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A REGULATORY FRAMEWORK

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### ABSTRACT

We describe a regulatory framework that helps consumers who have difficulty sticking to their own long-run plans. Early Decision regulations help long-run preferences prevail by allowing consumers to partially commit to their long-run goals, making it harder for a momentary impulse to reverse past decisions. In the cigarette market, examples of Early Decision regulations include restricting the locations or times at which cigarettes are sold, delaying the receipt of cigarettes following purchase, and allowing a consumer to choose in advance the legal restrictions on her own cigarette purchases. A formal model of Early Decision regulations demonstrates that Early Decisions are optimal when consumer preferences are heterogeneous. Intuitively, each consumer knows his own preferences, so self-rationing - which is what Early Decisions enable - is better than a one-size-fits-all regulation like a sin tax. Of course, Early Decision regulations incur social costs and therefore require empirical evaluation to determine their net social value.

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For some goods, convenience can be undesirable. Ex-smokers prefer *not* to have a spare pack of cigarettes in their cupboard. Dieters prefer *not* to have a bowl of candy on their desk or a gallon of ice cream in their freezer.

We recognize the conflicts between our long-run goals (e.g. “I want to stop smoking”) and our momentary desires (“I’d like to smoke right now”). The long-term perspective is patient (“I want to start a healthy diet”), while the short-run perspective is indulgent (“I’ll have dessert tonight despite the future consequences”). A failure of self-control occurs when the short-run preference leads to behavior contrary to the long-run plan.

For a range of reasons, societies often like citizens to act on their patient long-run preferences and resist their impatient short-run impulses.<sup>1</sup> Regulation may have a small role to play if a society wants to tip the balance in favor of long-run preferences. In this paper, we discuss a range of regulations that buttress consumers’ long-term behavioral intentions and reduce the likelihood that momentary impulses will undermine those intentions. All of these regulations, which we call Early Decision regulations, encourage consumers to make forward-looking decisions that they cannot easily reverse later.

For example, consider a regulation that severely restricts the hours of cigarette sales (e.g., to one hour per day). Such a policy would have both benefits and drawbacks. On the positive side, ex-smokers/quitters would rarely be able to make an impulse purchase; any cigarette consumption during non-sale hours would

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<sup>1</sup>Dynamically inconsistent preferences can microfound this societal goal.

be bounded by the number of cigarettes they decided to buy in advance. This makes it easier to quit smoking and easier to avoid a relapse. Such a policy would also have negative consequences. People who don't want to quit smoking would lose some convenience. A limited black market might develop to feed the demand of consumers who want a cigarette immediately and do not have a stock of prepurchased cigarettes. Hence, the merit of a time restriction policy is an empirical question. Does the benefit of reducing impulse buying offset the cost of lost convenience and the risk of encouraging a black market?<sup>2</sup>

Survey evidence weakly suggests that smoking regulations produce more benefits than costs, even for *smokers* (Hersch 2005). For example, among current US smokers 51% favor smoking bans in indoor work areas, 61% favor smoking bans in indoor sporting events, and 60% favor smoking bans in indoor shopping malls.

We describe examples of Early Decision regulations in Section 1, focusing on applications to the cigarette market. We emphasize that these Early Decision regulations have both costs and benefits and that all of our proposals would need to be empirically evaluated in small-scale experiments to determine their net social benefits. We review the likely costs for the cigarette market in Section 2. We then discuss extensions of our framework to other markets in Section 3.

In Section 4, we present a model that formalizes the theoretical rationale for Early Decision regulations. This model enables us to show how Early Decisions

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<sup>2</sup>Measuring these costs and benefits is not trivial, since it is not obvious which set of preferences (and discount functions) the analyst should use.

and sin taxes can be used to produce desirable consumer regulations. In the model, Early Decisions are superior to sin taxes when consumers have heterogeneous but fixed preferences. (Section 4 can be skipped by readers who are not interested in mathematical modelling.) In Section 5, we conclude by explaining why private market-based solutions are not always feasible as a substitute for Early Decision regulations.

## 1 Early Decision in the cigarette market

We begin with a discussion of the market for cigarettes. This is a natural starting point for two reasons. First, most smokers would like to stop smoking cigarettes. Indeed, 40% of U.S. smokers have tried to quit smoking in the past 12 months,<sup>3</sup> and 80% have tried to quit at some point.<sup>4</sup> Second, cigarettes are easily stored, which makes it possible to separate the moment of purchase from the moment the cigarette is smoked.

To illustrate our approach, we will discuss five different classes of Early Decision regulations: location-based regulation, time-based regulation, delay-based regulation, self-regulation, and hybrid regulation.

*Location-based regulations* force consumers to make Early Decisions by decreasing the frequency with which consumers are near sellers of the regulated good. To

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<sup>3</sup>U.S. Department of Health and Human Services (2004)

<sup>4</sup>Gruber and Koszegi (2001)

gain intuition for this regulation, we begin by noting that in the U.S., cigarettes are sold at most convenience stores, grocery stores, pharmacies, newsstands, and gas stations. Hence, cigarettes are widely available. For example, within one block of the Harvard Square subway station in Cambridge, Massachusetts, cigarettes are sold at six stores.

Location regulations reduce the density of cigarette vendors. For instance, location regulations could disallow vending machines at workplaces, train stations, or other public places. Likewise, location regulations could restrict sales to a limited number of licensed stores. Such licenses could be auctioned off. Moreover, spatial restrictions might be placed on the vendors who participate in these auctions. For example, only stores at least 200 meters *away* from a public transportation hub could be eligible. Location-based restrictions have two effects. First, they give the “licensed” vendor market power, thereby raising the market price. This acts as an implicit sin tax (see Gruber and Koszegi 2004 for calibration of optimal sin taxes). This tax effect is a redundant consequence of a location restriction, since the government can impose cigarette taxes directly. Hence, we focus our analysis on the second effect of location restrictions: limits on availability.

Consider a smoker who is trying to cut back his consumption of cigarettes despite his strong momentary impulses to smoke. In the status quo free market environment, rationing his cigarette consumption is difficult. Whenever he runs out of cigarettes, he is likely to be near a convenience store that will gladly sell him

another pack. In contrast, if cigarette vendors were few and far between, then the smoker would be able to partially precommit to a particular quantity of cigarettes. For example, precommitment would be possible if the town supermarket were the only store that could stock cigarettes and the supermarket were not close to the smoker's home, workplace, or commuting route. The consumer might visit the supermarket once per week to pick up his groceries. During that weekly visit, the consumer would decide how many cigarettes to buy for the week. Over the course of the week, impulses to buy additional cigarettes might be easy to resist given the transactions costs of prematurely returning to the supermarket.<sup>5</sup>

*Time-based regulations* work on a similar set of principles. For example, all cigarette vendors could be permitted to sell cigarettes only from 8 A.M. to 9 A.M. each day. Alternatively, cigarette sales could be permitted only during some limited window of time on Mondays. Such time-based regulations generate no pricing distortion, since they do not change the competitive structure of the market. Nevertheless, time-based regulations do limit access to the regulated good, again facilitating self-rationing.<sup>6</sup>

*Delay-based regulations* work on the principle that impulse purchases are motivated primarily by a *transitory* desire to *immediately* consume the regulated good.

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<sup>5</sup>In both the U.S. and Europe, location-based restrictions exist on some products. For example, in some U.S. states cigarettes and alcohol cannot be sold within a certain distance of a school. In some U.S. states, alcohol can only be purchased in state-owned liquor stores, and in other states alcohol can only be sold with a license. Some U.S. municipalities forbid alcohol sales altogether. European nations have many such restrictions as well, particularly the Scandinavian countries.

<sup>6</sup>Many U.S. municipalities restrict alcohol sales after a certain hour (e.g., 11 P.M.) or during certain days (e.g., so-called "blue laws" restrict alcohol sales on Sundays).

Hence, consumption would be significantly reduced if a delay were built into the purchase process, so that a current purchase did not create an immediate opportunity for consumption. For example, consider a mail-order system for cigarettes, with delivery lagged by some number of days. In such a system, consumers could buy as many cigarettes as they wanted, but they would not be able to buy and *immediately* smoke on impulse. A decision to buy today would only enable consumption at a lag. Such a system would work well for a consumer who was happy to commit not to smoke next week but could not resist smoking right now. With cigarettes only available by mail, such a consumer would be able to commit not to smoke in the future by simply not ordering cigarettes in advance.

*Self-regulation* refers to a broad category of schemes that allow the consumer to create her *own* regulatory constraints. With self-regulation, the consumer is *only* constrained if she wants to be. Such self-regulation systems give the consumer autonomy and acknowledge the consumer's decision-making authority. We discuss three versions of self-regulation, in increasing order of complexity.

In the simplest case of self-regulation, buying cigarettes would require a cigarette photo ID card. To obtain a cigarette card, a consumer would fill out a (confidential) application form, obtain an appropriate photograph, and submit her application to the regulator with a modest annual fee (e.g., \$20). After an intentional delay of one month, two copies of the card would be delivered, and the cards would expire a year after receipt. Two cards would be provided in case the consumer loses one

of them. The consumer would reapply every twelve months to maintain a current card.

Such a system would have the following benefits. First, a card system makes it possible for a smoker to commit to temporarily stop smoking by simply cutting up her current cards. Second, for a smoker who is trying to quit, the expiration date of her current cards creates a salient quit date. Third, a card system creates a default of not smoking, since *not* applying for the cigarette card is the path of least resistance. Fourth, the card system discourages impulse initiation or resumption of smoking, since application delays make it impossible for a person without a card to immediately obtain one.

In a second (more complex) version of self-regulation, the card system would be customized for each individual. For example, on the application the consumer could request that certain restrictions be printed on her cards. If the applicant were trying to cut back her smoking, she could designate that her card restrict purchases to a limited number of hours (e.g., only 8 A.M. to 9 A.M.) or days of the week (e.g., only Saturdays).

A third (even more complex) version of such a system, would allow highly customized self-regulation. (This last self-regulation requires that all cigarette vendors have an Internet connection.) In this proposal, all cigarette card holders would be given a personal homepage on which they could set the access rules for their cigarette card. For example, a consumer could give herself the right to buy

one pack a day, ten packs a month, or an unlimited number of packs. She could instruct the system to reduce her allowance over time, either gradually or with a sudden drop. Almost any self-allowance scheme would be possible with a well-designed Web interface. When a consumer tries to buy cigarettes, her cigarette card would be swiped by the vendor, and the central database would be queried. If the consumer has given herself permission to make the current cigarette purchase, the transaction would be completed in the store, and the system would be updated to reflect this incremental purchase. If the consumer has not given herself permission to make the current cigarette purchase, the consumer would be told that she has hit her self-imposed constraint, and the purchase would be denied.

In such a system, consumers would sometimes want to readjust the allowances they had previously set for themselves. This too could be flexible. A default setting would allow consumers to change their allowances, but changes would only take effect after three days, preventing consumers from increasing their allowances on impulse in order to smoke immediately. Consumers could change this lag time if they preferred to do so.

*Hybrid regulations* combine different Early Decision regulations. For example, a hybrid policy might both offer mail-order purchases and create hour limits on in-store sales. Hybrid regulations could also combine Early Decision regulations with other regulatory structures, like sin taxes. For example, a hybrid regulation might impose a low tax rate on cigarette sales between 8 A.M. and 9 A.M. and a much

steeper tax rate during other hours. We will refer to this particular hybrid policy as time-contingent taxation. Intuitively, time-contingent taxes achieve three goals. First, consumers who do not want to quit are able to buy cigarettes without facing a highly distortionary sin tax; these committed smokers will stock up during the low-tax periods. Second, consumers who wish to self-ration can do so more easily. Such consumers would buy only limited supplies of cigarettes during the low-tax periods. Third, time-contingent taxes allow consumers to purchase a cigarette at any time if they are very highly motivated. This safety valve reduces incentives to create a black market and enables consumers to buy cigarettes in response to unexpected taste shocks.

## **2 The road to hell is paved with good intentions**

All of the regulations discussed in Section 1 would generate at least some negative consequences. We quickly review the five most likely side-effects: black markets, positive demand effects, agency effects, perverse inconvenience effects, and privacy effects.

*Black markets* would grow as a result of Early Decision regulations. Some smokers will run out of cigarettes and then appeal to a friend: “I’m feeling the urge for a smoke. Can I borrow/buy a cigarette from you (since the regulations prevent me from buying one for myself right now)?” Such black (or “side”) markets are unavoidable and will reduce and potentially eliminate the efficacy of the Early

Decision proposals made above. However, a black market transaction generates special costs to the parties in that transaction. We imagine that embarrassment and inconvenience would be the most important of these costs. In addition, the person receiving the appeal for a cigarette may not know whether he is helping or hurting his friend by acceding to the request. If black markets generate some transactional frictions like embarrassment, then the existence of black markets will not completely offset the benefits of Early Decision regulations. We anticipate that black markets will not be associated with high markups, since there will probably be plenty of people who are willing to lend (or even give) a friend a cigarette. Hence, black markets are not likely to become an outlet for organized crime. The primary problem with the black market is that it will undermine the ability of consumers to constrain their own behavior.<sup>7</sup>

*Positive demand effects* occur when Early Decision regulations paradoxically *increase* the consumption of the regulated good. This could occur for several reasons, two of which we mention here. First, it is possible that anti-cigarette legislation would increase the countercultural appeal of cigarettes. Second, some smokers who want to quit might respond to vendor restrictions by stockpiling cigarettes, particularly if they are naïve about their future tendency to succumb to temptation.<sup>8</sup> Such cigarette stockpiles could induce some consumers to *increase*

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<sup>7</sup>The prevalence of the black market and its association with organized crime will depend on the type of regulation. For example, time-of-day sales restrictions might lead to more black market activity than self-regulation. High cigarette taxes have led to an active black market in Canada.

<sup>8</sup>See Strotz (1956), Akerlof (1991), and O'Donoghue and Rabin (1999) for analysis of naivete

their rates of smoking.

By reducing consumer choice, regulations affect consumer autonomy. To some people, such *agency effects* are an overarching concern. These concerns derive from at least three sources. First, some observers oppose regulations that have the effect of implicitly encouraging people to rely on the state (which these observers view as a bad habit). Second, many of the regulations that we have discussed might be perceived as unwelcome, elitist efforts to control the behavior of other members of society. Third, some observers oppose consumer regulation on the principle that consumer freedom should be maximized. But it is not clear that Early Decision regulations necessarily violate these libertarian principles. For example, some of the Early Decision policies we have discussed give the consumer the freedom to engage in self-regulation.

*Perverse inconvenience effects* arise when satisfied smokers are inconvenienced by regulations that are designed to help ambivalent smokers quit. For example, the self-regulation cigarette card policy would have the unfortunate consequence of generating bureaucratic costs for cigarette smokers who do *not* want to quit. Indeed, all of the policies that we have discussed have at least some potential to inconvenience satisfied smokers. In addition, some of the policies create bureaucratic costs for cigarette vendors. In the case of the cigarette card policy, vendors would have to engage in the time-consuming task of inspecting cigarette cards or installing Internet connections in their stores. If these policies do little to

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in self-control.

help ambivalent smokers cut consumption but substantially inconvenience satisfied smokers and cigarette vendors, then the policies generate a net reduction in social surplus.

Finally, *privacy effects* arise when self-regulation schemes create unwanted public disclosures of private preferences. Of course, self-regulation schemes could be designed to minimize as much as possible such information revelation.

### 3 Early Decision in other markets

Other markets could also be regulated using Early Decision principles. A complete description of such possibilities is beyond the scope of the current paper. However, Early Decisions could be considered in any market where some consumers have a conflict between their long-run behavioral goals and their actual behavior. At the same time, if a market is a candidate for Early Decision regulation, one might consider whether the Early Decision policies can be designed so that they generate only small inconveniences for consumers who are not interested in changing their behavior (Camerer et al 2003).

Gambling is an example of a domain that could be regulated using Early Decisions. Some gamblers have a profound conflict between their long-term goals—gambling responsibly—and their short-run reckless behavior. Also, gambling restrictions can be designed to disproportionately inconvenience such compulsive gamblers. For instance, casino guests could be allowed to purchase chips only once

every 24 hours. Alternatively, chip sales could be disallowed between midnight and 9 A.M. As another possibility, gamblers could be asked to preregister the amounts they intend to put at risk. Responsible gamblers would be only marginally affected by such restrictions, but *compulsive* gamblers might be considerably helped. Legislation has already created self-rationing programs at U.S. casinos. “Self-Limit Access Programs” can be used to cancel access to promotional mailings and casino services such as credit provision and check-cashing. Many states also have self-exclusion programs where consumers can ask to be barred from all casinos. Those who are subsequently found in a casino may face fines and prison time (Yerak 2001).

Alcohol and unhealthy foods are other examples of markets where Early Decision principles could be applied. Self-regulation policies could help consumers precommit not to purchase predesignated goods in these categories. For instance, an alcohol card could be designed using the same principles as the cigarette card.

## 4 Theory for Early Decision Regulations

In this section, we develop a simple model that enables us to study Early Decision regulations. The model has three periods. In period 0, the consumer can *purchase* (but not immediately consume) quantity  $c_0 \geq 0$  of the regulated good. Think of this period as a short buying opportunity on the way to work. In period 1, the consumer is able to buy more of the regulated good ( $c_1 \geq 0$ ) and also to

consume the regulated good (think of this as the bulk of the consumer's day). Total consumption is  $c = c_0 + c_1$ . In period 2, the consumer uses any remaining resources to consume the non-regulated good  $x$ .

We assume that the consumer faces the following budget constraint:

$$1 + T = c_0(1 + \tau_0) + c_1(1 + \tau_1) + x$$

where  $\tau_0$  and  $\tau_1$  are taxes on  $c_0$  and  $c_1$  respectively and  $T$  is a lump-sum transfer. Specifically,  $T = \bar{c}_0\tau_0 + \bar{c}_1\tau_1$ , where  $\bar{c}_0$  and  $\bar{c}_1$  are the average cigarette consumption of all consumers. In a large economy,  $\bar{c}_0$  and  $\bar{c}_1$  are not affected by the consumer's own consumption. The budget constraint normalizes non-transfer income to be unity without loss of generality.

The game is summarized in the following timeline:

- Period 0: purchase amount  $c_0$  at after-tax price  $(1 + \tau_0)$ .
- Period 1: purchase additional amount  $c_1$  at after-tax price  $(1 + \tau_1)$ . Consume  $c = c_0 + c_1$ .
- Period 2: purchase and consume  $x$  at price 1 with remaining resources:  $1 + T - c_0(1 + \tau_0) - c_1(1 + \tau_1)$ .

The consumer has a quasi-hyperbolic intertemporal discount function:  $1, \beta\delta, \beta\delta^2, \beta\delta^3, \dots$ . We assume  $0 < \beta < 1$ , so this function captures the idea that

consumers discount more sharply in the short run than in the long run (Phelps and Pollak 1968, Laibson 1997), implying dynamically inconsistent preferences. Empirical estimates find that  $\beta \simeq 2/3$  and  $\delta \simeq 1$  (Laibson, Repetto and Tobacman 2005).

The regulated good,  $c$ , generates both immediate rewards and delayed costs. Imagine that  $c$  represents cigarette consumption, so the immediate rewards are pleasure and relaxation and the delayed costs are health-oriented. We assume the following functional forms for illustrative purposes.

The immediate benefit from smoking  $c$  cigarettes is  $(\alpha + \Delta + \varepsilon) \ln(c)$ , where  $\alpha$  is a fixed taste-shifter,  $\Delta$  is a fixed taste shifter, and  $\varepsilon$  is a stochastic taste shifter. We assume that the stochastic taste shifter,  $\varepsilon$ , is not revealed until period 1. Assume, without loss of generality, that  $E[\varepsilon] = 0$ . Assume also that  $\alpha > 0$ ,  $\Delta > 0$ , and  $\Delta + \varepsilon > 0$  (for all values of  $\varepsilon$  in the support of the distribution).

The delayed cost from smoking  $c$  cigarettes is  $\alpha \ln(c)$ .

The benefit of residual consumption of  $x$  is assumed to be linear to reflect the fact that “all other goods” will show little if any diminishing marginal utility relative to the curvature of a single good like  $c$ .

From the period 0 perspective, the utility function is

$$EU_0(c, x) = E[\beta\delta(\alpha + \Delta + \varepsilon)\ln(c) - \beta\delta^2\alpha\ln(c) + \beta\delta^2x].$$

To simplify analysis and to reflect the fact that we are thinking about high fre-

quency choices (at the daily level), we set  $\delta = 1$ . Therefore, the period 0 utility function becomes

$$\begin{aligned}
 EU_0(c, x) &= E[\beta(\alpha + \Delta + \varepsilon)\ln(c) - \beta\alpha\ln(c) + \beta x] \\
 &= E\beta[(\alpha + \Delta + \varepsilon)\ln(c) - \alpha\ln(c) + x] \\
 &= E\beta[(\Delta + \varepsilon)\ln(c) + x].
 \end{aligned}$$

From the period 1 perspective, the utility function is

$$U_1(c, x) = (\alpha + \Delta + \varepsilon)\ln(c) - \beta\alpha\ln(c) + \beta x.$$

Note that the period 0 and period 1 utility functions are not affine transformations of each other, reflecting the dynamic inconsistency in the quasi-hyperbolic discount function.

## 4.1 Perfect precommitment case

In this subsection, we derive the optimal commitment path from the perspective of the period 0 self. This is the policy function that maximizes the period 0 utility function and which the period 0 self would like to achieve. Note that this policy function is primarily of theoretical interest, since it may not be possible in practice for the period 0 self to achieve this outcome (recall that  $\varepsilon$  is not revealed until period 1, so the period 0 self has insufficient information to commit at period

0 to the first-best path). Note also that the taxes  $\tau_0$  and  $\tau_1$  do not need to be considered here, since they serve a purely regulatory function.

**Proposition 1** *Under perfect precommitment and  $\tau_0 = \tau_1 = 0$ ,*

$$c = \Delta + \varepsilon,$$

*and*

$$EU_0 = E[\beta(\Delta + \varepsilon) \ln(\Delta + \varepsilon)] + \beta(1 - \Delta).$$

**Proof.** For each value of  $\varepsilon$ , the period 0 first-order condition is

$$\frac{\Delta + \varepsilon}{c} = 1.$$

■

## 4.2 No regulation case

We now consider the free-market case in which the government imposes no regulation whatsoever. This will not be optimal, but it is nevertheless an important benchmark.

**Proposition 2** *With no regulation* ( $\tau_0 = \tau_1 = 0$ ),

$$c = \frac{\alpha(1 - \beta) + \Delta + \varepsilon}{\beta},$$

and

$$EU_0 = E\beta \left[ (\Delta + \varepsilon) \ln \left( \frac{\alpha(1 - \beta) + \Delta + \varepsilon}{\beta} \right) \right] + (\beta - \alpha(1 - \beta) - \Delta).$$

**Proof.** For each value of  $\varepsilon$ , the period 1 first-order condition is

$$\frac{\alpha(1 - \beta) + \Delta + \varepsilon}{c} = \beta.$$

■

Without regulation, the marginal utility of consuming  $c$  is strictly less than the marginal utility of consuming  $x$  from the perspective of the period 0 self. The free-market outcome is not first-best optimal.

### 4.3 Optimal regulation with heterogeneous consumers and no taste shocks

We now consider the case in which consumers have fixed differences in preferences. Intuitively, this is the natural case in which some consumers like to smoke

more or less than others and these taste differences persist over time. To capture this stylized fact, we assume that  $\Delta$  has a distribution across the population.

The following proposition shows that an Early Decision regime is the optimal regulatory mechanism in the world of heterogeneous consumers with no taste shocks. In this example, the Early Decision mechanism allows consumers to purchase the regulated good in period 0 but does not allow consumers to purchase the regulated good in period 1.

**Proposition 3** *With heterogeneous consumers (i.e., with variation in  $\Delta$ ) and no taste shocks (i.e., no variation in  $\varepsilon$ ), an Early Decision mechanism with no taxes in period 0 and no market for  $c$  in period 1 is optimal. Under this optimal regulation,*

$$c = \Delta,$$

and

$$EU_0 = E\beta [\Delta \ln(\Delta)] + \beta(1 - E[\Delta]).$$

**Proof.** Under the Early Decision mechanism, the period 0 first-order condition is

$$\frac{\Delta}{c} = 1,$$

so

$$U_0 = \beta\Delta \ln(\Delta) + \beta(1 - \Delta).$$

This consumption rule achieves the first-best consumption allocation (see the perfect precommitment case in Proposition 1) when  $\varepsilon = 0$ . ■

Formally, Early Decisions are equivalent to an extreme combination of taxes: no taxes in period 0 and infinite taxes in period 1. Now, we characterize optimal tax rates under a regime with stationary taxes.

**Lemma 4** *With homogeneous consumers (i.e., no variation in  $\Delta$ ) and no taste shocks (i.e., no variation in  $\varepsilon$ ), a taxation mechanism with a stationary tax rate  $\tau$  has*

$$c = \frac{\alpha(1 - \beta) + \Delta}{\beta(1 + \tau)}.$$

*The tax rate that optimizes period 0 welfare is*

$$\tau = \left(\frac{\alpha}{\Delta} + 1\right) \left(\frac{1}{\beta} - 1\right),$$

*in which case*

$$U_0 = \beta[\Delta \ln(\Delta) + (1 - \Delta)].$$

**Proof.** Since period 1 demand for  $c$  exceeds period 0 demand for  $c$ , we can ignore period 0 choices. The period 1 first-order condition for utility maximization is

$$\frac{\alpha(1 - \beta) + \Delta}{c} = \beta(1 + \tau),$$

or

$$c = \frac{\alpha(1 - \beta) + \Delta}{\beta(1 + \tau)}.$$

To derive the optimal tax rate, the period 0 first-order condition to maximize  $EU_0$  is

$$-\frac{\Delta}{1 + \tau} + \frac{\alpha(1 - \beta) + \Delta}{\beta(1 + \tau)^2} = 0,$$

which gives us the unique optimal tax rate

$$\tau = \left(\frac{\alpha}{\Delta} + 1\right) \left(\frac{1}{\beta} - 1\right)$$

and

$$c = \Delta.$$

■

With homogeneous consumers, this taxation mechanism is optimal. However, such a taxation mechanism is no longer optimal when consumers are heterogeneous.

**Proposition 5** *With heterogeneous consumers (i.e., with variation in  $\Delta$ ) and no taste shocks (i.e., no variation in  $\varepsilon$ ), a taxation mechanism with a stationary tax rate  $\tau$  is strictly non-optimal. In particular, such a mechanism is strictly dominated by an Early Decision mechanism with no taxes in period 0 and no market for  $c$  in period 1.*

**Proof.** In the stationary tax rate case, period 1 demand for  $c$  exceeds period

0 demand for  $c$ , so we can ignore period 0 choices for the stationary tax rate case.

From Lemma ??,

$$c = \frac{\alpha(1 - \beta) + \Delta}{\beta(1 + \tau)}.$$

To derive the optimal tax rate, the period 0 first-order condition to maximize  $EU_0$  is

$$\beta \left[ -E[\Delta] \left( \frac{1}{1 + \tau} \right) + \frac{\alpha(1 - \beta) + E[\Delta]}{\beta(1 + \tau)^2} \right] = 0,$$

which gives us

$$\tau = \left( \frac{\alpha}{E[\Delta]} + 1 \right) \left( \frac{1}{\beta} - 1 \right).$$

Note that  $\beta[\Delta \ln(c) + (1 - c)] < \beta[\Delta \ln(\Delta) + (1 - \Delta)]$  for  $c \neq \Delta$ , which holds whenever

$$\tau = \left( \frac{\alpha}{E[\Delta]} + 1 \right) \left( \frac{1}{\beta} - 1 \right) \neq \left( \frac{\alpha}{\Delta} + 1 \right) \left( \frac{1}{\beta} - 1 \right).$$

Since this holds for a nonzero mass of consumers,

$$\begin{aligned} EU_0 &= E\beta[\Delta \ln(c) + 1 + T - c(1 + \tau)] \\ &= E\beta[\Delta \ln(c) + 1 - c] \\ &< E\beta[\Delta \ln(\Delta) + 1 - \Delta]. \end{aligned}$$

Thus such a taxation mechanism is non-optimal. ■

We have shown that a pure Early Decision mechanism is optimal in a world of heterogeneous consumers and no taste shocks. Intuitively, each consumer knows

his own preferences, so self-rationing—which is what Early Decisions enable—is superior to a one-size-fits-all regulation like a stationary sin tax.

#### **4.4 Regulatory mechanisms with taste shocks**

Adding taste shocks makes the analysis of optimal regulation far more complicated. In the case of homogeneous consumers with taste shocks distributed according to a general class of density functions, a stationary tax is optimal (see Beshears et al. 2005). With heterogeneous consumers and taste shocks, we conjecture that the optimal mechanism will be a hybrid with a low tax rate in period 0 (the Early Decision period) and a high tax rate in period 1. The analysis of this case is beyond the scope of the current paper and provides fertile ground for future work.

## **5 Conclusion**

When consumers' long-run plans are regularly thwarted by short-run impulsivity, technologies that facilitate making choices today that bind future selves can improve welfare. Such technologies are unlikely to be provided by the private market when the failure of self-control represents a profit opportunity for some other party. In the cigarette market, a firm offering to restrict cigarette sales to a smoker trying to quit will be undercut by other firms eager to sell the smoker another pack. This market failure arises from the inability of a firm to write contracts with all

other existing firms and potential entrants.<sup>9</sup>

This paper has presented a number of examples of Early Decision regulations that facilitate self-control with respect to smoking: restricting the geographic accessibility of vendors or the hours of cigarette sales, mandating delays between cigarette purchase and receipt, or allowing each consumer to choose in advance the legal restrictions on her cigarette purchases. We also give examples of other domains where Early Decision policies could be introduced, such as gambling, alcohol, and unhealthy food. Our theoretical analysis shows that Early Decisions can be particularly useful when consumer preferences are heterogeneous. Intuitively, each consumer knows his own preferences, so self-rationing with an Early Decision mechanism can be more effective than a one-size-fits-all regulation like a sin tax.

Early Decisions impose costs as well. These include the encouragement of black markets, a counterculture backlash, the loss of consumer agency, and the inconvenience experienced by vendors and consumers who do not want to change their behavior. In addition, using sin taxes rather than Early Decisions may be more attractive when the desirability of smoking (from the patient long-run perspective) is unpredictable. Sin taxes, unlike Early Decisions, may also allow other taxes that are more distortionary to be decreased. It is an empirical question whether the costs of Early Decisions outweigh the benefits. Therefore, the desirability of Early Decision regulations can only be evaluated in small-scale experiments.

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<sup>9</sup>If the firm could perfectly contract with everybody, then all parties could commit to restrict sales, and some of the gains to the smoker from such a restriction could be distributed to the firms and potential entrants.

## References

- [1] Akerlof, G.A. (1991). Procrastination and obedience. *American Economic Review*, 81, 1-19.
- [2] Beshears, J., Choi, J.J., Laibson, D., Madrian, B.C., and Widland, T. (2005). Time-contingent taxation for time-inconsistent consumers. Working paper.
- [3] Camerer, C., Issacharoff, I., Loewenstein, G., O'Donoghue, T., and Rabin, M. (2003) "Regulation for Conservatives: Behavioral Economics and the Case for 'Asymmetric Paternalism,'" *University of Pennsylvania Law Review*. 151, 1211-1254.
- [4] Gruber, J. and Koszegi, B. (2001). Is addiction 'rational'? Theory and evidence. *Quarterly Journal of Economics*, 116, 1261-1303.
- [5] Gruber, J. and Koszegi, B. (2004). Tax incidence when individuals are time inconsistent: The case of cigarette excise taxes. *Journal of Public Economics*, 88, 1959-1987.
- [6] Hersch, J. (2005) "Smoking Restrictions as a Self-Control Mechanism," *Journal of Risk and Uncertainty*, 31(1).
- [7] Laibson, D. (1997). Golden eggs and hyperbolic discounting. *Quarterly Journal of Economics*, 62, 433-477.

- [8] Laibson, D., Repetto, A., and Tobacman, J. (2005). Estimating discount functions from lifecycle consumption choices. Harvard University mimeo.
- [9] O'Donoghue, T. and Rabin, M. (1999). Doing it now or later. *American Economic Review*, 89, 103-124.
- [10] Phelps, N. and Pollak, R. (1968). On second best national saving and game equilibrium growth. *Review of Economic Studies*, 35, 185-199.
- [11] Strotz, R.H. (1956). Myopia and inconsistency in dynamic utility maximization. *Review of Economic Studies*, 23, 165-180.
- [12] U.S. Department of Health and Human Services. (2004). Health behaviors of adults: United States, 1999-2001. *Vital and Health Statistics*, 10, 19.
- [13] Yerak, B. (2001). Program helps gamblers quit. *Detroit News*, December 2. <http://www.detnews.com/2001/business/0112/02/b01-356707.htm>