Puffing in Hard Times

Does the Financial Crisis Have a Role on Smoking Prevalence in the US?

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Abstract

Several previous studies have found that economic downturns may result in health improvements (procyclical effect), including a decline in tobacco use. However, the extant literature on the relationship between economic conditions and smoking is based on normal business cycles. We reassess the procyclical argument on smoking prevalence exploiting the exogenous shock given by the 2008 global financial crisis, which caused a sharp increase in unemployment rate in 2009 in the USA. We estimate a series of logit models predicting the probability of smoking using the Behavioral Risk Factor Surveillance System for the years 2006, 2007, 2009, 2010, covering a representative sample of the US adult population with a total of 1.6 million respondents. The state-level unemployment rate is used as an indicator of economic conditions. Comparing 2009-2010 *vs.* 2006-2007 periods, we find no significant relation between the change in state unemployment rate and the change in state smoking prevalence for the whole population, after adjusting for state variation and individual characteristics. A further subsample analysis shows a positive relation between smoking and state-level crisis intensity for students and a negative relation for employed individuals and subjects with high labor market attachments. Our results, based on uniquely large datasets, do not support the idea that smoking has been procyclical in this current economic crisis. In hard times a decline in affordability of tobacco products is likely offset by an increase in stress, which in turn unfavorably influence smoking.

Keywords: economic crisis, smoking prevalence, tobacco control, stress, unemployment, USA

Introduction

As it became clear that the current global recession triggered by the financial crisis in 2007-2008 would last for many years to come, concerns were raised about its consequences on poverty, development and public health. With a decline in government expenditures on health, reduced household income and increased job losses, there have been warnings that health would deteriorate especially for the most vulnerable people in society (Horton, 2009; Marmot & Bell, 2009). Based on evidence from past economic downturns, however, it remains unclear whether health gets worse during a period of economic recession (Catalano et al., 2011; Riva et al., 2011; Suhrcke & Stuckler, in press).

On the one hand, a series of studies report that the relationship between mortality and economic condition is "countercyclical", that is the risk of mortality increases when the economy goes bad (Brenner, 1979; Bunn, 1979; Economou et al., 2008; Gerdtham & Johannesson, 2005; Halliday, 2006). On the other hand, several studies report "procyclical" effects of the economy on all-cause mortality, that is mortality declines during times of economic downturn (Neumayer, 2004; Ruhm, 2000; Tapia Granados, 2005; Tapia Granados, 2008; Tapia Granados & Diez Roux, 2009). The inconsistency in the findings is partly due to heterogeneity in terms of data, period of study, methods, countries studied and outcomes observed.

The effects of the economic cycle vary considerably when looking at specific causes of death. What is often found, for example, are countercyclical effects for suicides (Luo et al., 2011; Stuckler et al., 2009, 2011) but procyclical effects for alcohol-related deaths (Ruhm, 1995) and traffic deaths (Ruhm, 2000; Tapia Granados, 2005; Tapia Granados, 2008; Tapia Granados & Ionides, 2011). As for other health

outcomes, it is mostly observed that health behaviors improve when the economy slows down. This includes a reduction in alcohol consumption (Freeman, 1999; Ruhm, 1995; Ruhm & Black, 2002) and smoking (Charles & Decicca, 2008; Ruhm, 2000, 2005) and increased physical activity (Ruhm, 2005).

There has not yet been much evidence on the health consequences of the current economic crisis apart from three studies from Europe and Australia. A recent study of 10 countries in the European Union (EU) find an increase in suicide rates in 2009 as compared to 2007 among people aged 0 – 64 years (Stuckler et al., 2011). Similarly, a study comparing health services use and health outcomes between 2007 and 2009 in Greece show a significant increase in individuals reporting unmet medical need and having bad health (Kentikelenis et al., 2011). A longitudinal cohort study investigating mental health of older adults in Australia (mean age=66.6) report a significant increase in depression and anxiety symptoms in 2009-2010 as compared to 2005-2006 (Sargent-Cox et al., 2011). The deteriorating psychological health could be a result of both the anticipation and experience of deprivation and hardship.

Besides psychological health, it is also plausible that health behaviors and lifestyle habits changed during the time of economic downturn. More specifically, previous literature investigating the relationship between economic fluctuations and smoking found that smoking prevalence increases during periods of expanding economic growth and vice-versa (Charles & Decicca, 2008; Martin-Moreno et al., 2010; Ruhm, 2000, 2005). Using the BRFSS data from 1987 – 1995 on a representative sample of the US adult population with 751,505 respondents, Ruhm (2000) find that one percent point increase in the state unemployment rate corresponds with 0.3 percentage points reduction in the prevalence of current smokers. Another study by Ruhm (2005) using the same survey data from 1987 – 2000 reports

similar findings. Based on the National Health Interview Surveys (NHISs) with a sample of 27,159 men aged 24 – 59 years old for the years 1997 – 2001, Charles and DeCicca (2008) confirm a procyclical relationship between smoking and local unemployment rate.

Nevertheless, extant studies only analyze the relationships between smoking and normal business-cycle fluctuations, not the "recession" *per se*. During the period covered by the previous studies, there was no severe economic deterioration in such a comparable scale as the 2008 financial crisis. The relationships found between smoking and routine economic cycle might not be the same under severe economic conditions (Catalano et al., 2011; Riva et al., 2011; Suhrcke & Stuckler, in press). For example, recent studies on tobacco use have reported an increase in smoking prevalence from 19.8% in 2007 to 20.6% in 2008 in the USA (CDC 2009). Similarly, using two representative surveys conducted in Italy in 2008 and 2009, Gallus and colleagues (Gallus et al., 2011) find a significant increase in smoking prevalence from 22.0% in 2008 to 25.4% in 2009 in contrast with the continuing declining trends for several decades. They conclude that the upward trend could in part be attributed to the relapse of former smokers, due to increasing stress related to the economic crisis. Likewise, there is evidence that the sales of tobacco products increased in 2007 and 2008 (He & Yano, 2009).

In this paper, we investigate the effects of the present economic crisis on smoking prevalence in the USA. The paper's primary contributions are threefold: 1) We provide new findings on the relationships between economic crisis and smoking, the topic not being widely studied as compared to other health outcomes; 2) We exploit the financial crisis of 2007-2008 as a unique exogenous source of identification (i.e. using a sudden rise in unemployment following the crisis); and 3)

Using the diverse across-states variation, we isolate the impact of the crisis from other confounding factors.

The plan of the paper is the following. In the next section we describe main theoretical mechanisms that have been identified in the literature to explain both positive and negative relations between smoking and economic situations. Then, we describe in details the data and methods used as well as the results. The final section concludes and discusses the findings.

Mechanisms explaining the relationships between economic cycle and smoking

There are four relevant explanations how macroeconomic conditions might or might not (in the case of the cigarette epidemic model) influence changes in smoking behavior.

1) Economic model

The economic framework holds that in daily life people have budget constraints in terms of time, energy and money. Based on cost/benefit analyses, one rank the importance of each aspect and make a decision on which activity to invest. Within the economic literature, smoking can be both countercyclical and procyclical. The countercyclical literature argues that in time of economic crisis, people invest more time and effort to mitigate the impacts of job loss and reducing income (Bruckner, 2008). Those who rank the uses of time, energy and money in maintaining economic wellbeing relatively high in the hierarchy will consequently have less resource left to invest in activities that promote health (e.g. exercise, good nutrition, medication, surveillance of one's own or others' biology or behavior). For these people, health will deteriorate during hard times. Likewise, it is likely that smoking

cessation, which is physiologically demanding, becomes even harder during the economic downturn. This suggests that smoking prevalence increases when the economy goes bad.

On the other hand, the procyclical version maintains that some individuals rank risky goods and services at the bottom of their priorities. These individuals will cut back their alcohol or tobacco consumptions practically because of the reduction of income due to job loss (Ettner, 1997). In addition, job loss and reduced working hours result in an increase in non-market time. The opportunity cost of time in pursuing non-market activities including health-producing activities (e.g. exercising, consuming homemade healthy diet and spending time with family) is thus lower during the time of economic downturns (Ruhm, 2005). This implies that due to increasing free time and decreasing disposable income which consequently lower affordability of tobacco products (IARC, 2011), people are more likely to quit or less likely to initiate smoking

2) Stress mechanism

There is robust evidence that unfavorable changes in life circumstances such as unemployment and income drop are associated with depression, mental disorders and suicide (McKee-Ryan et al., 2005; Paul & Moser, 2009). The economic crisis generates stress both at individual and ecological levels. As more people are laid off during the time of economic downturn, mental distress increases since losing a job brings about a loss of income, supportive social network and even a purpose in life. Meanwhile, unexpectedly high level of unemployment during recession can create anxiety even for those who are still in employment due to greater uncertainty about the future and job insecurity (Catalano, 1991; Catalano & Dooley, 1983). The anticipation of job loss and difficulty in meeting financial obligations is stressful.

Besides, having one member being out of employment can increase stress in a family because of income reduction and weakening of social status and social networks.

The increase in stress can consequently influence smoking habits. It is well documented that stress and smoking are closely associated (Ayyagari & Sindelar, 2010; Kassel et al., 2003; Pomerleau & Pomerleau, 1991). Alcohol and cigarettes are legal psychoactive substances which certain individuals turn, for example, to alleviate stress and anxiety and painful effects of employment problems and financial hardship (Escobedo et al., 1998; Harris & Edlund, 2005). It has been found that people with high level of stress are more likely to be smokers and smoke more cigarettes (Metcalfe et al., 2003). The increased stress during the economic decline both at the individual-level (for those who actually lost their jobs) and at the ecological-level (for those who fear of losing jobs) could result in a rise in smoking prevalence.

On the contrary, the stress mechanism can work in a procyclical direction. Work-related stress is the main source of stress in daily life (Karasek & Theorell, 1990). The decreased working time results in a decline in employment related-stress. Hence there is less need to rely on smoking, drinking or overeating as a stress-reduction strategy (Ruhm, 1995). This implies that smoking prevalence declines as the economic crisis leads to a reduction in working time and subsequently work-related stress.

Essentially, within this framework, the way smoking behavior changes with the economic cycle depends on whether the "relevant" stress is work-related or it is derived from experiencing unemployment and/or economic uncertainty.

3) Frustration-aggression hypothesis

When people perceive that they are denied achievement of a certain desired goal, this often leads to aggression (Berkowitz, 1989) which can be exhibited in form

of antisocial behaviors and alcohol and drug abuse. Job loss due to the economic crisis can be frustrating because workers are denied economic and social benefits of working for reasons irrelevant to their ability and behavior. This frustration can provoke an increase in the incidence of violence as well as substance abuse (Catalano et al., 1997). This suggests that smoking prevalence will increase for individuals who lost their jobs during the economic downturn.

Meanwhile, the harsh environment during the economic crisis can cause fear of losing jobs or not finding one for those entering the labor market. The threat of job loss can produce an "inhibition effect" whereby individuals will do whatever to keep their job including regulating their behavior (Catalano et al., 2002). The contracted labor market means there are more people seeking jobs than the number of jobs available. Employers can easily substitute workers with deviant behaviors with new ones with more desirable characteristics. This implies that smoking prevalence declines for those who remain in employment due to the fear of job loss.

4) Cigarette epidemic model

It is also plausible that economic recession does not have any direct effects on the total tobacco use in a country. Due to successful anti-smoking campaigns and support in tobacco cessation over the last decades, smoking prevalence has steadily declined in the USA and other Western countries such as Canada, Italy, New Zealand, Sweden and Great Britain (Shafey et al., 2003). Lopez et al. described that the USA is entering the final stage (stage IV) of the tobacco epidemic whereby smoking prevalence for both men and women continues to decline, although slowly (Lopez et al., 1994). It was shown that investment in tobacco control programs could contribute significantly to the reduction in cigarette sales (Farrelly et al., 2003; Farrelly et al., 2008). If there is no specific cut in tobacco control policy during the crisis, we might

observe no change in the trend of smoking prevalence accordingly. The general declining smoking trend thus could be independent of the economic trend.

It is clear that it is not possible to discriminate between the different mechanisms by using simple cross-sectional data. Different explanations can lead to similar implications in terms of smoking behavior. The main research question of this study is then mainly empirical: is smoking procyclical or countercyclical?

Data and methods

The analysis is based on cross-sectional data from the Behavioral Risk Factor Surveillance System (BRFSS) survey for the years 2006, 2007, 2009 and 2010. The BRFSS is a state-based, random-digit-dialed telephone survey of the non-institutionalized adult population in the USA aged ≥18 year administered by the Centers for Disease Control and Prevention (CDC). Between 2006 – 2010 fifty states participated in the survey, covering the sample sizes of over 350,000 individuals each year. We select the sample of adult with valid responses on the question on smoking status. This gives us a sample of 1,661,371 respondents.

Besides socio-demographic characteristics (sex, age, education, marital status, race and occupation), the survey collected information on selected health risk behaviors, including tobacco use. Based on the question "Do you smoke cigarettes now?", current smoker is defined as an individual who responded that they smoke every day or some days as opposed to not at all. Smoking prevalence then is measured as the proportion of current smokers to the overall population.

State-level monthly unemployment rate is an indicator of economic conditions. This information is obtained from the Bureau of Labor Statistics Local Area

Unemployment Statistics (LAUS) Database. The annual data on weighted average cigarette price per package in each state are obtained from the report "The Tax Burden on Tobacco" (Orzechowski & Walker, 2010).

We chose unemployment rate rather than other economic indicators because it best represents harsh economic conditions originated from the current financial crisis. Two possible alternatives could be used instead. First, employment rate which was used, for example, by Ruhm (2005). In the presence of normal economic cycles, it well represents economic possibilities available for regular citizens. However, here we want to capture a measure of the level of uncertainty related to the surrounding economic environment. In a deep crisis like the one we are observing, unemployment rate better represents this sense of uncertainty, since it measures the number of people that are looking for a job but can not find one[1]. A second option could be the change in GDP. However, GDP might intuitively serve well as an indicator for national/regional income but it does not measure economic well-being or national welfare.

Identification strategy

The main issue when looking at a relation between smoking and unemployment (Figure 1) is that none of the two series are stationary in time. For example, a Dickey-Fuller GLS test on the pre-crisis series for smoking prevalence (1984-2007) reveals the presence of unit roots in the process. Unemployment, instead, might be "fractionally" integrated (Caporale & Gil-Alana, 2007). These characteristics of the data make it difficult to identify a causal relation between smoking behavior and unemployment by simply correlating the two variables, even when time trends are included in the analysis.

[FIGURE 1: ABOUT HERE]

In our setting a clear structural break in the time series of actual unemployment rate represents a unique opportunity to identify the real relation of interest. If the economic condition causes a change in smoking prevalence, then a strong economic crisis, by moving unemployment out of its regular time-related pattern, should be associated with a significant deviation in smoking prevalence from its pre-crisis trend. For this reason, the economic crisis represents a good identification moment for investigating the relation.

Since the crisis hits differently in different states, an ideal approach is to exploit state-level variability: if there is a relationship between the economic crisis and smoking behaviors, we should observe a stronger impact in the states where unemployment rose in greater magnitude. Hence, we compare smoking prevalence in the period 2006-2007 (before the financial crisis) with the period 2009-2010 (post crisis).

With this in mind, a model predicting the probability Pr(·) of current smoking is given by

$$\Pr(S_{ijt} = 1) = \alpha_j + \gamma_t + X_{ijt}\beta + Z_{jt}\varphi + \Delta U_j T_t \delta + \varepsilon_{ijt} \quad (1)$$

where S_{ijt} is a self-reported smoking status of person i in state j in time t, coded 1 if currently smoking and 0 otherwise; α_j is a series of dummies for states adjusting for time-invariant differences among state-level smoking prevalence and economic conditions; γ_t is a series of dummies for months capturing trends in smoking prevalence; X_{ijt} is a vector of covariates including age, sex, race, educational attainment and marital status; Z_{jt} is state-level time varying information: average

cigarette price per pack; $\Delta U_j T_t$ captures the difference in unemployment rate between 2006-2007 and 2009-2010 in state *j,* multiplied by a dummy T which is equal to 1 for the post-crisis period; and ε_{ijt} is an error term.

Parameter δ is what we are interested in. The stronger the crisis, the higher the value of $\Delta U_j T_t$. Hence, a positive δ implies that people smoke more in states where the crisis hits harder. In general, this is referred to as the "countercyclical" effect of the contracted economy on smoking. On the opposite, if δ is negative, then smoking is considered "procyclical". Although these definitions are not entirely correct, in the following the terms "countercyclical" and "procyclical" are used following the previous literature. In the Discussion section the issue will be addressed more in depth.

The model is estimated as a weighted logit with error term clustered at state level. In the logit models, we also consider socio-demographic characteristics associating with smoking, including age (<25, 25-44, 45-64, ≥65), sex, race (White, Black, Hispanic, other), marital status (married, divorced or separated, widowed, never married, cohabiting) and employment status (employed, unemployed, inactive, student, retired). Educational level is collapsed into no/low education (never attended school or only attended kindergarten, grades 1 through 8, and grades 9 through 11), high school (grades 12 or GED), some college (college 1 year to 3 years) and college (college 4 years or more).

In the robustness analysis, we order states according to the changes in state-level unemployment rates between 2006-2007 and 2009-2010. In order to select a sufficient sample size, the top and the bottom 3 deciles of the distribution are kept. Overall, 30 states are included. The "treatment" group is then defined by the 15 states that experienced the crisis the hardest, while the "control" group refers to the 15 states with the lowest change in unemployment rates. This method allows us to simulate a

treatment-control setting and calculate differences-in-differences in individual smoking prevalence in the two groups of states: one with greatest change (treatment group) and one with slightest change in unemployment rate in 2009-2010 (post-crisis). Practically, we run Equation (1) on this new subsample, replacing $\Delta U_j T_t$ with a dichotomous variable coded 1 if an observation is from state *j* in the treatment group and in the post-crisis period and 0 otherwise.

Results

Descriptive results

Table 1 shows the descriptive statistics for the dependent and independent variables separately for the periods between 2006-2007 and 2009-2010. The distribution of the sample population by socio-demographic characteristics i.e. age, sex, race, marital status and education do not sensibly vary between the two periods. Notably the proportion of those in employment declines from 61.1% in 2006-2007 to 57.1% in 2009-2010. Simultaneously, the proportion of unemployed individuals rises substantially from 4.9% in 2006-2007 to 8.6% in 2009-2010. Smoking prevalence also declines significantly from 19.5% in 2006-2007 to 17.5% in 2009-2010.

[TABLE 1: ABOUT HERE]

Figure 1 shows trends in smoking prevalence (from the BRFSS) and unemployment rate between 1984 – 2010 in the USA. Before the current financial crisis hit in 2008, unemployment in the USA fluctuated following business cycles. Even in 1992 when unemployment rate rose to 7.5%, the increase had been gradual.

In 2009 however we observe a sharp increase in unemployment (9.3% in 2009 vs. 5.8% in 2008). Meanwhile, smoking prevalence has continuously been declining over the period observed, from 28.3% in 1984, to 22.8% in 1994, to 20.7% in 2004 and to 17.1% in 2010[2].

Unemployment and smoking prevalence however could as well be unrelated. In order to examine the relations between the two events in details, we compare state-specific changes in smoking prevalence and unemployment rate between 2006-2007 and 2009-2010 as displayed in Figures 2 and Figure 3 respectively.

[FIGURES 2 & 3: ABOUT HERE]

Figure 2 shows that smoking prevalence declined in all states but not uniformly. The change in smoking prevalence ranges between -0.01% and -0.04%. Figure 3 presents an increase in unemployment rate in all states in 2009-2010. In some states the unemployment rate was just 1% higher in 2009-2010 than in 2006-2007. In others, it increased by more than 10%. Given state-level variation in unemployment rate, if there is a relation between smoking behavior and economic climate, we should observe a larger change in smoking prevalence in a state with a larger shift in unemployment. For example, in many states in the West such as Oregon, California, Nevada and Arizona, unemployment rate increased sharply by 5% – 9% after the onset of the economic crisis (2009-2010) but smoking prevalence did not dramatically change. Similarly, for some states in the Midwest and the South such as North Dakota, South Dakota, Nebraska, Kansas, Iowa, Oklahoma, Arkansas and Texas, unemployment rate only increased by 1% – 3% but smoking prevalence declined heterogeneously varying between -0.01% and -0.04%.

Logit models for the whole population

[TABLE 2: ABOUT HERE]

Table 2 shows four nested logit models estimating the propensity of currently smoking controlling for heterogeneity between states. In Model 1, where we consider the relationship between Δ*Unemployment*post* and smoking prevalence controlling for state variation only, the relevant coefficient has a negative sign and is significant at the 1% level. Adding individual socio-demographic characteristics in Model 2, its magnitude reduces but it remains statistically significant. The association between individual characteristics and the propensity to smoke is in an expected direction, i.e. the age groups 25 – 44 and 45 – 64 years, men, those who are not married, White Americans and those with no or low education are more likely to report being current smokers. Model 3 adds month dummies in order to capture any time trends that might produce a spurious relationship between smoking prevalence and unemployment. After detrending, we find that the magnitude of the Δ*Unemployment*post* coefficient reduces, and the estimate no longer reaches statistical significance. Consistently in Model 4 where a further control on average weighted cigarette price per package in each state is added, we find no significant relationship between an increase in state-level unemployment rate and individuals' smoking status.

Logit models for subsamples

Following the arguments from the economic model, the stress mechanism and the frustration-aggression hypothesis economic crisis might not have a direct impact on health behaviors but through changing employment status. For example, a surge in smoking prevalence might be due to the fact that more people became unemployed and took up smoking to relieve stress. It is also plausible that the impact of the economic crisis on health behaviors is not distributed evenly among different groups. It is thus necessary to distinguish between different employment statuses when investigating the relationship between economic crisis and smoking.

In Table 3 we show various subsample analyses of the full model (Model 4) shown in Table 2. The sample is divided into different strata according to employment status, age, sex, race, marital status and education. We report only the coefficients related to Δ*Unemployment*post* with their standard errors. In addition, we also calculate the marginal effects, that is the change in the probability of being a smoker when post-crisis unemployment increases by 1%.

[TABLE 3: ABOUT HERE]

Table 3 shows that for most subgroups, smoking prevalence is not influenced by an increase in the state-level unemployment rate. However, the relevant coefficient is negative and statistically significant for the subsamples of the subgroups typically associated to high employment rates: those aged 45 – 64 years, men, people who are never married and individuals who completed 4-year college or higher. The probability of smoking for these subgroups decreases by -0.2% – -0.5% with a 1% increase in unemployment rate. Even more indicatively, the propensity to smoke given an increase in state-level unemployment rate in 2009-2010 varies with

employment statuses. Specifically, the probability of being a current smoker declined by 0.2% and increases by 0.8% for people who are in employment and for students respectively.

Robustness check

The results from subgroup analyses imply that a stronger crisis is associated with a bigger reduction in smoking prevalence in certain subgroups of the population. In order to check the robustness of our results, in this subsection we limit the analysis to meaningfully selected states. The idea is to drop all the "medium" states that experienced similar reductions in unemployment rates from the analysis because it is more likely that differences in smoking prevalence between these states (if any) can not be caused by little variations in impacts of the crisis. In other words, by comparing two groups of states in the two-tailed of the distribution of the changes in the unemployment rates, if there is a relationship between state-level unemployment rate and smoking behaviors, we should be able to observe this relationship even more evidently.

Table 4 displays results for the whole population, for subgroups according to their employment status and for all other subgroups with a significant treatment effect coefficient.

[TABLE 4: ABOUT HERE]

Consistently with the results reported in Table 2, for the whole population we do not find that people living in states with greater change in unemployment rate have

higher (or lower) probability of smoking. Meanwhile, when considering only employed people, we find that those living in states which were hit harder by the crisis did reduce their smoking prevalence more than those living in "spared" states. On average, after the crisis employed people living in the treatment states smoked 0.14% less than their counterparts living in control states. At the same time, the propensity to smoke for unemployed individuals, students and retirees did not seem to vary between treatment and control states. The results obtained from the main model are thus fully confirmed.

Previous findings are confirmed also for the subgroups of males and college educated. Those aged 45 – 64 years old and those never married are not reported in Table 4 because their relevant coefficient is not statistically significant at the 5% level and it is close to 0, indicating that these categories do not smoke significantly less in treatment states. This is in contrast with the findings in Table 3 and casts some doubts about the robustness of the results in these specific clusters of the population. Finally, it turns out that a negative and significant effect for the post-treatment variable is found for Hispanics. This is not in contradiction with the previous findings, since it shows that the effect fades away once the states in more similar economic situations are included in the analysis.

Discussion and conclusion

This study provides novel empirical evidence on the relationship between the current economic crisis and smoking behavior. While previous studies on this topic only look at smoking prevalence under normal business cycles, we exploit the financial crisis as a unique exogenous source of identification. The crisis caused a

sharp increase in unemployment in the USA in 2009. Meanwhile, during 2006 – 2010, smoking prevalence had declined steadily. We then test whether there is any relationship between these two trends, investigating whether an individual is more or less likely to smoke in states hit harder by the crisis

Our results show that after controlling for time trend, individual characteristics and cigarette prices there is no significant relation between the state-level unemployment rate and the propensity to smoke. Coefficients related to state-level unemployment rate after the crisis are negligible and not statistically significant, although always slightly negative. A further analysis limiting the estimation only to states on the tails of the distribution of the change in unemployment rate confirms the robustness of these results. Since the study population is quite large (hence confidence intervals are naturally smaller) and the economic downturn is remarkably deep, coefficients that are not significant and small in values can cast some serious doubts about the hypotheses that smoking prevalence increases/decreases in hard times.

Meanwhile, the subsample analyses stratified by age, sex, race, marital status, education and employment status show that the likelihood of being a current smoker significantly declines in 2009-2010 when unemployment rate peaks for the groups of people aged 45 – 64 years, men, never married, highly educated subjects and employed individuals. The finding that the decrease in smoking propensity is particularly evident among employed individuals or those with high labor market attachments (e.g. men, people in middle-older age groups, highly educated persons), is consistent with that of Ruhm (2005).

For students, however, we find that their propensity to smoke increases during the period of contracting economy. Since our sample include people aged 18 years

and over, students here comprise individuals who will soon enter the labor force. The high unemployment rate could create stress and fear of not finding a job.

The relationship between economic crisis and smoking does not operate only at the ecological level (e.g. employed people smoke less for fear of losing a job or students smoke more for stress of not finding a job) but also at the individual-level. The unemployment rate, which surged to 9.2 percent in 2009, results in as many as 14,265,000 individuals who become jobless as compared to 8,924,000 in 2008 (BLS, 2011). Unlike the usual business cycles, this current economic crisis affects also individuals who otherwise would have low chance of losing a job. A further investigation of the characteristics of the unemployed shows a marked increase in the proportion of individuals in middle/older age groups (25 – 44 and 45 – 64 years old), married and with a college degree in 2009-2010. Since these individuals are normally less likely to smoke, we would expect that smoking prevalence among the post-crisis unemployed would decrease more than it would do following its regular trend. However, this is not the case. It seems that losing a job or joblessness is indeed a stressful situation. Thus at the individual-level, the fact that more people became unemployed during the economic crisis also results in a higher number of smokers.

Is smoking procyclical?

Our findings of no association between state-level unemployment rate and smoking for the whole population and significant negative association only for employed individuals and those with high labor market attachments cast doubts about how one can systematically draw a conclusion on the relationship between the two events. Specifically, we find a 0.2% reduction of smoking prevalence for an increase

of 1 percentage point in unemployment rate among people who are in employment. This result is similar to that of Rhum (2005) and Charles and DeCicca (2008). However it cannot simply be concluded that smoking is procyclical. Population composition (by employment status) changed before and after the crisis. In hard times, the number of people who become unemployed increases. That the unemployed are more likely to smoke (approximately 33% compared to only 16.9% of those in employment in 2009-2010) means that the absolute number of smokers would automatically increase as the number of unemployed individuals doubled in 2009-2010.

In assessing whether the relationship between economic crisis and smoking is procyclical (or countercyclical), we then need to take into account the distribution of population from different employment statuses. Since the economic crisis hits hard, the composition of the subgroups changed substantially after the crisis. An assessment of the overall effect of the crisis on smoking should then take into account both the effect on smoking prevalence within each subgroup and the effect on the size of subgroups with different propensities to smoke.

The coefficients obtained from our subsample analysis report a 0.2% reduction and a 0.8% increase in smoking propensity for the employed and students respectively, given a 1% increase in state-level unemployment rate. Since the average increase in the unemployment rate according to LAU is around 4.8%, the average reduction in smoking prevalence *due to the crisis* is around 1%, while the increase among the students is around 3%. Prevalence among the employed in 2010 was around 17%, while one over three unemployed was smoking in 2010. Finally, our result also reports no substantial change in smoking behavior for the unemployed due to the crisis.

It is then possible that the crisis-related reduction in smoking prevalence among the employed might be offset by the increase in the number of (likely-to-be-smoker) unemployed individuals (plus the increase in the propensity to smoke for the group of students). Indeed, taking this information into account it can be found that the total number of smokers in 2009-2010 is actually higher than what we would expect after controlling for the decreasing trend of smoking prevalence in the USA[3]. Calculations represent of course an approximation. However, the important point is that the procyclical claim found in previous studies might not be valid if the information on group-specific smoking prevalence and population composition by employment status is not taken into account, especially when the economic downturn is particularly deep.

Finally, it is worth noting that regardless of the current economic crisis, smoking prevalence has been declining steadily in the USA over the last few decades . Anti-smoking campaigns have been shown to play a crucial role in the reduction of tobacco use in the USA (Levy et al., 2004; Warner & Mendez, 2010) and sustention of this kind of public health programs remains of primary importance. The USA has one of the most comprehensive tobacco control programs worldwide and continues to make advances in this area (CDC 2011). These strategies might influence smoking prevalence more significantly than any economic crisis.

Based on our findings of no relationships between smoking and the economic crisis for the whole population and weak negative relationships for subgroups of employed people and individuals with high labor force attachments, we however do not argue that one need not worry about the health impacts of the present economic recession. The effects might become more evident in longer term or are more alarming in other health outcomes. More adversely, with expenditure cuts in

preventive and curative health care, it is likely that health would deteriorate especially for those in vulnerable socioeconomic positions.

Note

[1] We have substituted unemployment rates with employment rates in the models and have obtained similar results.

[2] Note that an increase in proportion smoking in 1996 as compared to 1995 is likely due to the change in question wording in the BRFSS. Up until 1995, current smokers were commonly identified through the question: "Do you smoke cigarettes now?" given two response categories (a. Yes, b. No). From 1996 onwards, the BRFSS instead asked: "Do you now smoke cigarettes everyday, some days, or not at all?". Those who chose the options everyday and some days were identified as current smokers. This question change can over- or underestimate smoking prevalence accordingly. If the question were to remain the same, the smoking trend would continue to decline steadily.

[3] In a subgroup *i* the number of smokers is $s_i(t)*p_i(t)*N$, where s is the sub-group prevalence corrected for the trend and p is the proportion of people in subgroup *i*, both calculated in time t. N is the overall population, which for simplicity could be assumed equal to 100 and never changing. Indicating with t=0 the pre-crisis and with t=1 the post crisis, the change in the number of smokers *due to the crisis* can be expressed as $[(s_i(1)- s_i(0))* p_i(1)+(p_i(1)- p_i(0))* s_i(0)]*N$. The total change is then equal to the sum of the changes in each subgroup. Table 1 provide data for p. Information on prevalence for the relevant subgroups is given in the text. Summing up the impact on the employed and on the students and including the increase in the number of unemployed, the total change is positive, implying a countercyclical relationship.

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Table 1 Percent (%) distribution of 1,661,371 subjects according to selected socio demographic characteristics and smoking status. BRFSS 2006, 2007, 2009, 2010.

Characteristics	2006-2007 (%)	2009-2010 (%)
Age group (years)		
< 25	12.7	11.3
25 - 44	38.1	37.4
45 - 64	32.5	33.9
≥ 65	16.7	17.4
Sex		
Men	48.6	48.7
Women	51.4	51.3
Race/ethnicity		
White	68.9	68.6
Black	9.5	10.1
Hispanic	14.8	14.3
Other	6.8	7.0
Marital status		
Married	60.2	61.0
Divorced/separated	11.1	10.7
Widowed	6.5	6.2
Never married	18.2	18.5
Cohabiting	4.1	3.6
Education level		
No/low education	11.8	10.4
High school	29.0	28.0
Some college	26.3	26.4
College graduate	33.0	35.3
Employment status		
Employed	61.1	57.1
Unemployed	4.9	8.6
Inactive	13.4	13.2
Student	4.5	4.8
Retired	16.1	16.3
Smoking status		
Never smoker	56.3	57.6
Ex-smoker	24.2	24.9
Current smoker	19.5	17.5
N	783,350	878,021

Table 2 Logistic estimates of the probability of smoking, overall sample

	Model 1	Model 2	Model 3	Model 4
Age group (ref: 18 – 25 years)				
25 - 44		0.581**	0.582**	0.582**
		(0.032)	(0.032)	(0.032)
45 - 64		0.391**	0.392**	0.392**
		(0.027)	(0.027)	(0.027)
≥ 65		-0.788**	-0.786**	-0.786**
		(0.043)	(0.043)	(0.043)
Woman		-0.271**	-0.271**	-0.271**
		(0.040)	(0.040)	(0.040)
Marital status (ref: Married)				
Divorced/separated		0.933**	0.933**	0.933**
		(0.014)	(0.014)	(0.014)
Widowed		0.448**	0.448**	0.448**
		(0.025)	(0.025)	(0.025)
Never married		0.576**	0.576**	0.576**
		(0.021)	(0.021)	(0.021)
Cohabiting		0.892**	0.892**	0.892**
		(0.053)	(0.053)	(0.053)
Race (ref: White)				
Black		-0.325**	-0.325**	-0.325**
		(0.048)	(0.048)	(0.048)
Hispanic		-0.720**	-0.720**	-0.720**
		(0.029)	(0.029)	(0.029)
Other		0.005	0.005	0.005
		(0.040)	(0.040)	(0.040)
Level of education (ref: low/no education)				
High school		-0.391**	-0.391**	-0.391**
		(0.051)	(0.051)	(0.051)
Some college		-0.736**	-0.736**	-0.736**
		(0.053)	(0.053)	(0.053)
College		-1.693**	-1.693**	-1.693**
		(0.069)	(0.068)	(0.068)
Price per package				-0.000
				(0.000)
ΔUnemployment*post	-0.026**	-0.021**	-0.011	-0.012
	(0.002)	(0.002)	(0.007)	(0.007)
Constant	-1.148**	-0.795**	-0.828**	-0.780**
	(0.005)	(0.052)	(0.076)	(0.089)
State dummies	YES	YES	YES	YES
Month dummies	NO	NO	YES	YES
N	1,599,468	1,599,468	1,599,468	1,599,468

note: robust standard errors in parentheses. ** p<0.01; * p<0.05

Table 3 Logistic estimates of the probability of smoking, subsample analysis (only coefficients for the variable Δ*Unemployment*post* are reported)

	Coefficient	Standard Error	Marginal effect	N
Employment status				
Unemployed	-0.015	0.021	-0.003	78,533
Employed	-0.020	0.009	-0.002*	832,736
Retired	-0.006	0.012	-0.000	438,728
Student	0.074	0.035	0.008*	27,293
Age group (years)				
18-25	-0.006	0.023	0.000	46,665
25 - 44	-0.008	0.012	-0.002	405,110
45 - 64	-0.015	0.007	-0.002*	674,319
≥65	-0.003	0.010	-0.000	492,868
Sex				
Woman	0.000	0.005	0.000	1,007,164
Man	-0.028	0.011	-0.004*	611,798
Race				
White	-0.015	0.007	-0.002	1,290,337
African American	0.000	0.020	0.000	124,807
Hispanic	-0.025	0.028	-0.003	116,215
Other	0.002	0.035	0.000	87,603
Marital status				
Married	-0.006	0.008	-0.001	906,553
Divorced/separated	-0.002	0.008	-0.001	260,852
Widowed	-0.000	0.011	-0.000	225,253
Never married	-0.029	0.012	-0.005*	189,700
Cohabiting	-0.016	0.036	-0.001	36,604
Level of education				
No/low education	-0.007	0.023	-0.001	161,025
High school	-0.013	0.007	-0.002	489,053
Some College	-0.003	0.008	-0.001	428,924
College	-0.035	0.017	-0.003*	536,726

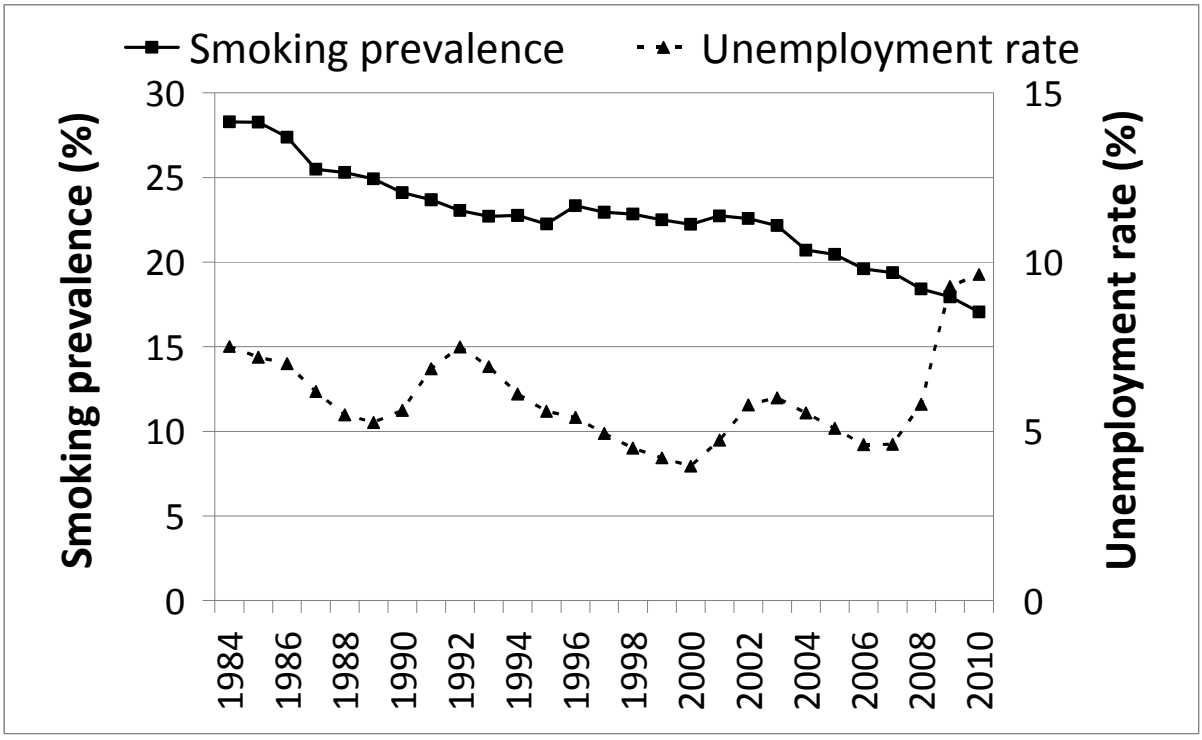
note: all regressions include state level dummies and all the covariates used in model 4 in table 2. ** p<0.01; * p<0.05.

Table 4 Logistic estimates of the probability of smoking, comparing top 15 states and bottom 15 states in the distribution of unemployment rate change between 2006-2007 and 2009-2010

	Treatment*post crisis	s.e.	Marginal Effect	N
Whole population	-0.022	0.023	-0.002	910,443
Employment status				
Employed	-0.108**	0.028	-0.014**	463,112
Unemployed	-0.498	0.725	-0.009	43,236
Retired	-0.004	0.442	-0.000	251,883
Students	0.273*	0.139	0.032*	12,317
Other significant subpopulations				
Male	-0.097*	0.040	-0.014*	340,196
Hispanic	-0.130*	0.063	-0.015*	56,320
College	-0.113**	0.043	-0.009**	288,636

note: coefficients for the variable Δ*unemployment*post* are reported; all regressions include state level dummies and all the covariates used in model 4 in table 2. ** p<0.01; * p<0.05

Figure 1 Trends in smoking prevalence and unemployment, USA, 1984 – 2010



Source: Percentages of current smoker is calculated from the weighted BRFSS data. Annual unemployment rate is obtained from the Bureau of Labor Statistics.

Figure 2: USA changes in smoking prevalence between 2006-2007 and 2009-2010

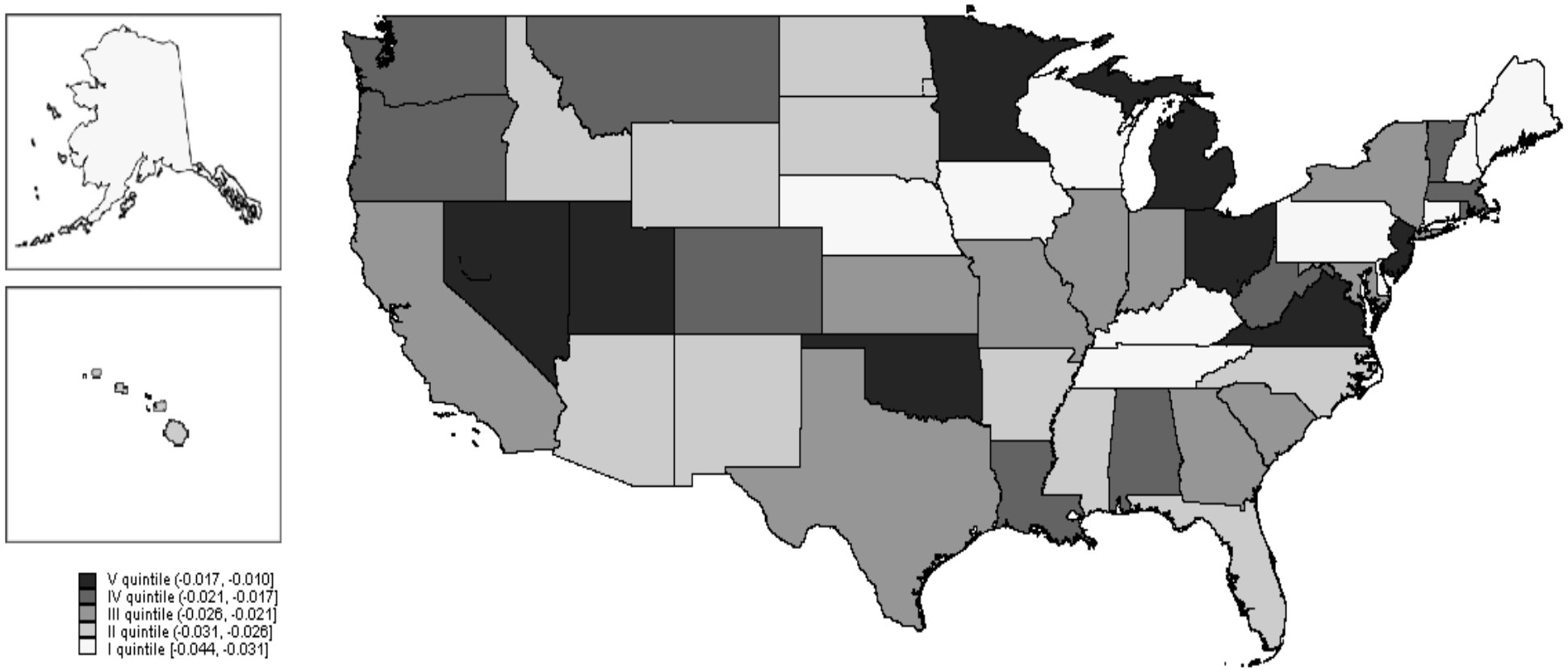


Figure 3: USA changes in unemployment rates between 2006-2007 and 2009-2010