.00131***	0.00129***	0.00130***	0.00245***	0.00130***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

*State and time fixed effects regressions include controls for Age, Age squared, gender, race, highschool education, urban setting, household composition, religious attendance, log(income), father's education and an index of the state's smoking restrictio

Note: All regressions are estimated using two stage least squares with tax as an instrument for price

Robust standard errors in parentheses, clutered at the state level

*** p<0.01, ** p<0.05, * p<0.1

5.2 Heterogeneity in Underlying Propensity to Smoke

Consistent with prior literature, results in Table 3 show that there exists considerable heterogeneity in an individual's underlying propensity to smoke. Most significant for the findings of this study, an individual's degree of self-control is a significant predictor of smoking behavior. Individuals with poor self-control are 5.8% more likely to smoke and if they do choose to smoke, they smoke 3.3% more and are 3.9% less likely to quit. Smoking participation and intensity increases non-linearly with age. Significant differences in smoking behavior also exist along racial lines. Black and Hispanic respondents are less likely to smoke or start smoking, and if they do smoke, they smoke less and are more likely to quit. Women are significantly less likely to smoke, and if they do smoke, they smoke less. Education is also a significant predictor of smoking behavior; respondents who completed high school by the age of 20 are less likely to start smoking and, if they do smoke, they smoke significantly less and are more likely to quit. Interestingly, once education is controlled for, income is not a significant factor in the propensity to smoke.[43] More religious individuals are less likely to smoke, and if they do smoke, they smoke less. This is an intuitive result if religious attendance captures an individual's taste for risky behavior. Smoking behavior is also positively sensitive to peer smoking, suggesting that smoking behavior is significantly influenced by social situational factors. Lastly, a respondent's household background is also a significant determinant of smoking behavior. Individuals from more stable backgrounds (educated fathers and two-parent households) are less likely to smoke, and smoke less if they do.

5.3 The Role of Self-Control

I continue building on this model by examining whether price responses differ by self-control by including an interaction term between self-control and price. Because of the significant bias evident in the cross-sectional analysis, I will focus on individual fixed effects models for the rest of the paper. Results in Table 4

[43] When we exclude a measure of education from the regression, income has a significantly negative effect on the propensity to smoke. Similar results were found by Fletcher, Deb and Sinclair (2009).

Table 3: Heterogeneity in Underlying Propensity to Smoke

	Dependent Variables		
Variable	Participation		Monthly Smoking
	OLS	Logit	OLS
log(price)	0.00067	-0.00876	0.07898
	-0.113	(0.112)	-0.483
self-control	-0.05827***	-0.05728***	-0.32632***
	-0.013	(0.012)	-0.066
Age	0.13531***	0.17212***	0.63104***
	-0.019	(0.020)	-0.101
Age^2	-0.00362***	-0.00445***	-0.01668***
	-0.001	(0.001)	-0.003
female	-0.02812**	-0.02869**	-0.16539***
	-0.013	(0.013)	-0.061
black	-0.12728***	-0.13091***	-0.79621***
	-0.016	(0.017)	-0.08
hispanic	-0.07455***	-0.07563***	-0.60589***
	-0.021	(0.022)	-0.108
Father education	0.00128	0.00132	-0.00548
	-0.001	(0.001)	-0.006
log(income)	0.00019	-0.00017	0.00432
	-0.002	(0.002)	-0.011
highschool	-0.23541***	-0.21163***	-1.41903***
	-0.02	(0.016)	-0.116
urban	-0.01878	-0.01784	-0.08303
	-0.012	(0.012)	-0.073
Two parents	-0.02272*	-0.02237*	-0.17036**
	-0.013	(0.013)	-0.068
Pct. Peer	0.04982***	0.04734***	0.27091***
	-0.005	(0.004)	-0.024
religious	-0.04086***	-0.04142***	-0.22124***
	-0.005	(0.006)	-0.028
index	0.00012	0.00066	-0.00281
	-0.007	(0.007)	-0.035
Observations	32,348	32,348	31,998
R-squared	0.131		0.185

*Regression results include full set of state and year fixed effects and are estimated using 2SLS
Robust standard errors in parentheses, clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

reveal that not everyone responds to price in the same way. In Table 4B, the effects of the price on individuals with self-control is greater across all behavioral responses, although not all are statistically significant. For smoking participation, prices have no effect on individuals without self-control but a 100 percent increase in prices decreases smoking participation for the self-controlled by 4.0 percentage points.[44] Similarly, prices have no effect on the monthly consumption of people without self-control but the people with self-control decrease their consumption by 10% in response to a 100% increase in prices.

[44] These estimates come from the individual fixed effects model with state and time fixed effects.

Table 4: Heterogeneity in Price Response due to Self-Control

A. First Stage Regressions

	Time FE		State and Time FE	
	log(price)	price*self	log(price)	price*self
excise tax	0.00245***	-0.02565***	0.00130***	-0.02714***
	(0.000)	(0.002)	(0.000)	(0.002)
self*tax	-0.00000	0.04852***	0.00000	0.04847***
	(0.000)	(0.004)	(0.000)	(0.004)

B. Individual Fixed Effects Models

	Dependent Variable			
	Participation	Monthly Smoking	Initiation	Cessation
Time FE				
log(price)	0.00951	0.14855	-0.08665	-0.08349
	(0.039)	(0.242)	(0.060)	(0.093)
log(price)*self-control	-0.02758	-0.27676***	-0.01499	0.10323*
	(0.019)	(0.087)	(0.022)	(0.060)
State and Time FE				
log(price)	-0.00862	0.16409	-0.05404	-0.08717
	(0.054)	(0.173)	(0.043)	(0.132)
log(price)*self-control	-0.03112	-0.26251***	-0.00629	0.12732**
	(0.019)	(0.087)	(0.021)	(0.061)
Obs.	32,348	31,998	17,945	8,428

Note: All regressions are estimated using two stage least squares with tax and tax*self-control as instruments for price and price*self-control. First stage regressions estimated with individual fixed effects as well as standard set of time-varying controls

Robust standard errors in parentheses, clutered at the state level

*** p<0.01, ** p<0.05, * p<0.1

Self-control is also an important determinant in response to price for smoking initiation and cessation. Smokers with self-control are about 3 percentage points more likely to quit when prices increase by 100%, while there is no significant effect on people without self-control. The first stage regressions in Table 4A shows that again, on average, when taxes increase by 1 dollar (100 cents), price increases by 13%, meaning that the smoking participation decreases by 0.52 percentage points for people with self-control and only 0.104 percentage points for people without self-control.

5.4 Specification Tests

As mentioned above, a serious concern with this identification strategy is that excise taxes may be endogenous. Even though I instrument price with cigarette excise tax to account for the possibility that prices are correlated with aggregate smoking in the state, it remains possible that excise taxes are also endogenous and therefore not a good instrument. If taxes are set in response to patterns in state cigarette consumption, one of the assumptions for ordinary least squares will be violated and the estimate of the effect of taxes on consumption will be biased. If taxes are increased in response to an upward trend in consumption, then this bias will be toward zero, potentially explaining why I find such small and statistically insignificant coefficients for price.

5.4.1 Aggregate Consumption

One approach to address the concern that excise taxes may be endogenous due to a correlation between both individual smoking and taxes and aggregate consumption is to directly include in the regression a measure of aggregate consumption. This should directly control for any potential endogeneity bias due to the omission of aggregate consumption.[45] Column 1 of Table 5 shows that, as suspected, aggregate state cigarette consumption is one significant factor explaining the rise in cigarette excise taxes over time. As shown in columns 2-5 of Table 5, when the measure of aggregate consumption is included in the regression, the coefficients on price throughout the specifications decrease (move away from zero) although aggregate consumption comes up insignificant. This finding suggests that excise taxes and aggregate smoking may be correlated through this channel.

5.4.2 Discrete Policy Changes

An alternative way to address the concern that state taxes are endogenous to smoking behavior is to restrict analysis to large discrete changes in taxes. Even if cigarette consumption is trending and cigarette taxes are changing in response, looking at large changes in taxes over a short time period should dominate any potential endogeneity bias. This is essentially a difference-in-difference approach, in which changes in consumption

[45] This method of including lagged consumption follows Gruber and Zinman (2000).

Table 5: The Effect on Price Elasticity of Including Lagged Consumption

A. Adding Aggregate Consumption

	Dependent Variable				
	Log(price)	Participation	Monthly Smoking	Initiation	Cessation
log(price)		-0.07978	0.63278	-0.14116	-0.27340
		(0.114)	(0.505)	(0.128)	(0.261)
log(price)*self-control		-0.00467	-0.18488*	-0.01395	0.14739**
		(0.024)	(0.104)	(0.026)	(0.067)
l.aggregate	0.00147***	0.00017	-0.00091	0.00018	0.00037
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Obs.	60,696	32,348	31,998	17,945	8,428

B. First Stage Regressions

	log(price)	price*self
taxstate	0.00079***	-0.00208***
	(0.000)	(0.000)
self2state	0.00000	0.00446***
	(0.000)	(0.000)

*Regressions include State and Time fixed effects as well as a standard set of control variables

Note: Regressions in column 2-5 are estimated using two stage least squares with tax and tax*self-control as instruments for price and price*self-control.

Robust standard errors in parentheses, clutered at the state level

*** p<0.01, ** p<0.05, * p<0.1

over time within states subject to large tax increases are compared to changes in consumption over time in states not subject to large discrete tax changes. A large tax increase is defined to be any tax that increases at least 100 percent change in a given year. Over our sample period, there are 31 such increases in taxes in 29 states.[46]

I begin by imposing a constant treatment effect, defining a single policy treatment year. Results in Table 6 show results similar to the continuous price model. Individuals without self-control who were subject to a 100% tax increase did not change their smoking behavior differently from people without self-control who were not subject to the large tax change. However, individuals with self-control who faced the large tax increase decreased the probability that they smoke, as well as their monthly smoking, significantly more than self-controlled individuals who were not subject to the policy changes. Additionally, large tax changes had a significant effect on the probability of initiation and the probability of cessation of people with self-control, but not on people without self-control.

[46] For simplicity, we drop the two states for which there are two large changes, Ohio and Delaware.

When I remove the assumption of a constant treatment effect and instead allow for the effect of the policy to vary by year, I find that the effect of the policy is not constant over time.[47] Because cigarettes are addictive, current smoking behavior depends on decisions made in previous periods, and therefore tax changes in previous periods. Indeed, results in the first row of Table 6 reveal that the taxes only have a significant instantaneous effect on smoking initiation, an intuitive result since the decision to initiate smoking is not influenced by any past addictive stock and therefore would not react with a lag. The effect of tax increases on smoking participation and on monthly smoking intensity among the people with self-control detected in Table 6A in fact does not take place immediately but is effective up to 4 years later. Column 1 shows that in the year of the policy change, the difference in price response of smoking participation between people with and without self-control is 1.1 percentage points. However, in the following year the difference is 4.0 percentage points. The other columns of Table 6 demonstrate that the results are similar for the other smoking behaviors. One reason that self-control becomes more important as price changes get farther away is incorporated in the model of rational addiction. Long run price elasticities are predicted to be larger than short run elasticities and therefore the initial difference in price response are magnified as time passes.

5.4.3 Three Stage Least Squares

A third way to deal with the possible omitted variable bias is to explicitly allow for a non-random assignment of excise taxes and replicate the method used to deal with the endogeneity of price. In this case, excises taxes are treated as an endogeneous variable and are instrumented with another variable, leading to a regression done in three stages, rather than two.[48] In order to follow this identification method, I need a variable that affects individual's smoking decisions only through excise tax rates - in other words, a

[47] This model is defined such that big change is an indicator variable if there was a 100% or greater tax increase implemented in that year. I then add 4 lags of the policy variables (1 year, 2 year, 3 year, and 4 or more years prior to the treatment) as well as 4 leads of the policy variable (1 year, 2 years, 3 years and 4 and more years after the treatment.

[48] In the participation, cessation and initiation equations, the outcome of interest is discrete. An appropriate model in this case would be a bivariate probit model. However, Angrist (1991) and Evans et al (1999) argue that estimates from 2SLS models provide results very similar to the more correct bivariate probit model.

Table 6: The Effect on Price Elasticity of Including Lagged Consumption

A. Constant Treatment Effect

	Participation	Monthly Smoking	Initiation	Cessation
Policy	0.00239	0.01213	0.00043	-0.03266*
	(0.011)	(0.055)	(0.008)	(0.017)
Policy*self-control	-0.03232**	-0.19506***	-0.01752*	0.10226***
	(0.014)	(0.069)	(0.009)	(0.026)

B. Policy Effect by year

policy- t	-0.00022	0.04150	-0.02669**	-0.03753
	(0.012)	(0.058)	(0.013)	(0.026)
policy- t - 2	0.02175*	0.17260***	-0.02908**	-0.00440
	(0.012)	(0.060)	(0.013)	(0.027)
policy - t - 3	0.03648**	0.20489***	-0.02142	-0.04459
	(0.015)	(0.071)	(0.015)	(0.027)
policy- t - 4+	0.02202	0.01352	0.00005	-0.00183
	(0.014)	(0.071)	(0.012)	(0.025)
policy- t +1	0.02805*	0.09839	0.00663	-0.06085**
	(0.015)	(0.069)	(0.015)	(0.027)
policy- t +2	0.04063**	0.20352***	0.01216	-0.04459
	(0.017)	(0.078)	(0.017)	(0.029)
policy- t +3	0.03518*	0.07913	0.00199	-0.02411
	(0.019)	(0.087)	(0.017)	(0.032)
policy- t +4+	0.04178**	0.14997	0.01016	-0.02641
	(0.020)	(0.095)	(0.015)	(0.031)
self*policy - t	-0.01336	-0.09307	0.02641	0.05276
	(0.023)	(0.105)	(0.019)	(0.052)
self*policy- t-1	0.00337	0.03922	0.00812	-0.00225
	(0.020)	(0.091)	(0.015)	(0.046)
self*policy- t-2	-0.02435	-0.16152	0.04014**	-0.01434
	(0.023)	(0.111)	(0.020)	(0.051)
self*policy- t-3	-0.05244**	-0.25817**	0.02695	0.03172
	(0.024)	(0.117)	(0.022)	(0.051)
self*policy- t-4+	-0.02372	-0.01242	0.01120	-0.04374
	(0.023)	(0.111)	(0.019)	(0.049)
self*policy - t + 1	-0.04324*	-0.18169*	-0.01026	0.09973*
	(0.024)	(0.110)	(0.021)	(0.054)
self*policy - t + 2	-0.06934***	-0.34762***	-0.00683	0.08011
	(0.025)	(0.116)	(0.023)	(0.057)
self*policy - t + 3	-0.05480**	-0.19322	0.00700	0.04950
	(0.027)	(0.123)	(0.024)	(0.059)
self*policy - t + 4+	-0.08171***	-0.39722***	-0.02285	0.12855**
	(0.028)	(0.130)	(0.019)	(0.061)

*Regression includes individuals fixed effects as well as a set of contorl variables

*Excluded variable is the effect of the policy on those without self-control in the period immediately preceding the tax increase. Therefore, the coefficients on the lead variables represent the changes from the period immediately before the policy.

Robust standard errors in parentheses, clutered at the state level

variable that is uncorrelated with shocks to cigarette demand but correlated with cigarette excise taxes. One variable that I believe meets these requirements for a viable instrument variable is the state sales tax. The strategy would be to estimate the following three equations:

$$\widetilde{tax}_{st} = \beta_0 + \beta_{10} sales_{st} + \beta_2 X_{ist} + \delta t + \lambda S + \varepsilon \quad (8)$$

$$\log \widetilde{(\text{price})}_{st} = \beta_0 + \beta_{10} \widetilde{tax}_{st} + \beta_2 X_{ist} + \delta t + \lambda S + \varepsilon \quad (9)$$

$$Y_{ist} = \beta_0 + \beta_1 sc_i + \beta_2 \widetilde{price}_{ist} + \beta_3 \widetilde{price}_{ist} * sc_i + \beta_4 X_{ist} + \delta t + \lambda S + \varepsilon_{ist} \quad (10)$$

where $\widetilde{tax}_{st}$ is the part of the variation excise taxes explained by variations in sales tax, and $\log \widetilde{(\text{price})}_{st}$ is the final prices that are explained by this sales-explained portion of excise taxes. The state sales tax is likely to be uncorrelated with cigarette demand because sales tax is applied to many goods. Since cigarettes are also taxed separately, any incentive to adjust taxes to match demand would result in a change in the excise tax rather than the sales tax. Though this exogeneity requirement cannot be explicitly tested, the economic intuition is convincing. However, I can test the instrument relevance requirement. If both cigarette excise taxes and general sales taxes are set to balance state budgets, it is possible that they are correlated: states with financing needs increase both sales taxes and cigarette excise taxes. Additionally, both sales tax and cigarette excise taxes are affected by the state's attitude toward consumption taxes, suggesting that states that do not choose to tax general consumption would also choose not to tax cigarette consumption highly**.** Indeed, Table 7A show that state sales taxes and excise taxes in each year are positively correlated. Additionally, since the F-statistic for each instrumented variable is above 10, the state sales tax (the cents paid per pack of cigarettes) is not a weak instrument for the

cigarette excise tax. This method of three stage least squares identifies the effect of price only through the changes in excise taxes that are driven by state budget needs.

Table 7: Three Stage Least Square - Sales Tax as Instrument

A. First Two Stage OLS Estimates for Sales Tax and Cigarette Excies Tax

	Dependent Variable					
	Excise tax	log(price)	Excise tax	tax*self-control	log(price)	price*self
	(1)	(2)	(1)	(1)	(2)	(2)
sales tax (cent)	2.63265***		2.61537***	-0.80015***		
	(0.061)		(0.069)	(0.058)		
taxfitted		0.00243***			0.00244***	-0.00332***
		(0.000)			(0.000)	(0.000)
sales*self-control			0.03025	4.05844***		
			(0.061)	(0.068)		
taxfitt*self-control					-0.00002	0.00834***
					(0.000)	(0.000)

*taxfitted here is the predicted values from the regression in column
*All Regressions include individual fixed effects as well as time and year dummies and the full set of control variables in Table 2
Robust standard errors in parentheses, clutered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Why not just use sales tax as an instrument directly for price? Since cigarettes are subject to sales taxes, there should be a strong relationship between sales taxes and the price of cigarettes. However, a potential problem with using the state sales tax as an instrument for cigarette price and subsequently for excise tax relates to a recent finding by Chetty et al. (2009) that consumers tend to under react to taxes that are not salient. Cigarette excise taxes are listed in the price while state sales tax is added at the counter, making sales taxes less salient than excise taxes. Chetty et al. (2009) examine excise taxes on alcohol and find that increases in excise taxes reduce the consumption of beer more than similar increases in sales tax, suggesting that the behavioral response to taxes and prices differ in the long run. In the case of cigarettes, if smokers respond significantly differently to variations in prices and the excise taxes they include than to variation in sales tax, it is possible that the variation in price that derives from variation in sales tax captures a different behavioral response than the portion of price captured by differences in excise taxes. Since I am ultimately interested in isolating the effect that changes in excise taxes have on cigarette consumption, this instrument would not identify the relevant changes in price.

Results from the third stage regression in table 7B reveal that for smoking participation and intensity, the 3SLS estimate is significantly more negative than the two stage least squares estimate. In the price only model, the effect of an increase in price by 100% decreases the probability that people smoke by 0.074, an estimate much larger than

Table 7: Three Stage Least Square - Sales Tax as Instrument

B. OLS and 2SLS Estimates of Price

	Participation		*Monthly Smoking*		*Initiation*		*Cessation*	
	2SLS	**3SLS**	**2SLS**	**3SLS**	**2SLS**	**3SLS**	**2SLS**	**3SLS**
Price only model	-0.02754	-0.07391	-0.02014	-0.38958	-0.09727*	-0.06241	-0.03666	-0.08701
log(price)	(0.053)	(0.084)	(0.236)	(0.389)	(0.057)	(0.073)	(0.130)	(0.152)
Heterogenous Model								
log(price)	-0.00862	-0.02466	0.16409	-0.04721	-0.05404	0.24113	-0.08717	-0.08367
	(0.054)	(0.087)	(0.173)	(0.408)	(0.043)	(0.242)	(0.132)	(0.154)
log(price)* self	-0.03112	-0.07906***	-0.26251***	-0.54092***	-0.00629	-0.51926***	0.12732**	0.09785*
	(0.019)	(0.029)	(0.087)	(0.146)	(0.021)	(0.145)	(0.061)	(0.052)

*Regression includes individual fixed effects, state and time dummies and full set of time-varying control variables
Robust standard errors in parentheses, clutered at the state level
*** p<0.01, ** p<0.05, * p<0.1

in the previous models. Similarly, the price elasticity of monthly consumption is now -0.39, which is almost identical to the estimates throughout the literature which hover around of -0.4. However, both of these elasticity estimates are derived from statistically insignificant coefficients. Rows 2 and 3 of Table 7B show that with the price and self-control interaction term, the 3SLS estimate is more negative and statistically significant for all behavioral responses. The estimated price elasticity of monthly consumption for those without self-control is -0/05 but for people with self-control is it almost -0.60, which is both statistically significant and economically significant. These results strongly suggest that excise taxes are endogenous and that 2SLS estimates using excise taxes as an instrument for prices are subject to significant endogeneity bias

5.5 Heterogeneity by Age

To directly address the literature examining the differences in price response between adolescents and adults, I divide my sample into two age groups – those under 18 and those 18 and over - and repeat the analysis separately for each sample. Because I find evidence that 2SLS estimates are subject to endogeneity biases, I use the 3SLS estimates for this comparison. Table 8 demonstrates that in general, the older sub-sample is more responsive to prices than the younger sub-sample. Table 8A show that when just price is considered (without interaction with self-control), the older sample's monthly smoking price elasticity is -0.303 and the younger sample's is half that. Additionally, prices have a significant negative effect on adult initiation but not on younger smoking initiation.

Table 8: Price Elasticity for younger and older subsamples

A. Price Only

	Dependent Variable			
	Participation	Monthly Smoking	Initiation	Cessation
Adolescent (<18)				
log(price)	0.26223	-0.17073	0.43378	0.30149
	(0.484)	(2.030)	(0.439)	(1.085)
Obs.	14,331	14,227	10,936	3,632
Young Adult (18-28)				
log(price)	-0.13296	-0.30315	-0.17610***	-0.13074
	(0.085)	(0.395)	(0.066)	(0.166)
Obs.	21,044	20,753	9,289	5,602

B. Self-control Interation

	Dependent Variable			
	Participation	Monthly Smoking	Initiation	Cessation
Adolescent (<18)				
log(price)	0.30176	0.09660	-0.29065	0.37372
	(0.488)	(2.038)	(0.805)	(1.081)
log(price)*self	-0.09976	-0.64676**	-0.67615**	0.19185
	(0.068)	(0.295)	(0.295)	(0.181)
Obs.	14,331	14,227	10,936	3,632
Young Adult (18-28)				
log(price)	-0.09933	-0.19213	0.00820	-0.18340
	(0.097)	(0.477)	(0.294)	(0.167)
log(price)*self	-0.05786	-0.18949	-0.14081	0.21943
	(0.069)	(0.331)	(0.326)	(0.138)
Obs.	21,044	20,753	9,289	5,602

*Regression includes state and year dummies, as well as standard set of control variables. All estimates are from a 3SLS regression using tax as an instrument for prices. Individual Fixed effects are included

Robust standard errors in parentheses, clutered at the state level

*** p<0.01, ** p<0.05, * p<0.1

These results are in line with findings by Gruber and Zinman (2001) and Wasserman et al. (1991), who also find that younger youths are less responsive to prices than older adolescents. This relationship between price elasticity and age may be explained by the fact that youth seek peer acceptance more than adults and, therefore, the benefit from smoking in terms of peer acceptance outweighs any price changes.[49] Alternatively, because it is illegal in all states for youth to buy cigarettes, the younger sample must obtain cigarettes through friends or family, obscuring the price they actually face. Lastly, referring back to the rational addiction framework, since younger smokers are less

[49] DeCicca (2002).

addicted (have a lower past stock of consumption), they behave less myopically. Therefore, they should be less responsive to permanent changes in prices because the calculated current price of future consumption is greater for more addicted individuals.

However, while older individuals are found to be more responsive to prices, I find that self-control plays a more significant role in price responsiveness among the younger sample. Table 8B shows that being self-controlled is an important determinant of price responsiveness for youth monthly smoking and initiation while there is no significant effect among the older subsample. Youth with self-control have an estimated elasticity of monthly consumption of -0.55, while it is only -0.44 for the older sample. Similarly, a 100% increase in prices decreases the probability that youth will initiate smoking by almost 0.90 while older people with self-control see a change of only 0.13. This result that self-control is particularly important in youth initiation is particularly relevant for policy formation. Because most smokers begin smoking before the end of high school, the main target of policies aimed at reducing teen smoking is smoking initiation**.** However, this finding suggests that only youths with self-control will respond to such policies.

Why is self-control more important in youth price response than for adult price response? One explanation may be that youth are in a developmental stage in which they have particular difficulty discounting the future. If people with self-control are less likely to have trouble discounting the future, which is a plausible link as conscientiousness implies attentiveness to both present and future consequences, then the differences between people with self-control and without self-control will be magnified when people are younger. However, as people grow up and their time preferences change, this gap closes.

5.6 Limitations

5.6.1 Accuracy of Self-Control Measure

Probably the largest threat to the internal validity of this study is the accuracy of the measure of self-control. To check the accuracy of the self-reported degree of organization as an indicator of self-control, I repeat the analysis using the respondent's

Table 9: Alternative Measure of Self-Control - Conscientiousness

	Dependent Variable							
	Participation		Monthly Smoking		Initiation		Cessation	
	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS	2SLS	3SLS
State andTime FE								
log(price)	-0.01912	-0.06390	0.08061	-0.23552	-0.09607*	-0.05397	-0.06620	-0.09328
	(0.054)	(0.084)	(0.241)	(0.397)	(0.058)	(0.074)	(0.133)	(0.154)
log(price)*self-control	-0.00965	-0.01505	-0.14637*	-0.24584**	0.00297	-0.01375	0.07608	0.05964
	(0.019)	(0.023)	(0.087)	(0.116)	(0.021)	(0.016)	(0.062)	(0.043)

*Individual fixed effect model is used with State and time dummy variables as wella s a standard set of time-varying control variables
Robust standard errors in parentheses, clutered at the state level
*** p<0.01, ** p<0.05, * p<0.1

self-reported degree of conscientiousness. Results in Table 9 show that these results are only marginally different. Although with this measure self-control the difference in price responsiveness between those with and without self-control is smaller, there remains a significant difference in price response between people with and without self-control. This suggests that organization and conscientiousness are both capturing the same behavioral effect.

However, the possibility remains though that neither of these self-control measures are picking up the true behavioral differences in impulse control but rather are capturing differences price attentiveness. People with self-control are more organized and conscientiousness than people without self-control and therefore it is plausible that they would be more likely to manage a budget well, observe price changes and behave accordingly. The differential price elasticity may not reflect a true behavioral component of addiction but rather just an overall difference in attentiveness to prices.

In order to test this theory, I examine consumer responsiveness to a non-addictive good to test whether price elasticity varies by the degree of self-control. Impulse control should not be a factor in this consumption decision and therefore any effect of self-control on price response would be attributed to a general increased attentiveness to price. Because the National Longitudinal Survey of Youth 1997 does not contain much detailed information on consumption, this type of test is difficult. The only consumer good that is non-addictive and is partially reported in the data is fruits and vegetables, which is reported in 2002 as the answer to the questions “In a typical week, how many times do you eat fruit? (Do not count fruit juice)” and “In a typical week, how many times do you

eat vegetables other than French fries or potato chips?" From this, I construct a measure of weekly fruit and vegetable consumption.[50] The state price of fruits and vegetables is calculated using data from the American Chamber of Commerce Research Association (ACCRA) Cost of Living Index 2002.[51] This index reports the price of numerous goods across 307 cities in the United States. I construct a city index price of fruits and vegetables using a weighted sum, according to expenditure shares provided by ACCRA, using the price of the following six items: potatoes, lettuce, bananas, peas, canned tomatoes, and canned peaches.[52] To construct a state-wide price, I calculate a state average, weighting each included city using 2000 census data.[53] Table 10A presents a summary of the variables used in this analysis.

Table 10A: Summary Statistics for Fruit and Vegetable Demand

Variable	Obs	Mean	Std, Dev	Min	Max
Fruit and Vegetables					
Fruits	7833	4.631	5.290	0	28
Vegetables	7833	5.859	5.434	0	28
Combined Index	7833	10.489	9.172	0	56
Price Index	7534	1.556	0.216	0.1095711	2.348031
Covariates					
Self Control	4841	0.573	0.495	0	1
Age	7833	19.936	1.443	17	23
Female	7833	0.494	0.500	0	1
Black	7833	0.270	0.444	0	1
Hispanic	7812	0.212	0.409	0	1
Father's Education	7010	12.616	3.699	1	95
log(income)	7833	2.537	1.865	-6.907755	5.590763
Highschool	7833	0.747	0.435	0	1
Urban	7582	0.781	0.414	0	1
Two parent household	6896	0.559	0.615	0	3

[50] The fruit and vegetable weekly consumption were coded as follows according to the responses: "I do not usually eat fruits and vegetables" assigned zero; "1-3 times per week" assigned two; "4-6 times per week" assigned five; "1 time per day" assigned seven; "2 times per day" assigned fourteen; "3 times per day" assigned twenty one; "4 times or more per day" assigned twenty eight. These counts were added for fruit and vegetables.

[51] Data is from the second quarter, 2002.

[52] Prices are exclusive of taxes.

[53] I drop three states that do not have price data in the ACCRA Cost of Living: Vermont, New Hampshire, and Rhode Island.

To estimate a basic demand equation of fruits and vegetables, I use a simple equation of the following form:

$$fruit_{is} = \beta_0 + \beta_1 \log(price_{is}) + \beta_2 X_i + \epsilon_i$$

i indexes individual, s indexes states, and X_i is a set of covariates to control for individual and household characteristics including age, race, gender, education, urban or rural location, two-parent households, father's education and log of income.[54] As this is only one cross section, identification comes from variation in fruit and vegetable prices across states.

Results in column 1 of Table 10B show that in general, there is little response to food prices. When prices increase by 1 dollar, people decrease their consumption of fruits and vegetables by only 0.31 servings per week, leading total price elasticity of -0.04. Additionally, the estimate is not statistically significant. Column 1 of Table 10B also shows that people with self control consume about 1 more serving of fruit and vegetables per week, an intuitive result as people with self-control are more likely to consume the foods they know are good for them. Column 2 reveals that people with self-control are more responsive to prices. Even though they consume significantly more than people without self-control (4.47 additional servings per week), they are more sensitive to prices.

This finding suggests that at least part of what I am picking up in the cigarette analysis is a difference in attentiveness to prices between groups with and without self-control. This means that extrapolations from these results to the underlying models of addiction must be made with caution. However, while the theoretical implications of these findings may be limited by this finding, the differential price responsiveness still has important implications for public policy. Regardless of the underlying behavioral models, if smokers without self-control are not responding to prices, then prices will not be an effective mechanism to discourage smoking for that portion of the population.

[54] This methodology follows Powell, Zhao and Wang (2009).

Table 10b: Demand for Fruit and Vegetables

	Fruit and Veg	
	(1)	(2)
price	-0.31052	1.04278
	(0.606)	(0.840)
price*self		-2.18059**
		(1.066)
self2	1.07512***	4.47198***
	(0.246)	(1.662)
AGE	-0.37004**	-0.37287**
	(0.155)	(0.154)
female	0.94492**	0.94065**
	(0.416)	(0.419)
black	-1.16364**	-1.15047**
	(0.453)	(0.450)
hispanic	-0.77666*	-0.75345*
	(0.432)	(0.436)
father	0.10479**	0.10340**
	(0.043)	(0.043)
lincome	-0.03599	-0.03387
	(0.064)	(0.064)
highschool	0.83898**	0.82959**
	(0.366)	(0.366)
urban	0.11544	0.11709
	(0.385)	(0.381)
relation	0.38674	0.39060
	(0.304)	(0.303)
Constant	15.02738***	12.97605***
	(2.609)	(2.618)
Observations	3,629	3,629
R-squared	0.019	0.019

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5.6.2 Interstate Smuggling

Another potential source of upward bias in my results is that I do not account for any interstate cigarette smuggling. Respondents in states with high cigarette taxes may be able to purchase cigarettes from neighboring states with lower tax rates. Because this study uses micro-level data, failure to capture cross-border smuggling would create a positive bias on the effect of taxes by overestimating the price paid by individuals in high-tax states. This smuggling bias may help explain why I estimate smaller price elasticities of cigarette demand than throughout much of the literature. Emery et al. (2002) argues that the effect is likely small, as only 5% of regular smokers try to avoid

taxes by purchasing cigarettes in neighboring states, on Indian reservations or on military bases. DeCicca et al. (2002) suggest that this bias should be less significant for the younger part of our sample, who are unlikely to have access to cars and are not likely to make frequent trips to other states. However, my sample includes many older respondents, and therefore smuggling may be prevalent. Additionally, it is possible that the degree of tax evasion may vary with an individual's degree of self-control. If individuals with self-control behave as rational utility maximizing addicts, while people without self-control are more susceptible to last minute temptation, then the self-controlled individuals are more likely to plan ahead and cross state lines in search of lower prices. Unfortunately, due to the limited geographical nature of my data, this concern is difficult to address directly.

5.6.3 Other Challenges

Another limitation to the internal validity of this study is that I only consider state excise taxes. Many counties and even municipalities levy additional taxes on cigarettes. In some states, the variation in prices faced can vary significantly. However, due to data limitations, I do not consider this local tax variation. Fortunately, these municipal taxes are more likely subject to more tax evasion as it is may be easier for people to travel beyond city limits than to another state to purchase cigarettes.

Similarly, because most restrictions to cigarette smoking are mandated at the state level, I cannot accurately examine the effect of such control policies. While Table 1 showed that almost half of the states ban smoking in private workplaces, many counties enacted the changes before the statewide ban took effect, making it difficult to isolate the effect of the change.

Lastly, this examination of price elasticity of smoking demand by degree of self-control does not explore the mechanism through which the prices affect demand. Price may affect smokers both directly and indirectly through its influence on peer smoking. If people with self-control are more likely to be friends with other people with self-control, then the direct effect is potentially magnified through the negative effect on peers. These

results then are perhaps best described as a reduced form of both direct and indirect influences on youth smoking.[55]

6. Conclusion

In this study, I examine the role of self-control in cigarette demand models by using individual fixed effects models and two stage least squares estimation. I find that, across all smoking behaviors, individuals with self-control are more responsive to price than individuals without self-control. To put this in perspective, based on my final estimates, the recent increase in New York state cigarette taxes will lead to a decrease in the monthly smoking of those with self-control by 14.4% but will only decrease the consumption of those without self-control by 1.02%.[56] As I estimate that about 50% of the population reports having self-control problems, this has significant implications for public policy. Additionally, since I also find that individuals with self-control problems also have a higher propensity to smoke regardless of price, increases in prices induced by changes in state excise taxes are not affecting the behavior of those who smoke the most.

What do these results mean for underlying models of addiction? I find that at least part of the detected difference in price elasticity can be attributed to price attentiveness. However, if this difference is not entirely explained by price attentiveness, these findings are in line with the models of addiction that incorporate deviations from rationality. In the time-inconsistent model, this difference in price elasticities could be explained by the fact that individuals with self-control problems are unable to reduce their consumption as much as they would like and therefore are less responsive to prices than more self-controlled rationally behaving smokers. In the cue-triggered model, everyone is unresponsive to taxes in their "hot" state. However, if individuals with self-control problems are unable to control their impulses and are therefore more susceptible to environmental triggers for the "hot" state, they would be less price responsive overall than self-controlled individuals who more rarely enter their "hot" state. Therefore, the

[55] Carpenter and Cook (2008).
[56] These calculations use the 3SLS estimates in Table 7B as well as the second stage regression estimate that a $1.00 increase in excise taxes will increase prices by 24%.

difference in price response across self-control levels could be explained by differences in the frequency of "hot" states.

Because individuals with self-control are not responding significantly to changes in prices, these results suggest that taxes are not functioning as a self-control mechanism but rather are an additional fee on those prone to visceral impulses. So what then can be done to reduce smoking of those without self-control since taxes are ineffective? Other state-imposed commitment devices may be more promising such as smoking bans in social settings, which likely reduce the environmental triggers and therefore may be more effective in helping people control their impulses. Alternatively, since these results show self-control to be one of the most important predictors of smoking, perhaps policies should be directed not only towards directly discouraging the habit but altering individuals' underlying propensities to smoke by teaching self-control at a young age. This would not only decrease their overall smoking even in the absence of policies but would increase their response to other policies as well. This behavioral approach to policy would not impose a self-control mechanism but would help individuals create their own.

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