# Return to Sender

# Essays on Extended producer Responsibility

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Linköping, August 2006

Helen Forslind

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<sup>1</sup> Published in *Journal of Cleaner Production*.

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<sup>&</sup>lt;sup>2</sup> Resubmitted for publication in *Environmental Economics and Policy Studies*.

<sup>&</sup>lt;sup>3</sup> Submitted for publication in *Journal of Law and Economics*.

## Introduction

### **Extended Producer Responsibility**

The consumption-based society of today gives rise to several environmental and financial problems. One such problem arises when complex durable goods are worn out. The continuous increase in goods produced results in an increasing amount of waste.

The assumption that government agencies can contribute to environmental improvement by taking active part in providing markets that facilitate the internalisation of environmental costs has promoted a number of policy changes. Many countries have committed themselves to the "Polluter Pays Principle" (PPP),<sup>1</sup> resulting in a number of campaigns and legislative changes aimed at reducing the visual proliferation of litter.

In the mid-1990s, 18 per cent of all municipal waste in OECD countries was destined for recycling.<sup>2</sup> However, public opinion on landfills and

<sup>&</sup>lt;sup>1</sup>OECD (1972), "Guiding Principles Concerning International Economic Aspects of Environmental Policies (Recommendation adopted on 26th May, 1972), C72(128). For a more extensive discussion of PPP see Faure, M. and G. Skogh (2003), "*The Economic Analysis of Environmental Policy and Law – an Introduction*", Edward Elgar, Cheltenham. UK.

<sup>&</sup>lt;sup>2</sup> OECD (2001), Extended Producer Responsibility: A Guidance Manual for Governments, Paris, Organisation for Economic Co-operation and Development.

incinerators became increasingly negative.<sup>3</sup> Policy makers responded with a tightening of disposal options and increased emphasis on waste reduction, reusing, and recycling.

As the environmental awareness became more general, the legislators' focus changed. Extended Producer Responsibility (EPR) was introduced as one possible solution among others, such as environmental taxes and tradable emissions permits. Consideration was no longer limited to the end-of-life treatment of used products. The introduction of EPR was the extension of PPP. The EPR principle states that producers should be responsible for the environmental impact of their products throughout the whole life cycle.

The EPR principle is widely used as a basis for government policy aiming at reducing the environmental impact of products. EPR itself can be considered an environmental strategy. To implement the strategy some kind of *policy instrument* is required. The choice of policy instrument sets the character of the implemented EPR. A policy instrument can be, for example, an obligation to provide information about the product and its environmental effects. (This will be referred to as "informative responsibility".) Another instrument can be making the producer responsible for the whole or an extensive part of the cost associated with end-of-life management. (This will be referred to as "economic responsibility".) 4

The number of product groups covered by EPR has increased in the OECD countries, both in the form of voluntary waste management programmes introduced by producers, and in the form of a significant body of legislation.

<sup>&</sup>lt;sup>4</sup> See Essay I for a survey of EPR

<sup>&</sup>lt;sup>3</sup> See, for example, World Commission on Environment and Development, (The Brundtland Commission) (1987), Our Common Future, Oxford University Press.

Initiatives are often co-operative efforts between industry and policy makers. The existing programmes are in various stages of development. Products affected so far, include used electronic appliances, computers, batteries and tyres, and end-of-life vehicles. The European Union (EU), for example, has passed community legislation on end-of-life vehicles, waste electrical and electronic equipment as well as packaging waste. The product group where EPR policies have been most far-reaching is packaging material, which is covered by a large body of specific programmes and mandatory legislation.

In year 2000, the European Union issued a directive demanding member states to implement EPR for End-of-Life Vehicles (ELVs) in national legislation. The directive demands, among other things, informative responsibility and economic responsibility. The exact implementation is a national matter. It should be noted that the directive does not require that the producers can fulfil their future financial responsibility; in the directive, no financial system is required. When EPR is implemented without an explicit financial system attached, the producer must pay for the end-of-life management when an ELV is returned. Sold but not returned vehicles may cause a large debt. This implementation requires that the producer is still in the market when the product reaches the end of the usage phase.

The EU directive demands free take-back, i.e., the return of an ELV must not be associated with a cost for the owner. However, the directive does not require any economic compensation to the owner when the ELV is returned. That is, it is implicitly assumed that the owner of the ELV is willing to return the ELV for dismantling without compensation. Free take-back,

<sup>&</sup>lt;sup>5</sup> EU directive 1994/62/EC (packaging and packaging waste), 2000/53/EC (end-of-life vehicles) and 2002/96/EC (waste electrical and electronic equipment).

which is what the directive demands, does not imply that the return is without costs for the owner. There is at least a transportation cost and a cost associated with the time spent returning the ELV. Empirical experience suggests that a legal obligation is not enough to make all owners return their vehicles for scrapping when the return is associated with a cost.

Previous research concerning EPR has mainly focused on changes in product design. The concept "design for environment" is often considered to be the primary motivation for EPR. In some studies the focus is on the cost efficiency of EPR policies compared to non-EPR policies in promoting "design for environment".<sup>6</sup> Another question asked is: How crucial is the degree of individual responsibility for the design?<sup>7</sup> The effects of the existing EPR programs have been shown in terms of reduced waste associated with consumer products and in increasing the rate of recycling.<sup>8</sup>

Another line of research concerning EPR is focused on monitoring the recycling quotas and the physical limits of recycling. Johnson and Wang (1999) optimise the dismantling of a vehicle and evaluate the material destination under the imposed requirements of EPR. However, the reciprocity and dependency between the prior legislation and the implemented EPR has not been examined.

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<sup>&</sup>lt;sup>6</sup> See, for example, Walls, M. (2003), "The Role of Economics in Extended Producer Responsibility: Making Policy Choices and Setting Policy Goals", *Resources For The Future*, March 2003, Discussion Paper 03-11.

<sup>&</sup>lt;sup>7</sup> Tojo, N. (2004), "Extended Producer Responsibility as a Driver for Design Change – Utopia or Reality?" *Lund University, Doctoral Dissertation.* 

<sup>&</sup>lt;sup>8</sup> Walls, M. (2006), "EPR Policies and Product Design: Economic Theory and Selected Case Studies", OECD.

<sup>&</sup>lt;sup>9</sup> One example is Reuter, M.A., A. van Schaik, O. Ignatenko, and G.J.de Haan (2006), "Fundamental Limits for the Recycling of End-of-Life-Vehicles", *Minerals Engineering*, vol. 19, 433-449.

<sup>&</sup>lt;sup>10</sup> Johnson, M.R. and M.H. Wang (2002), "Evaluation Policies and Automotive Recovery Options According to the European Union Directive on End-of-Life –Vehicles (ELV)", *Journal of Automobile Engineering*, vol. 216, Part D.

In the first four essays of this thesis car scrapping in Sweden is used to investigate the economic consequences of the implementation of EPR. A motivation for using Sweden as an example is that this country has extensive regulation governing ELVs. The data go back to the 1970s.

### The Swedish Experience

To dump an ELV has been an environmental offence for a long time, punishable by fines or even imprisonment. It has been, and still is, difficult to get anyone convicted since it is the person who dumps the vehicle rather than the owner who can be held liable. This problem initiated the work leading to a new car scrapping scheme in 1975. The new legislation was warranted by an increasing problem with dumped ELVs – this despite the fact that the general waste law already prohibited dumping. According to the legislation, the buyer of a new vehicle is obliged to pay a fee when a vehicle is registered for the first time. This fee entitles the last owner of the vehicle to a *premium* when it is returned for end-of-life management. The purpose of the premium was initially twofold: (i) to finance the end-of-life management and (ii) to create an incentive for the owner to return the ELV properly. The number of abandoned ELVs did initially decrease and for a long time the system worked the way it was intended.

The collected fees are not funded in the traditional meaning. Although often referred to as a fund, they are actually part of the government's current account. The "fund" can therefore more or less be interpreted as a Pay-As-You-Go (PAYG) system where the contributions at one point in time are used to cover the claims at the same point in time. If there had been a direct connection between the size of the fee and the size of the premium, the

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 $<sup>^{11}</sup>$  SFS 1975:343, Bilskrotningslagen and SFS 1975:348, Bilskrotningsförordningen .

system could have been regarded as a funded system. A funded system implies that a contribution paid by an agent at one point in time is funded, and the future claim depends on the income from the funded capital. The effectiveness of the scheme, in terms of return frequency, has decreased over time. The usual explanation is that the value of the premium has been eroded by inflation.

An extensive part of the EU directive on ELVs had already been implemented by Swedish legislation as of 1 January 1998. (Even if the Swedish legislation preceded the directive, it was warranted by it.) The amendment of 1998 states that vehicles registered for the first time after 1 January 1998 are covered by EPR. In the Swedish case, EPR was incorporated into the already existing car scrapping scheme without major adjustments to the old scheme. As EPR requires that the producers cover the costs associated with dismantling, the aim of the premium is reduced to create an economic incentive for the owners to return the ELV.

In November 2003, the Swedish Agency for Public Management was assigned to study the collection and recycling of ELVs. This assignment resulted in an inquiry in 2004, in the following referred to as *the inquiry*. <sup>14</sup> In the inquiry, the Swedish Agency for Public Management proposed that the Swedish government should examine the option of extending liability under the Swedish Environmental Code. Offences by vehicle owners should lead to legal actions. The Agency argues that the premium would be superfluous since it is not needed to finance disposal when producers assume responsibility for the cost of dismantling as EPR is implemented. The Swedish Financial Supervisory Authority is also doubtful as to the need

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<sup>&</sup>lt;sup>12</sup> SFS 1997:788, Förordningen om producentansvar.

<sup>&</sup>lt;sup>13</sup> In 2001, some minor adjustments were made: SFS 2001:145, Lag om ändring i bilskrotningslagen (1975:343).

<sup>&</sup>lt;sup>14</sup> Statskontoret (2004), Bilskrotningens framtida finansiering, 2004:26, Stockholm.

for a deposit refund system.<sup>15</sup> The Authority argues that the possibility of returning the vehicle free of charge is enough incentive for the owner of an ELV. No empirical or theoretical studies are presented to support these statements.

### **Purpose**

The purpose of this thesis is to apply economic theory to analyse the implementation of EPR. A Central questions is whether the implementation through economic policy instruments promotes the environmental goals. Another issue is how the economy is affected by the introduction of EPR.

The purpose of *Essay I* is to provide a description of the legislation concerning EPR and ELVs and to apply economic theory to analyse its effects. An important matter is to analyse to what extent EPR creates the economic incentives required and to what extent the incentive system of the old scheme affects the behaviour of the agents.

In the European Union directive concerning EPR for ELVs, it is implicitly assumed that consumers will fulfil their responsibility without any economic compensation. As mentioned before, the effect of the Swedish scrapping premium has been questioned, for example, by the Swedish Financial Supervisory Authority. However, no evidence is presented, either to support or to reject the assumption that a premium has an impact on the number of ELVs returned for dismantling. One focus of econometric studies of the effects of the Swedish car scrapping premium have been on how the

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<sup>&</sup>lt;sup>15</sup> Swedish Financial Supervisory Authority (2002), "Ekonomiska garantier för producentansvarets fullföljande för bilar – Granskning av några alternativ", *FI Dnr 02-7592-000*, Stockholm.

premium affects the age of the fleet of vehicles.<sup>16</sup> The purpose of *Essay II* is therefore to empirically study the relationship between the numbers of ELVs returned for dismantling and the size of the premium received by the owner. In sum, the question is, does the size of the premium affect the return frequency?

The purpose of *Essay III* is to apply economics of crime in a theoretical analysis of how different incentive structures facing the owner can be used to achieve the optimal number of returned ELVs. A comparison between the efficiency of a positive (carrot) and a negative (stick) incentive system is made. The carrot incentive of interest is the premium paid to the owner; and the stick incentive is constituted by the risk of facing legal sanctions, i.e., having to pay a fine. The third essay therefore compares two methods to deter owners from dumping their vehicles, with respect to their efficiency in achieving optimal rate of returned vehicles.

The purpose of *Essay IV* is to compare a system where a fee is paid when the vehicle is put on the market and funded during the usage phase to a system where the fee is not funded. In this essay the existence of the premium is not questioned. Given that the owner of an ELV is entitled to a premium when the ELV is returned, the question of how to finance such a system efficiently is addressed.

The purpose of the final essay,  $Essay\ V$ , is to analyse how the financing of EPR affects the level of output and economic growth, that is, the impact of the chosen financing system on the overall performance of the economy. As the number of products covered by EPR is increasing and EPR comprises an

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<sup>&</sup>lt;sup>16</sup> Berglund, C. M. and P. Matstoms (1999), "Yngre bilpark med höjd skrotningspremie"?, VTI rapport 432-1999, Väg- och transportforskningsinstitutet, Linköping; Sandström, F.M. (2003), "Car Age, Taxation, Scrappage Premiums and the ELV Directive", Working Paper No. 591, 2003, Research Institute of Industrial Economics, Stockholm.

increasing share of the economy, the question of how the financing of EPR affects the rest of the economy needs to be addressed.

#### Method

EPR raises a number of problems that can fruitfully be analysed by economic methods. Even though the subject area is well defined, there are many issues raised, which justify the use of more than one method.

The choice of car scrapping in Sweden as empirical base in the first four essays has primarily two reasons. First, vehicles have the advantage of being a registered durable good, which ensures the availability of data. Second, Sweden has a relatively long experience of a functioning car scrapping scheme. In addition, the implementation of the EU directive started earlier in Sweden than in other EU member states.<sup>17</sup>

In *Essay I* the prior Swedish legislation relating to ELVs is taken as the context, and the consequences of implementing EPR are analysed. The focus is on how EPR affects the existing car scrapping scheme, aimed at both creating economic incentives and financing end-of-life management. Microeconomic theory is used to analyse the legislation on EPR. The essay examines the financial consequences and surveys to what extent the implemented EPR creates the economic incentives desired.

The method used in *Essay II* is time series econometrics. Using Swedish data, a model is used to estimate the relationship between the number of returned ELVs and the size of the premium. The number of deregistered vehicles is used as a proxy for the number of returned ELVs. The data used are monthly data for the period January 1978 to April 2003.

<sup>&</sup>lt;sup>17</sup> See Essay I for a survey of the implementation process of EPR in the member states.

In *Essay III* the problem of how to make the owners shoulder their responsibility (to return the ELVs for end-of-life management) is addressed without taking the existing scheme as a prerequisite. The possibility of using fines and deposits in order to change the incentive structure facing agents is examined using methods from the economics of crime literature. Following Polinsky and Shavell (2000), a model is used to compare a fine-based system to a deposit-refund system, and finally a combination of the two is considered. <sup>18</sup>

The question of how to finance the incentive system is addressed in *Essay IV*. A funded system is compared to a PAYG system. An Overlapping Generations (OLG) model is applied to study differences in risk exposure and rate of return between the two systems. Finally an empirical comparison of the two alternatives is made using Swedish data.

In the OLG model, generally used to study pension systems, the individuals have finite lives, giving rise to a turnover in population causing several generations to coexist in the same period. To simplify the model, a common assumption is that each individual lives only two periods. In this application, when the OLG model is used to compare two alternative ways of financing the premium, the vehicles constitute the individuals. This makes it possible to compare a system where one generation covers the costs for another generation, i.e., a PAYG system, to a system where each generation covers its own costs, i.e., a funded system.

Essay V studies the question of how to finance EPR, with the analysis no longer limited to ELVs. As the number of product groups covered by EPR has increased, this has raised the question of how the overall performance of

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<sup>&</sup>lt;sup>18</sup> Polinsky A. M. and S. Shavell (2000), "The Economic Theory of Public Enforcement of Law", *Journal of Economic Literature*, 38 (March), pp. 45-76.

the economy is affected by the policy. An OLG model with endogenous growth is applied to the case where output is interpreted as product groups covered by EPR. A comparison between two financing system, a funded insurance system and a system where the new products bear the costs associated with the end-of-life management of the old products, is made with respect to the impact on the overall performance of the economy in terms of output and economic growth.

#### Results

This thesis extends the analysis of EPR by analysing the economic effects of the implementation and the effect on the legal context surrounding it.

It is shown in *Essay I* that EPR gives rise to two interdependent responsibilities, one for the consumers and one for the producers. The consumers' responsibility is to return the product when the usage phase is ended. The producers' responsibility involves financing the end-of-life management. When treating the two responsibilities separately, it is not possible to draw conclusions about the welfare effects. It is therefore important to stress their interdependency.

It is also noted that a financial solution is needed to secure the producers' ability to fulfil their responsibility. It is in this context important to distinguish between the cost and the payment. One important conclusion is that, since the market for vehicles has the character of an oligopoly, the vehicle owners and the producers *share the costs* but the producers *make the payment*. The responsibility for making the payment will bring about financial risks for the producers. They will not only face uncertainty regarding the lifetime of a vehicle. They will also face uncertainties regarding the rate of return on the financial markets, future requirements for

recovery, recycling and reuse ratios. The return frequency of ELVs is also uncertain. The important conclusion is that the financial solution should be separated from the producers to ensure that future liabilities can be met.

The main contribution of *Essay II* is that a positive relationship between the return frequency and the size of a monetary incentive was established. The results indicate that an increased premium would result in an increased number of returned ELVs: a 10 per cent increase in the premium would result in a 2.3 per cent increase in the number of returned vehicles. If, for example, the year 2002 premium had been 10 per cent higher, approximately 7000 more vehicles would have been returned.

The results from *Essay III* indicate that when the environmental harm of littering is relatively low, a deposit-refund system is preferred. When cases of high environmental harm are included, a combined system would be preferred. This result rest on the assumption that the cases where harm is high can be targeted and the owners held liable without drastically increasing the enforcement costs.

The results from *Essay IV* indicates that during the period studied a funded system would have been better than a PAYG system. The funded systems performed better both with respect to the rate of return and risk exposure. The results show that under a PAYG system vehicle owners were charged an implicit tax during a predominant part of the period studied, i.e., they had to pay more than would have been necessary under the system with the highest rate of return.

Essay V addresses the question of how the choice of financing system affects the overall performance of the economy. It was found that both the growth rate in production and the level of output is favoured by the choice

of a funded system. The short run effect of a technological shock on growth is also found to be bigger when a funded solution is chosen.

In sum, the results from the thesis imply that a monetary incentive to the last owner of the vehicle does increase the number of returned ELVs. In the case where some littering is relatively harmless and some is harmful it appears efficient to combine a funded premium with criminal sanctions. Both the premium and the end-of-life management should be financed through a funded system as it gives the highest rate of return and the most beneficial effect on production and growth.

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