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Optimal tax rules and addictive consumption

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ABSTRACT

This paper studies implementation of the social optimum in a model of addictive consumption. We consider corrective taxes that address inefficiencies due to negative externalities, imperfect competition, and self-control problems. Our setup allows us to evaluate how such taxes are affected by (i) market power and (ii) a requirement for implementation to be time consistent. Together, these features can imply significantly lower taxes. We provide a general characterization of the optimal tax rule and illustrate it with two examples.

1. Introduction

Addictive goods may give rise to various welfare distortions. Inefficiencies may result from externalities, self-control problems, and imperfect competition. To implement the social optimum, the government could impose excise taxes. Our paper examines how such taxes might be set according to a state-contingent rule. Such a policy would ensure robust and time-consistent implementation.

We provide a general characterization of the efficiency-inducing Markovian tax and show that each of the above distortions is represented by a separate component of the optimal tax rate. This decomposition is used to identify tax rules for specific examples. It enables us to illustrate the implications of imperfect competition and time-consistent implementation. We argue that these two features will have mutually reinforcing effects on tax policies.

The exposition focuses on the market for cigarettes, but our results might also be applied to the gambling, fast food and alcohol industries. Following Becker and Murphy (1988), we model dependence by assuming utility functions with intertemporal complementarities: a smoker's current consumption increases her future marginal utility of cigarettes. Individual consumers are viewed as price takers: they cannot influence aggregate variables. We also assume that all agents

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correctly forecast future prices and policies, both on and off the equilibrium path. Our setting departs from Becker and Murphy (1988) by incorporating features that provide a rationale for corrective taxes.

First, we explicitly consider the external costs of addiction (e.g. passive smoking, drunk driving, and crime). For this purpose, we introduce a negative stock externality: consumer utility is decreasing in past consumption by other agents. There is abundant empirical evidence for these costs. For example, Gruber and Köszegi (2001) report per-pack estimates of smoking externalities that are between 42 and 72 cents for low birth weight babies, 19 and 70 cents for second hand smoke, and 33 cents for other externalities. Larger values are reported by Sloan et al. (2004).

A second motivation for government intervention is the presence of consumption internalities. They could arise from misperceptions regarding the harm of the addictive good (Cremer et al., 2012), the intensity of future cravings (Loewenstein et al., 2003) or the utility from future consumption (Bernheim and Rangel, 2004). Sloan et al. (2004) find that the main costs of smoking are borne by the smokers themselves, while Gruber and Köszegi (2001) argue that self-control problems call for much higher cigarette taxes than those that would be justified by externalities alone.

Following the bulk of the literature on sin taxes (O'Donoghue and Rabin, 2006; Kotakorpi, 2008; Haavio and Kotakorpi, 2011; Gruber and Köszegi, 2001, 2004) we acknowledge internalities by allowing consumers to be present-biased: they give excessive weight to current payoffs relative to future costs. Immediate gratification bias is evident in some aspects of addiction. For example, many people express ex post regrets about taking up smoking. They often employ commitment devices and self-control techniques in order to quit or reduce cigarette consumption. Such behavior is not predicted by a standard habit formation model with exponential discounting.

Our model also accounts for imperfect competition. The US tobacco industry is highly concentrated: in 2007, its Herfindahl index was 0.33.[1] Market power may lead to underprovision of cigarettes. Furthermore, the combination of rational expectations and intertemporal complementarities will give rise to a different type of time consistency problem for imperfectly competitive firms, even if they discount future profits exponentially. Driskill and McCafferty (2001) study the implications of habit formation for the laissez-faire equilibrium in an oligopolistic industry. They show that (i) producers' inability to precommit to future actions would suppress their output and (ii) market power may be disadvantageous. Our analysis incorporates such considerations and explores their consequences for government intervention.

Finally, we require tax policies to deliver time consistent implementation: no player would wish to deviate from the social optimum in any period, provided that her opponents also behave optimally. Specifically, we allow the policy maker to change the tax rate as consumers become more or less addicted. This is in contrast to Gruber and Köszegi (2001), who propose a constant tax rate to address self-control problems in a perfectly competitive setting with quadratic utility. Unless the industry is in an efficient steady state, such a policy would generally be neither first best nor time consistent. To attain the social optimum, the tax should be set equal to the difference between the private and the social valuations of a marginal change in addiction. This wedge will typically vary over time. Consequently, the social planner will be tempted to renege on past promises by changing taxes in the future.

Time consistent implementation can be attained with a policy rule that ties taxes to state variables. This instrument would allow the government to achieve efficiency robustly by adjusting its behavior in response to both anticipated and unanticipated changes in the environment. One possibility is personalized tax rates that depend on the smokers' individual addiction stocks. However, such policies are impractical. Following an alternative approach suggested by Krusell et al. (2010), we condition taxes on the aggregate stock. Although no consumer could individually affect this type of government policy, oligopolistic firms do take into account the consequences of their decisions for future tax rates.

While our tax proposal delivers time consistent implementation, it may fail to attain the social optimum in some subgames. A policy rule that is contingent on aggregate variables might only provide efficient incentives to all smokers if they have the same preferences, as well as identical addiction stocks. However, our results also apply to some settings with heterogeneous consumers, e.g. when payoffs are quadratic.

Our first contribution is to identify an interaction between time consistent implementation and market power. We show how these two features can have significant and interdependent consequences for the level of corrective taxes. In particular, the optimal tax rate at the efficient steady state may be lower than what would be suggested by previous studies. Imperfect competition may lead to higher market prices, and thus reduce addictive consumption. Moreover, a Markovian structure for taxes will generally mean that rates should be higher in states with excessive addiction. Higher current output would oblige a firm to pay more taxes today, but would also lead to higher tax rates in the future as the government responds to increased addiction stocks. In this way, Markovian taxes provide oligopolistic firms with additional motivation to curtail production.

Our second contribution is to show that the optimal tax can be decomposed into separate terms that reflect the welfare distortions identified above. We obtain an expression for each of these distortions, and construct a time consistent tax rule that addresses them all. Our results are illustrated with two examples. First, we assume payoffs that are homogeneous of degree one. In this special case, efficiency can be attained with a tax rule that is independent of the state. Thus, implementing a Markovian policy would be equivalent to imposing a constant tax rate. Second, we adopt a quadratic specification. Time consistent implementation in this example would require tax rates to be adjusted over time. The Markovian policy that provides such flexibility would imply lower taxes for given values of the welfare distortions. The

[1] The index was computed using data from the economic fact sheet of the Center for Disease and Control (www.cdc.gov).