



Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Journal of Environmental Economics and Management

journal homepage: www.elsevier.com/locate/jeem



Learning abatement costs: On the dynamics of the optimal regulation of experience goods



Beat Hintermann ^{a,*}, Andreas Lange ^b

^a University of Basel, Switzerland

^b University of Hamburg, Germany

ARTICLE INFO

Article history:

Received 18 February 2012

Available online 17 June 2013

Keywords:

Experience goods
Dynamic regulation
Learning by doing
New technology
Externalities
Pollution

ABSTRACT

We study the introduction of new technologies when their costs are subject to idiosyncratic uncertainty and can only be fully learned through individual experience. We set up a dynamic model of clean experience goods that replace old polluting consumption options and show how optimal regulation evolves over time. In our base setting where social and private learning incentives coincide, the optimal tax on the polluting consumption is increasing over time. We show, however, that if social and private learning incentives diverge because the private discount rate exceeds the social discount rate, it may be optimal to temporarily increase the tax rate beyond net marginal external damages to induce more learning before reducing the tax rate to the steady state level. Alternatively, one could complement the tax with subsidies for first-time users which can be phased out over time. Similar results apply if consumers have biased expectations. We therefore give a rationale for introductory subsidies on new, clean technologies and non-monotonic tax paths from a perspective of consumer learning.

© 2013 Elsevier Inc. All rights reserved.

1. Introduction

Many environmental regulation schemes involve taxes or subsidies that change over time. In this paper, we study the dynamics of environmental regulation to control the adoption of a socially beneficial experience good. That is, by trying out a new, less polluting consumption choice, consumers may learn the personal net costs they incur from its use, i.e. their personal abatement costs.

Examples are widespread: Car users are often only partially informed about the specific costs and benefits of using public transport (or other means of transportation). Ecologically produced food and clothing may have attributes unknown to the inexperienced user, including taste, durability, social acceptance and the like. Household or office appliances are often advertised in terms of their higher energy efficiency relative to the older versions they seek to replace, but consumers only have limited knowledge about the operating costs and convenience associated with these new products. Learning by experience can also be linked to motivational factors such as the warm-glow effect or social reputation derived from using environmentally friendly products [2,4]. These examples share two features: that the new product reduces an externality and that consumers are uncertain about their personal benefits and costs before trying out the new product.

* Corresponding author. Fax: +41 61 267 3340.

E-mail address: b.hintermann@unibas.ch (B. Hintermann).

We study the optimal regulation of an experience good, explore rationales for initial subsidies for a new product, and demonstrate how optimal regulation levels change over time. We focus on the dynamics of a government intervention that is driven exclusively by consumers learning the net costs that they personally incur from adopting a new technology (hereafter denominated ‘learning’). That is, we abstract from learning spillovers among consumers as well as from supply-side arguments such as cost reductions through an intensified use of the new technology caused by technological spillovers among firms.

The study of experience goods is novel in the environmental economics domain. Our paper is, however, related to studies in industrial organization that focus on the supply of experience goods under imperfect competition. Bergemann and Välimäki [5] examine monopolistic pricing of experience goods in a dynamic model. They show that price dynamics crucially depend on a simple dichotomy between mass and niche markets.¹ While prices in mass markets are declining over time, they may initially be low but subsequently increase in niche markets. The low initial prices are set with a policy focus aimed at increasing market penetration, whereas the higher prices in the steady state (where no more learning takes place) maximize monopoly profits. The literature on dynamic pricing of experience goods goes back to Shapiro [14] who considers learning in a simple two-period model. The pricing of experience goods has also been discussed by Cremer [7], Farrell [10], and Milgrom and Roberts [13].

We set up a dynamic model of a new experience good that replaces a preexisting consumption choice which generates an environmental externality. We consider an infinite-horizon, discrete-time model with a continuum of consumers, who have (at most) unit demand per period for the new product. Alternatively, they consume the traditional, more polluting product. Consumers differ in their expected net costs of using the new technology and face an ex-ante unknown cost component. The latter is subject to idiosyncratic uncertainty and can only be learned through individual experience. We assume that consumers only learn their true costs, i.e. their valuation relative to the old technology, once they have used the new technology for one time period.²

We consider two different regulatory regimes: We start by analyzing the first-best case in which the regulator, at each point in time, determines both the number of inexperienced consumers who are exposed to the new technology for the first-time, and the set of experienced consumers whose continued use of the technology is optimal. Second, we consider a setting where the regulator needs to rely solely on subsidies or taxes. The subsidy in the given period then determines both the behavior of the experienced consumers as well as the inexperienced consumers' decision to try the new technology.

We show how optimal regulation evolves over time. As long as consumers' and social discount rates coincide and expectations about the net costs of the new technology are unbiased, the first-best case can be decentralized by simply relying on a corrective tax levied on the polluting technology, with the optimal tax rate increasing over time. If the private discount rate exceeds the social discount rate or if consumers' cost expectations are biased, the tax alone does not suffice. The first-best solution can then be implemented by complementing the tax with a subsidy for first-time users. This subsidy will be non-increasing over time. If the regulator cannot discriminate between first-time and experienced users, the second-best taxation scheme may involve a non-monotonic path: tax rates are initially increasing with a policy focused on reaching the optimal amount of knowledge (i.e. the number of consumers that have learned their net personal costs), before being reduced to the level that reflects the marginal social costs of using the polluting alternative.

Our results are qualitatively similar to those derived by Bergemann and Välimäki [5] in the context of the optimal monopoly pricing of experience goods. During the approach path, the government (or monopolist) sets the tax with a focus on inducing optimal learning. In the steady state, however, no more learning takes place, and the tax (price) is chosen so as to maximize social welfare (monopoly profits).

We believe that our results indicate an important reason for a slow introduction of pollution taxes that is motivated by the fact that consumers are uncertain about their personal costs or benefits from using a new and cleaner technology. Only by trying it will they learn about the personal fit. We show that such a setting not only motivates taxes that are increasing over time, but that it may also require introductory subsidies for first-time users that are phased out over time.

Our paper is structured as follows. Section 2 presents our basic model, and Section 3 discusses the social optimum. Section 4 considers the case of first-best regulation, while we turn to a second-best regulation that solely relies on usage taxes in Section 5. Section 6 concludes.

2. Base model

Consumers choose one of two mutually exclusive alternatives, which we will label A and B. Alternative A is the status quo and all of its costs and benefits are known, including environmental externalities (example: commuting by car). Alternative B is characterized entirely by private costs (example: commuting by train). For simplicity, we assume that alternative B does

¹ In their paper, a mass market is characterized by the optimal price for informed consumers being low enough that uninformed consumers have an incentive to try the new product. In such a market, all consumers will eventually try the new product. Conversely, a niche market will feature consumers who do not try the new product, as they have no incentive to do so at the optimal price for informed consumers.

² This is a stylized assumption. In general, learning takes places at different rates, and consumers may have different levels of initial knowledge about the new technology. Empirical evidence suggests that the rate of learning crucially depends on the market (e.g., [1,6,8,9,11,12]).

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات