# Will the ‘dual system’manage packaging waste?

**Gernot Klepper, Peter Michaelis**

**Angaben zur Veröffentlichung / Publication details:**

Klepper, Gernot, and Peter Michaelis. 1992. “Will the ‘dual system’ manage packaging waste?” Kiel: Institut für Weltwirtschaft, Universität Kiel. https://hdl.handle.net/10419/597.



# Kieler Arbeitspapiere
# Kiel Working Papers

Kiel Working Paper No. 503

## Will the 'Dual System' Manage Packaging Waste?

Gernot Klepper and Peter Michaelis

January 1992

Institut für Weltwirtschaft an der Universität Kiel

The Kiel Institute of World Economics

ISSN 0342 - 0787

Kiel Institute of World Economics
Düsternbrooker Weg 120
D-2300 Kiel 1, FRG

Kiel Working Paper No. 503

# Will the 'Dual System' Manage Packaging Waste?

Gernot Klepper and Peter Michaelis
January 1992

**Contents**

0. Introduction ..... 2
1. Packaging Waste in Germany ..... 3
2. The Legal Background ..... 4
   2.1. The "Verpackungsverordnung" ..... 5
   2.2. The Dual System ..... 7
3. Incentives in the Dual System ..... 11
   3.1. The Retailers Industry ..... 13
   3.2. The Producers ..... 16
   3.3. The Consumers ..... 19
4. Economic Efficiency ..... 20
   4.1. Efficiency in the Dual System ..... 21
   4.2. Efficiency Overall ..... 23
   4.3. Anti-trust Issues ..... 24
   4.4. The "Green Dot" as a Trade Barrier ..... 25
5. Implementation Problems ..... 28
6. Conclusions and Suggestions ..... 30

Appendix: An Estimate of Primary Packaging Waste in Germany ..... 33
Bibliography ..... 39

## 0. Introduction

The sheer amount of waste generated is quickly becoming a major problem for densely populated industrial societies in terms of disposal opportunities and in terms of environmental effects (Faber/Stephan/Michaelis 1988). Household waste is of major concern because of its volume and because of the diversity of substances contained in it. The Dual System is an attempt to improve this situation by reducing the disposal of packaging material either through the recycling of this form of waste or through the reduced use of packaging material by the industry.

In this paper a provisional review of the Dual System in Germany is given; provisional since the Dual System has in August 1991 just begun to be operated in seven cities and counties covering approximately 1.5 mio people. By the end of 1991 ten million German citizens are expected to be involved in it. The assessment presented here does therefore rely on preliminary information and it is partly based on preliminary arrangements which in the course of the implementation of the Dual System will probably be adjusted according to the experience from the current pilot projects.

The paper is organized as follows: The first part consists of an estimate of the quantities of waste which will be covered by the Dual System. This estimate is based on a rather scetchy data base such that it should be at most called an intelligent guess. In the second part the legal background of the Dual System is presented. The regulations of the "Abfallgesetz" - the "Law on the Prevention and Recycling of Waste" - and of the "Verpackungsverordnung" - the "Directive Concerning Packaging Waste" - are summarized. The organization of the Dual System and the institutions which have been established with it are also presented.

A first assessment of the incentives which the participants of the Dual System (i.e. households, the packaging industry, and the packers and fillers) face is given in the third part. The question whether the Dual System is designed as an efficient waste management system with respect to efficiency internally as well as for the economy overall is addressed in the fourth part which also contains a discussion of related issues such as anti-trust and trade policy problems. The fifth part contains a discussion of some of the potential and actual implementation problems of the Dual System. The paper closes with some preliminary conclusions and suggestions for improving the currently planned system.

## 1. Packaging Waste in Germany

The Dual System is designed to reduce and reprocess packaging waste from households. Since there exist no detailed statistics about the volume or weight and about the composition of household waste one can only estimate how much waste will be covered by the Dual System. Since a detailed account of the estimates is given in the appendix the results are presented here without a discussion of their validity.

The total amount of waste which is collected by the local waste management authorities from households in West Germany in 1985 was 14.0 mio tons. Another 6.4 mio tons of commercial waste which can hardly be separated from household waste has also been collected. More recent estimates are not available, yet table A2 in the appendix shows a falling trend which can probably be attributed to the rising fraction of household waste entering bring systems, e.g. paper and glass. This becomes evident from table A3 which shows that the composition of household waste by materials for 1979/80 and 1985 has falling shares for these two materials. Data about the composition of commercial waste are not available, nor is there information about the amount or composition of waste in the "new states" of Germany.

**Table 1:** Potential amounts of packaging waste materials from private households (mio t, estimates).

| | Packaging material contained in household waste | Separately collected packaging waste from private households | Total |
|---|---|---|---|
| Paper | 0.34 | 0.31 | 1.21 |
| Cardboard | 0.56 | | |
| Package comp. | 0.27 | 0.00 | 0.27 |
| Metals | 0.41 | 0.03 | 0.44 |
| Glass | 1.27 | 0.97 | 2.19 |
| Plastics | 0.64 | 0.005 | 0.645 |
| Total | 3.49 | 1.315 | 4.805 |

Source: Own calculations, based on 1985 data (see Appendix).

Since the statistics on the composition of household waste do not distinguish between packaging and non-packaging waste the likely amount of packaging waste to be treated by the Dual System has to be estimated. Table 1 summarizes our estimate according to which about 4.8 mio tons of packaging waste is contained in household waste. From this amount about 1.3 mio tons are already collected separately from general household waste leaving about 3.5 mio tons to be separated from the normal waste bins. Hence 25% of household waste in the general waste bin is packaging material.

If one assumes conservatively that commercial waste going into the local waste collection has at least the same packaging content as household waste then more than 1.6 mio tons of commercial packaging material need to be added to the numbers above. Hence the Dual System will have to collect, sort, and reprocess up to 6.5 mio tons of packaging material.

The "five new states" will also contribute their share of packaging material about which no information is available at the moment. In the medium run the composition and quantity of household waste will equal that in West Germany such that another 20% to 30% must be added bringing the total quantity of packaging waste to about eight million tons per year. Since only 80% of that quantity is to be covered by the Dual System (see chapter 2.1), it needs to develop capacities for about seven million tons of packaging material per year. Also accounting for the increase in the production of packaging material more than eight millions may be reached by today.

Table 1 also reveals that the different packaging materials are already partly separated from the general household waste, although to different degrees. We estimate that on average 27% of all packaging material of households has been collected separately. Whereas roughly 45% of glass and 25% of packaging paper and cardboard is already separated, the share of metal packaging is only 7%. Practically all plastic material and compound packaging is still in the general waste bins.

## 2. The Legal Background

The Dual System has grown out of the "Law on the Prevention and Recycling of Waste" ("Gesetz über die Vermeidung und Verwertung von Abfällen"; in short: Abfallgesetz - AbfG)[1]. §14,2 AbfG empowers the government to regulate the flow of specific products - especially packaging material and other containers. After their use, these products should be returned by the users for an environmentally friendly reprocessing through

---

1 See Bundesgesetzblatt (BGBl) I of 27.8.1986, pp. 1410-1420.

the producers, through wholesalers, or through some other intermediary. The reprocessing of packaging and containers should be secured by an appropriate deposit refund system.

In November 1990 the federal government of Germany did propose to the Bundesrat a "Directive Concerning the Prevention of Packaging Waste" ("Verordnung über die Vermeidung von Verpackungsabfällen"; in short: Verpackungsverordnung - VerpackVO). After the Bundesrat had introduced some stricter regulations into the directive, it passed the Bundestag on May 9. 1991.[2]

### 2.1. The "Verpackungsverordnung"

§1 of the VerpackVO states three guide-lines for the use of packaging. Packaging should

1. in terms of volume and weight be reduced to a degree necessary for the product;
2. be refillable as far as it is technically and economically feasible; and
3. it should be reprocessed if refilling is impossible.

There was and still is some confusion as to the exact definition of reprocessing. The debate in the Bundesrat has made clear that "thermal reprocessing", i.e. the burning of packaging material, is not considered as "reprocessing" in the sense of the VerpackVO.[3] Only "material reprocessing" is therefore covered by the directive.

The VerpackVO distinguishes between three types of packaging:

* Packaging for transport,
* primary packaging
* and secondary packaging.

Transport packaging is packaging which is exclusively used for protecting the product on its way from the producer to the sales outlet. Secondary packaging is material which is, e.g., used to protect a product against theft or to apply additional advertising and which can be removed by the consumer at the store without reducing the possibility to transport the product to its final destination and protect it until it is consumed. Primary packaging, finally, is packaging which the consumer needs to transport and protect the product.

---

2 See Bundesrats-Drucksache 817/90 of 14.11.1990, Bundesrats-Drucksache 236/91 of 19.04.1991 and Bundesgesetzblatt (BGBl) I of 20.6.1991, pp. 1234-1238.

3 See also chapter 4.2 for a discussion of related issues.

Transport packaging must be taken back after use by the manufacturer of the packaging or the user. §4 VerpackVO also requires reuse or "material reprocessing" outside the public waste disposal system by Dec. 1. 1991. Exemptions of these regulations are not provided for.

The same regulation applies for secondary packaging which should remain at the point of sales from where it is to be returned to reuse or to "material reprocessing". The directive requires wholesalers to supply - at the point of sale - appropriate containers which enable consumers to remove the packaging and leave it at the store. This regulation is to be implemented by April 1. 1992 (see §5 VerpackVO).

The VerpackVO also requires in §6 that primary packaging material must be taken back by the stores in or near the point of sale. The packaging then must be returned to the manufacturer of the product or the manufacturer of the packaging which are required to reuse or recycle it. The stores are only required to accept packaging material of products which they themselves supply.

In order to create additional incentives for consumers to return packaging to the stores, for all containers of beverages, of detergents, and of paint deposits between DM 0.50 and DM 2.00 will be introduced (§§7-8 VerpackVO).

Whereas transport packaging and secondary packaging receives no exemption from these rules, §6,3 VerpackVO offers the industry a possibility to substitute the deposit/refund system and the return system for the primary packaging according to §6,1 and §6,2 by an alternative, the so called "Dual System". This system represents an alternative to the communal waste disposal system and is to be administered by the industries which are involved in the production or use of packaging material.

The exemption from §6,1-2 is granted to producers and distributors by the state government if the Dual System guarantees a regularly collecting, sorting, and reprocessing of packaging waste. The criteria under which the exemption is granted are as follows:

* A specific percentage in terms of weight of packaging waste is collected by the dual system - the coverage ratios are given in Table 2.
* From this collected volume a specific percentage of the packaging waste as given in Table 2 must be sorted out in a way which allows material reprocessing of packaging waste.
* All of the material which has been sorted out must be reprocessed.

It is important to note that the coverage ratios do not only refer to packaging material with the "grüne Punkt" but to all packaging material produced, hence it will be difficult to meet these criteria if the system does not cover practically all packaging material.

Table 2: Coverage and sorting ratios required by the VerpackVO.

| | Coverage ratios from | | Sorting ratios from | |
|---|---|---|---|---|
| | 1.1.93 | 1.7.95 | 1.1.93 | 1.7.95 |
| Glass | 60 % | 80 % | 70 % | 90 % |
| Tin-plate | 40 % | 80 % | 65 % | 90 % |
| Aluminum | 30 % | 80 % | 60 % | 90 % |
| Card-board | 30 % | 80 % | 60 % | 80 % |
| Paper | 30 % | 80 % | 60 % | 80 % |
| Plastic | 30 % | 80 % | 30 % | 80 % |
| Package comp. | 20 % | 80 % | 30 % | 80 % |

Source: VerpackVO.

The required coverage ratios for different types of packaging waste will increase over time and by mid-1995 they will be uniformly 80%. The percentage which is sorted out will also increase between 1993 and 1995. By then 90% of collected glass, tin-plate, and aluminum must be sorted out, whereas only 80% are required for paper, cardboard, plastic, and composite waste (Table 2). The remaining 10% resp. 20% can be given to the public waste disposal system. Again, thermal reprocessing is not allowed.

There is also a special regulation concerning beverage containers for which an exemption from the deposit/refund system can only be granted if the percentage of refillable bottles in the state does not fall below 72% (§9,2 VerpackVO). With this constraint one wants to secure the already existing widespread deposit/refund system for beverages in Germany.

### 2.2. The "Dual System"

The VerpackVO in requiring collection at or near the point of sales and by requiring material processing has introduced a rather costly system for the recycling of packaging

waste. Packaging material must be returned to the respective producer of the product or of the packaging material. Obviously, such a system would require tremendous efforts in sorting packaging material not only with respect to the type of material, but also with respect to the manufacturer. The organizational burden would be laid upon the retailing industry, whereas the costs would probably first be passed on to the consumer goods industry. It is clear that all industries involved in this would gain from using the exemption from §6,3 VerpackVO and establish a "Dual Waste Management System" for recycling primary packaging waste.

The Dual System is organized as follows: On the 28. of September 1990, corporations from the retail industry, the packing and filling industry, the producers of packaging material, and the raw material suppliers for the packaging industry did get together to form the "Duales System Deutschland (DSD) GmbH". Today about 400 firms are members of the DSD, among them the largest packaging companies. The DSD has essentially two functions. Firstly, it organizes the arrangements between the industries which are participants in the "Dual System". And, secondly, it establishes firms which themselves take part in the recycling process of packaging waste.

The basic idea of the Dual System is to establish a privately organized system which assures that - hopefully - all primary packaging is returned from the consumer into a material-specific recycling process. This is done through the so called "grüner Punkt" (green dot). It is a label on packaging material which identifies the product as belonging to the Dual System. The retail industry participating in the DSD promises - after some time for adjustment - to accept for sale only products labelled with the "green dot".

The DSD issues the "green dot" to users of packaging material. In order to receive it, the firm must present a guarantee from some recycling firm to take back and to reprocess all packaging material of the type in question from the "Interseroh AG" (see below). Usually the producing firm will have a contract of that nature with the recycling firm. The firm also has to pay a license fee for each packaging unit which varies between zero and 0.20 DM depending on the volume of the container (see table 3).

The second activity of the DSD concerns the technical organisation of collecting primary packaging waste from consumers. The DSD has founded the "Interseroh AG" which is responsible for the collection and the sorting of primary packaging material; but can also intervene in other activities of interest to the DSD such as recycling. Originally, the Interseroh had planned to provide collection and sorting itself. It did, however, become criticized by the waste reprocessing industry and by communal waste collectors for trying to monopolize the market for waste collection and sorting since

they would not accept to be forced to dismantle their already existing local recovery systems. The Interseroh has therefore adjusted its policies and is now in the process of coordinating existing recovery systems with the needs of the DSD and to implement own systems in communities where other suppliers of such services do not exist.

**Table 3:** License Fees for the "Green Dot".

| Volume of the packaging (litres) | Fee per unit (DM) |
|---|---|
| up to 0.05 | 0.00 |
| over 0.05 up to 0.20 | 0.01 |
| over 0.20 up to 3.00 | 0.02 |
| over 3.00 up to 30.0 | 0.05 |
| over 30.0 | 0.20 |

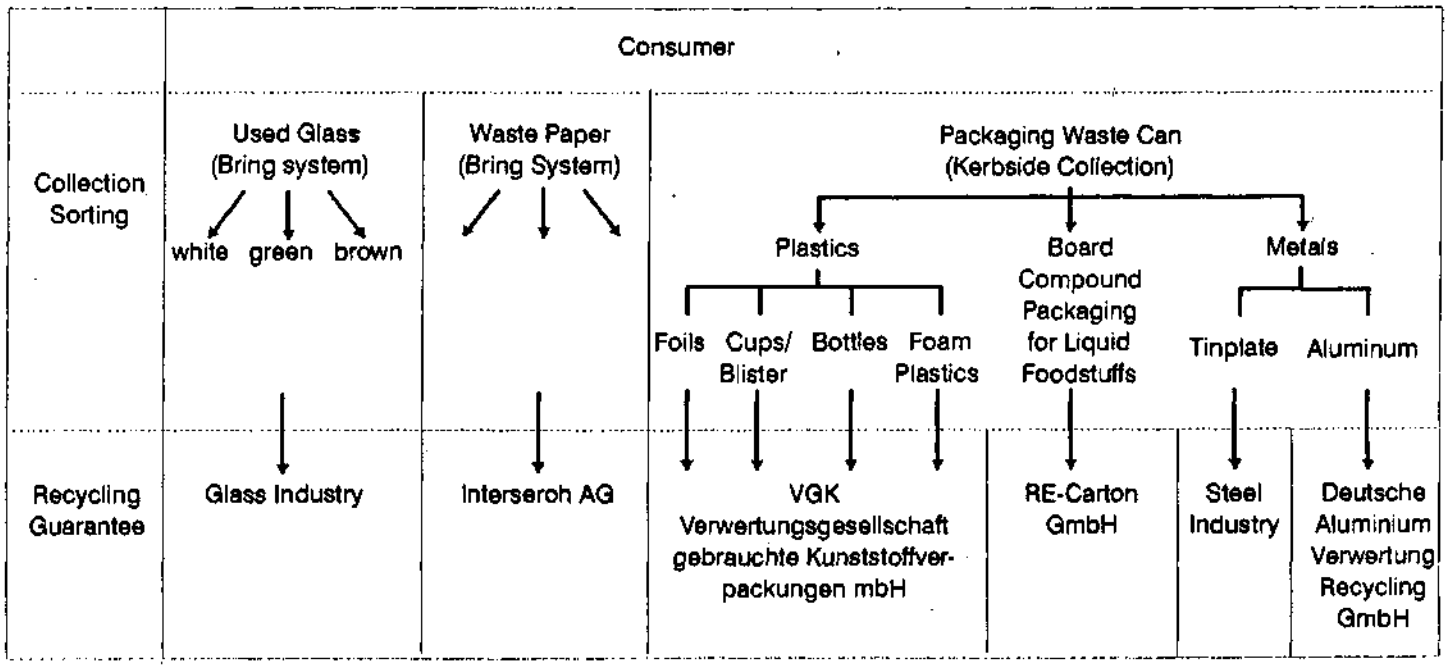
Source: DSD GmbH.

Once the waste is collected from consumers and sorted, material recycling would become the responsibility of those firms who had given the recycling guarantee which a packer and filler has presented to the DSD for getting the "green dot". This approach has been changed even before the Dual System has begun to operate. The raw material suppliers and the packaging converters have in several cases given a global reprocessing guarantee. Figure 1 illustrates the current situation. For glass products and tin-plate the glass industry and the steel industry have given such guarantees. Aluminum waste will be taken back and recycled through the "Deutsche Aluminium Verpackung Recycling GmbH" (German Aluminum Packaging Recycling) and cardboard-compound-packaging for liquid food by the RE-Carton GmbH. For plastic packaging the "Verwertungsgesellschaft gebrauchte Kunststoffverpackungen mbH - VGK"[4] (Reprocessing Corporation for Used Plastic Packaging) is preparing a list of plastics for which it guarantees take back and recycling. Since for packaging waste made out of paper and cardboard the waste paper industry did not give a recycling guarantee, the Interseroh has stepped in and guarantees material recycling.

---

[4] The VGK was founded in February 1991 in Frankfurt. The Interseroh holds 25.1% of the capital; the rest is equally shared by the producers and users of plastics (see Frankfurter Allgemeine Zeitung, 27.2.1991).

FIGURE 1 Collection and Reprocessing of Packaging Waste in the DSD



As a result, a packer and filler who uses packaging material other than plastic can easily obtain the "green dot" by simply making a contract with the DSD for the right to use the "green dot"; the reprocessing guarantee has already been signed between the DSD and the respective reprocessing firm. Only in the case of plastic material and aluminum packaging which is not used as beverage containers, the packer and filler must still make a contract with the VGK, the plastic recycler or the aluminum industry.

The DSD plans to organize the waste collection system through a combination of bring systems and kerbside recycling. Glass and paper/cardboard packaging will be collected predominantly through bring systems. In many communities such systems already exist such that only the density of containers would have to be increased. The DSD envisages a density of 500 inhabitants per container. The other packaging materials will be collected through the use of a packaging garbage can - the so-called "Wert-Tonne" ("Value-Bin") - in addition to the original bin . This bin with packaging waste will then be collected at the kerbside and sorted out at facilities of the Interseroh or of the local waste collectors. As mentioned above, the question who will do the collecting is not settled. The DSD expects that different systems might emerge at the community level.

In this way the DSD covers the material flow of packaging from the production stage through retailing and consumption back to the collection and reprocessing of the packaging material.

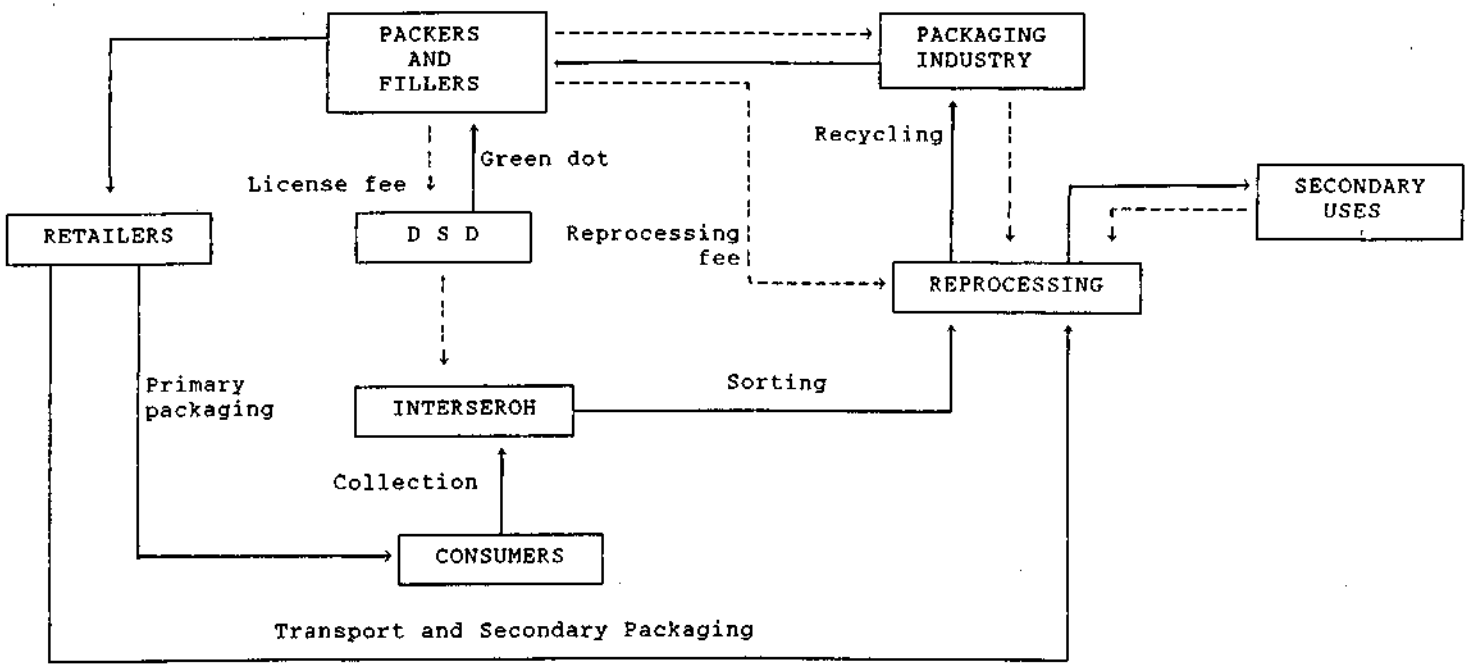
For an assessment of the Dual System - as it is proposed so far - we therefore conceptually differentiate between three types of issues which we believe to be critical:

1. The first question is, whether the Dual System provides incentives which guarantee its stable and efficient functioning.
2. The second concerns the question of welfare effects of the proposed system in an economic environment with distorted prices arises thus requiring a discussion of second best issues.
3. Finally, practical problems such as the relation to already existing systems, other regulations, legal constraints, or cost structures for recycling.

## 3. Incentives in the Dual System

The Dual System has three groups of actors whose behaviour within the group and between groups needs to be analyzed (see, e.g., Michaelis 1991a): The producers of packaging material together with the packers and fillers, the retail industry, and the consumers. Figure 2 illustrates the interrelations among the three groups. In one

**Figure 2:** The Dual System.



direction there is the material flow of packaging material from production of raw materials to the production of packaging material. The packers and fillers send it through the retail industry to the consumers from where the Interseroh collects and sorts the primary packaging. It is then recycled by the above mentioned recycling institutions which then deliver recycled material for either reuse in the packaging industry or for secondary uses in other sectors. Also exports can be used as an option of reuse.

This material flow is accompanied by a financial flow from consumers through payments for the consumption goods to eventually the packers and fillers who themselves have to finance the DSD by paying the fees for the "green dot" and by giving money to the recycling industry, if recycling is more costly than the value of the recycled product. If this is not the case, it is conceivable that the recycling industry may have to pay for receiving packaging waste from the Interseroh.

The burden of the costs of compliance with §6 VerpackVO for primary packaging would clearly be on the retail industry and on the packers and fillers. By requiring a take back guarantee in or near the point of sales by retailers for the packaging which they sell and by imposing a deposit/refund system for many products (§§7-8 VerpackVO), not only an administrative challenge is imposed upon the industry. In addition, the need to collect and separate packaging waste according to the point of sale and to the manufacturer imposes costs which could be avoided through more efficient institutional arrangements. It is clear that the retail industry has an utmost interest to push for the application of §6,3 VerpackVO which grants exemption from §6,1-2 and §§7 and 8 if the Dual System is established.

### 3.1. The Retail Industry

Since participation in the Dual System is voluntary the retail industry must be able to provide incentives to their suppliers inducing them to take part in this scheme. The proposed incentive consists of a declaration by the retail industry association announcing that - after some transitional period - it will accept for sale only products with the "green dot". If this pledge is credible every domestic or foreign supplier of goods containing primary packaging will be forced to participate in the Dual System.

The credibility of this announcement, however, can be questioned. Suppose the retail industry association has no regulatory power vis-a-vis their members - which it actually does not have - then there is always an incentive not to participate in the Dual System. Competition between retailers on the market will force them to look for a supply of goods which can be sold cheaper than at the stores of their competitors. Products without the "green dot" will have lower wholesale prices since they do not contain the cost of

collecting, sorting, and recycling of the primary packaging. Thus every store has an incentive to free-ride on the Dual System by selling goods without the "green dot" cheaper than the competitors.

It does, however, risk to becoming revoked the exemption according to §6,3 hence being required to take back all packaging material. This threat is not very serious as long as only a small number of retailers uses this strategy. The DSD administrating the Dual System will try not to have involved the state authorities in revoking the exemption since this could indicate that the Dual System is not successful. And even if the exemption is revoked the costs to the retailer are relatively small since the consumers still have the more convenient option of giving their packaging waste to the Dual System; it is therefore unlikely that much material will be returned to such a retailer.

If this free-riding strategy is rationally followed by retailers it will - at least in theory - rather quickly lead to a collapse of the Dual System. From a static point of view, the situation can be viewed as a typical prisoner's dilemma in which defecting from the cooperative solution is a dominant strategy. Figure 3 illustrates the different strategies in an example with just two players. Although empirical information on payoffs is not available, the payoffs for player 1 and player 2 are probably of the form $F > C > D > P$. $F > C$ implies that it is optimal to free-ride on the Dual System since one does not pay the cost of the waste disposal.

**Figure 3:** Prisoner's Dilemma for the Retail Industry.

| Player 2<br>Player 1 | Participate | Do not Participate |
|---|---|---|
| Participate | (C,C) | (P,F) |
| Do not participate | (F,P) | (D,D) |

$D > P$ is a reasonable assumption in this two-player game but less realistic in a game with a large number of players. It implies that, if the other player is not participating but the Dual System is still in place, then one is also better of not to participate. One reason could be that the recovery rates required by the Dual System can only be met by recyc-

ling the waste of the other player. This, however, might be more costly than having the Dual System collapsed, i.e. by both players playing the "non-participation" strategy. Hence, it will always be optimal for each player not to participate in the Dual System if the alternative to the Dual System is relatively cheaper than the cost of paying for the free-riding. The prisoner's dilemma therefore more likely applies when the retail industry is composed of a small number of firms.

These results of a static game can not be transferred to a more realistic setting of a repeated, i.e. dynamic, situation. In reality retailers compete over many periods and repeatedly have to make the decision whether to join - resp. leave - the Dual System. For these repeated games or supergames, unique qualitative results do not exist[5]. In simple repeated prisoner's dilemma games with a finite time horizon, defection from the cooperative solution is certain, whereas experimental evidence shows that people do in fact cooperate in most periods. Kreps/Milgrom/Roberts/Wilson (1982) show that a reputation effect can explain such cooperative behaviour. If almost everybody expects his competitor to cooperate in the Dual System since they all know that they will all be better off by participating, then such a cooperative solution can in fact emerge. Yet, once the systems has collapsed, the models offer no mechanism which in this game could lead the players back to the cooperative solution.

If in the static game the payoff P is larger than D - i.e. it is worthwhile to tolerate the free-riding behaviour of some players - then the prisoner's dilemma situation disappears and the strategic situation can be approximated by the socalled "game of chicken" (Shubik, 1983). This game results in unstable outcomes. It has two Nash-equilibria in the two-person context, namely either player one participates and player two defects or vice versa. On the other hand, the security levels for each player, i.e. minimax strategies, are attained when they both participate. In addition, if a player commits himself beforehand to not participating, the optimal strategy of the other player is to participate.

Since this is true for both players, in a repeated game situation complex interactions might occur with the players moving back and forth between free-riding on the Dual System and attempts to preserve its functioning through tolerating such behaviour. In other words, the potential for some free-riding behaviour is inherent in such a strategic environment. This inherently unstable situation is somewhat stabilized through the threat that the Dual System will be dismantled once and for all if the coverage percentages for reprocessing are not met and through the danger that the non-cooperative retailer might be forced to operate his own take-back system. This threat may induce

---

5 See e.g. Aumann (1981), Kreps/Milgrom/Roberts/Wilson (1982), Axelrod (1984), or Fudenberg/Tirole (1989)

the players to use more cautious strategies, i.e. to cooperate. Whereas in the prisoner's dilemma case a break down of the Dual System is certain if no incentives in the dynamic game prevent this from happening, the game of chicken situation may result in a preservation of the Dual System yet with turbulent changes in strategies.

The strategic situation for the retail industry is very delicate indeed. On the one hand, it probably benefits most from the Dual System by not being forced to handle the collection and sorting of packaging waste and by avoiding the need to operate deposit-refund systems. On the other hand, it is most sensitive to free-riding behaviour, since competition among retailers will always provide incentives for not participating in the Dual System. These incentives may be reduced through a more restrictive use of the exemption according to §6,3 by the authorities of the states than it is currently practiced where the exemption seems to be granted more or less on a global scale for the whole retail industry. Another solution, of course, would consist in a legal requirement in the VerpackVO forcing the retail industry only to accept products with the "green dot". This would rule out free-riding on the side of retailers. This would, however, make the DSD which is presently a voluntary organization a compulsory institution.

### 3.2. The Producers

The construction of the DSD requires the packers and fillers to obtain reprocessing guarantees for their packaging material and to pay fees to the DSD for the right to use the "green dot". The public discussion has primarily focussed on these two issues raising the question as to how strongly prices are affected by the fee and how difficult it might be to obtain the reprocessing guarantees. In fact, these issues do not turn out to be problematic.

The fees for the "green dot" are low and only pay for the expected cost of collecting and sorting packaging material through the Interseroh and other participating institutions. The other cost component for the packers and fillers comes from the fact that they may not get for free the reprocessing guarantees from the recycling industry. In accordance with the polluter-pays-principle the packers and fillers are responsible for the material reprocessing of their packaging material, hence they will in many cases need to pay a fee to the recycling firm for this reprocessing in addition to the payment to the DSD.

Therefore, the demand for packaging material will not only be guided by the overall cost of packing and filling, it will also depend on the cost of reprocessing. These costs depend on the cost of recycling and on the price that can be achieved for the recycled material. The packers and fillers will look for packaging material whose overall cost, i.e. material prices plus packing/filling costs plus the fee to the DSD plus reprocessing

costs, is minimal. The Dual System will therefore change the demand structure for packaging material, but it will also change the supply behaviour of the packaging industry.

The packaging industry could react by supplying material with low reprocessing cost or by engaging itself in recycling activities. These supply strategies can be expected to generate innovations in packaging materials and techniques such that the overall amount of packaging may be reduced or at least become more easily accessible to recycling. The more competition there is in the industry, the more intensive search by companies for recycling friendly packaging is likely to occur. This is more or less what has been hoped to emerge as the Dual System is installed.

However, in reality it had turned out that - except for waste paper - the different packaging industries have offered a global reprocessing guarantee, i.e. the glass industry for glass of all firms producing glass, the steel industry for all tin plate, etc. For waste paper the Interseroh itself has given this guarantee. Hence the incentives for a company in one specific industry to look for better packaging technologies then those of their competitors in the same industry has disappeared. Only the competition between different packaging materials, e.g. glass, paper, or plastics is still taking place. The advantages of market oriented solutions, i.e. their incentives to find new innovative solutions, has thus disappeared as far as company based improvements for a specific material are concerned.

At present, the glass industry, the producers of tin-plate and of aluminum - for beverage containers only - have given a global guarantee to the DSD to reprocess their packaging material. The packers and fillers do not need to get in contact with the recyclers at all since the reprocessing is free of charge. The Interseroh which has given the global guarantee for paper and cardboard packaging material for the next two to three years also provides this service free of charge. Since the market for waste paper is rather volatile, the waste paper industry did not risk giving such a guarantee. For the same reason the Interseroh has only given this limited commitment and plans to establish long-term contracts with foreign users of waste paper, mainly in Asia, in order to stabilize the German market for waste paper. If these contracts do not materialize in the desired way, reprocessing fees may be necessary in the future.

The plastic industry (Industrieverband Verpackung und Folien aus Kunststoff) has founded the VGK for handling the reprocessing of plastic packaging and for compound packaging waste. A packer and filler of plastic and plastic compound material needs to make a contract with the VGK which charges one fourth of the license fee for the "green dot" per plastic packaging unit for the reprocessing. However, it does not perform the reprocessing itself; with the receipts from the guarantees it subsidizes the

building up of recycling technologies and facilities. Whether the above charge will suffice in the future is not clear, since neither the market for secondary plastic nor the recycling facilities are developed by today.

In so far, materials which require cost-intensive recycling or which have a low price as recycled raw material will have a competitive disadvantage against other packaging material such that a restructuring of demand towards low-cost packaging will take place. It is therefore conceivable that industries producing a specific packaging material which has that disadvantage might become opponents of the Dual System.

For a producer of a specific packaging material the incentives to improve his product vis-a-vis other packaging materials also depend on the institutional arrangement in which the reprocessing guarantees are allocated internally. If the packer and filler gets a free reprocessing guarantee by the industry improvements in the collection, sorting, or recycling costs of a specific packaging material by a single producer will not pay off for him as long as the firms in the same industry use materials which are more costly to recycle than the new one and the license fee for the "green dot" does not discriminate according to costs of collecting and sorting. In such a case the cost savings are distributed among all producers in the respective industry and the cost advantage of that specific packaging material against other materials will be contaminated by the less efficient materials in the industry.

Improvements in the reprocessing costs of an entire industry will most likely not be represented in the reprocessing fees, but they will materialize indirectly. These cost savings will be passed on to the packers and fillers through lower prices for packaging material. Competition among different packaging industries does continuously reinforce the industry-wide incentives for improvements. It is possible, however, that the improvements will remain confined to the central reprocessing facilities as long as the fees do not reflect different reprocessing costs of different materials inside this industry, e.g. for different types of plastics.

The incentives for participation in the Dual System do not present a problem for companies of the packaging industry nor for the packers and fillers provided the retail industry requires the "green dot" in order to accept products for sale in their stores. If, however, the cooperative strategies in the retail industry do not materialize it is possible that the market for packaging material might split into one for recyclable - hence more costly - and one for non-recyclable, less expensive products. This in turn would further increase the incentives in the retail industry to free-ride on the Dual System.

Overall one can conclude that the producers of packaging materials and the packers and fillers will not oppose the Dual System as long as it covers practically the whole retail market. The advantages of the polluter-pays-principle in terms of dynamic effects, however, may be softened through the global reprocessing guarantees as they do not provide enough incentives for the individual companies to improve their products in terms of reprocessing costs.

### 3.3. The Consumers

Consumers are involved in the Dual System in two ways: they buy the packed products and they participate in the collection of packaging material. As far as buying is concerned, products with low recycling costs will get a competitive advantage compared to the situation without the Dual System. This will reinforce the incentives for packers and fillers to use the most cost effective packaging. Demand elasticities will determine the extent to which packers and fillers are forced to pass on cost savings of alternative packaging. At the same time, high price responsiveness of consumers will increase the incentive for retailers not to participate in the Dual System in order to reap some additional sales through lower prices.

A crucial part in the Dual System is the question whether and how consumers will contribute to the recycling of packaging waste by collecting and sorting packaging material. At present, the Dual System does not provide any incentives to consumers to take part in these activities. The currently planned system consists of developing the logistics for collecting and sorting packaging waste in two stages. In the first stage the already existing bring systems for glass and paper with containers will be expanded to a density of about 500 residents per container[6]. In a second step kerbside collection is to be developed or expanded if such systems already exist in some communities.

The combination of bring systems and kerbside collection is hoped to induce consumers to cooperate in the Dual System in such a way that the coverage ratios (table 2) required by the VerpackVO are met. Recent experience in Germany with already existing bring systems for glass, paper, cardboard, and tin-plate show coverage ratios of 45% and higher. Pilot studies on kerbside collection in the UK and Canada result in a recovery of cans up to 50%, of glass between 50% and 65%, of newspapers up to 70%, but only 10% to 43% of plastics (see Coggins/Cooper/Brown 1991, Table 2). It is highly

---

6 Frankfurter Allgemeine Zeitung, 10. July 1991. Drop-off schemes for glass have a density of one per 1,400 residents in the Netherlands and one per 10,000 in the UK (see Coggins/Cooper/Brown 1991).

questionable whether the DSD will be able to achieve a coverage ratio of 80% by 1995 for all types of packaging waste with nothing but moral suasion of consumers (see also chap. 5).

Households participating in the sorting and collecting of packaging waste reduce their waste supplied to local waste collection authorities. This reduction has, however, little financial incentive since most communities in Germany rely on fees for waste collection which are based on the size of the household or at most on the size of the waste bin (see Bongartz/Naumann 1990). Hence there is little connection between the volume of waste and its cost of disposal such that a reduction of waste volumes does only marginally reduce disposal fees.

In addition, disposal fees of the local waste collection authorities are too low from a welfare perspective. German regulations allow only to charge the direct cost of disposal whereas the scarcity rents of disposal space and the environmental damage from disposal facilities is not included in the price. Today, prices of as low as 30 DM/ton are charge at disposal facilities, but just the scarcity rent of disposal space can amount to 250 DM/ton in Germany (see Faber/Stephan/Michaelis 1988). An efficient pricing of waste disposal as well as fees related efficiently to the volume of waste could improve incentives for households to participate in the Dual System.

The question still remains whether these price incentives could be strong enough. A rough calculation of an efficient pricing scheme can illustrate the savings potential for a representative household of three persons. Such a household produces about 0.8 tons of waste per year of which about 25% is packaging material. Given collection and disposal costs of 1,200 DM/ton, participation in the Dual System would result in savings of 240 DM/year or 20 DM/month; still not very much if one considers the additional input of time and energy required from the household.

## 4. Economic Efficiency

Ignoring for the moment the problem whether the Dual System provides the incentives for a long-run participation of all economic actors, the question is whether it is designed in such a way as to achieve the goals as they are stated in the VerpackVO and whether the proposed system is the most economic way to achieve these goals. The VerpackVO intends to promote the use of environmentally friendly packaging material (§1,1), the prevention of unnecessary waste through a reduction in volume and weight as far as possible, through a priority for refillable packaging, as well as through material recycling of packaging waste (§1,2).

In other words, an environmentally effective and economically efficient allocation of packaging material is asked for. In the following the analysis of economic efficiency of the Dual System encompasses two related issues: whether it is efficient with respect to its internal allocation of resources and whether it is efficient with respect to the whole economy. In the following, both issues will be discussed separately.

### 4.1. Efficiency in the Dual System

The efficiency of the resource allocation inside the Dual System depends on the prices which guide the actions of the participating economic actors. If the prices of goods and services which are traded within the Dual System reflect their relative scarcity, then it can be judged to be internally efficient. The fact that the overall price structure of the economy may be distorted is ignored for the moment. The allocation of packaging material in the Dual System is guided by the license fee for the "green dot" and by the reprocessing fees charged by the institutions which have given the global reprocessing guarantees.

The DSD charges fees for the "green dot" according to the volume of packaging before use as shown in table 3. These prices are only introduced to finance the collection and sorting activities of the Interseroh, but they are not intended to function as tax-like instruments which channel resources into specific uses. Therefore, the question is whether the costs of the Interseroh only depend on the volume of the packaging and not on the type of material, on its weight, or on other characteristics.

The Interseroh is, at the moment, not collecting and sorting packaging waste, hence the unit cost of these activities for different materials are unknown. It seems clear, however, that at least as far as sorting activities for plastic materials are concerned costs differ from those for other materials such as tin-plate or glass. Similarly, collection costs seem to depend largely on the volume of the packaging after use. The fee is charged on volume of packaging before use, however. This would discriminate against deflatable packaging like PE foils and subsidize voluminous packaging such as glass and tin-plate. One could therefore imagine licensing fees which better reflect the costs of collection and sorting and thus better signal the resource cost of alternative packaging material.

A more efficient pricing for different packaging materials is not only wrecked on insufficient information, it also is impossible because the firms in the DSD have agreed that the activities of the DSD do not create a competitive advantage for a specific packaging material. This means, the DSD can not charge higher prices for a material which is expensive to collect and sort out - e.g. plastic packaging. This inefficiency apparently can not be eliminated inside the DSD.

The reprocessing fees are set to zero at the moment with the exception of plastic packaging material for which a fee of one fourth of the fee for the "green dot" per container is charged. Since the Dual System is not in practice information about reprocessing costs are not available. The reprocessing facilities do not exist in many cases and it is unknown how markets for reprocessed packaging materials will develop or - if they already exist - how prices will react to the increased supply of material.

In Germany markets for waste paper and for used glass are already established on a relatively large scale such that some inferences can be drawn from these markets. The market for waste paper is highly volatile in prices which make private collection and sorting in some periods unprofitable.[7] This may be due to the fact that a large quantity of paper is imported and exports of waste paper are not developed such that there is too little domestic demand by paper producers for waste paper. The Interseroh will face similar problems in marketing their collected paper packaging material. Since it plans to develop long-term contracts with foreign users of waste paper, it may well just break even in the marketing of waste paper. A free reprocessing guarantee therefore seems to be a reasonable starting point.

The situation for glass is somewhat different. Already today about 50% of one-way-glass is recovered through private firms using bring systems with bins and about 45% is recycled. These firms complain about the glass industry not passing on the energy saving through the use of used glass (Bundesverband der Deutschen Rohstoffwirtschaft, 1989), although the costs of the recovery firms seem to be covered. The global reprocessing gurarantee of the glass industry is most likely highly profitable because the costs of collecting and sorting of the glass is already done by the Interseroh. One can therefore presume that the reprocessing fee of the glass industry should consist of payments to the packers and fillers for using glass as packaging material.

In the case of plastic packaging waste a judgement about reprocessing costs is almost impossible. For many types of plastic packaging reprocessing technologies are not developed yet. A joint research company, the "Entwicklungsgesellschaft für die Wiederverwertung von Kunststoffen" (EWvK), was founded by BASF, Bayer, and Hoechst. Its objective is to develop and build pilot plants for plastic recycling and to eliminate impediments for recycling such as insufficient labelling of different types of plastic

---

[7] In 1988, e.g. average costs for collecting, sorting, pressing and handling of waste paper were approximately 10.00 DM/100kg. Prices, however, varied in the first half of 1988 between 3.00 and 9.00 DM/100kg (see Bundesverband der Deutschen Rohstoffwirtschaft 1989).

materials. It seems reasonable not to differentiate reprocessing fees as long as sufficient information about reprocessing costs is not available.

In summary, the price incentives of the Dual System for an efficient use of packaging material are minimal. The license fees for the "green dot" impose small additional costs, but do not reflect the collection and sorting costs of alternative materials.

The free reprocessing fees for paper, glass, and tin-plate given by the packaging industries probably do not reflect the different costs of reprocessing as well. They may, however, become reflected in changing prices of the packaging material thus giving a competitive advantage to easily recyclable materials. This will influence the relative competitiveness of the different industries, but it does not create incentives at the firm level to improve a particular packaging. Therefore, the Dual System will increase the percentage of packaging waste which is recycled but it will not improve the efficiency of the allocation of packaging materials by much. The second goal of the VerpackVO, the prevention of unnecessary packaging through a reduction of waste will hardly be achieved as long as price incentives are small.

### 4.2. Efficiency Overall

As far as the efficient allocation of packaging material is concerned when the internalisation of environmental effects is included, one can not only consider the internal price incentives of the Dual System. The decision of packers and fillers to use a specific packaging material - glass, paper, plastic, etc. - and specific packaging techniques - e.g. reusable or non-reusable packaging - obviously depends on prices of new packaging material, on cleaning costs for refillable packaging, etc. Given that the prices for nonrefillable packaging reflect the social costs of disposal or recycling[8], then an efficient allocation of resources is established only if the other costs of this packaging material reflect social costs as well. For several reasons, this is not the case. Frequently, indirect environmental effects of the production, use and reuse of different packaging materials are not internalized. These distortions lead to an inefficient choice of packaging material which cannot be corrected in the Dual System, hence additional regulations are required.

One important factor, e.g., is the content of fossil energy in different packaging. The by now well known greenhouse problem is created because the external effects of burning fossil energy are not internalized. Since different types of packaging materials have different energy contents, the private costs of producing packaging material do not reflect

---

8 For an analysis of efficient pricing in waste management see Michaelis (1991b).

social costs. It can not be determined in which direction distortions like those of energy prices actually go as long as complete material flows and ecological balances for packaging material are not available.[9]

These distortions have been recognized in the legislative process and have led to special provisions concerning already existing deposit/refund systems since it is believed that refillable containers are more in line with an optimal allocation. For all beverages - including wine, but excluding milk - the disposal through the Dual System is only allowed if the percentage of beverages in refillable containers does not fall below 72%. Otherwise the exemption according to §6,3 VerpackVO is revoked (§9,2 VerpackVO). For milk containers the same rule applies with a percentage of 17%. The Bundesrat has requested that these percentages are to be increased in the coming years and that a stronger differentiation with respect to types of containers should be looked for. Yet, the goal of internalizing these external effects could also be approached through price incentives such as a packaging tax for nonrefillable containers.

A similar issue concerns the prohibition of "thermal reprocessing", i.e. burning, of packaging material. Measured in terms of private costs the burning of plastic material might well be the most profitable activity. It could, however, be argued that the insufficient internalization of the environmental effects of waste incineration justifies such regulatory provisions as second best policies. Whether this is in fact true can only be determined through a cost-benefit analysis of waste incineration.

Even if one assumes that the Dual System will eventually charge fees according to marginal and/or average reprocessing costs, it is not designed to regulate the allocation between refillable and nonrefillable packaging material efficiently. Therefore, additional regulatory measures will have to accompany this self-organized waste reprocessing scheme. An in depth analysis of a first best packaging material allocation - which so far has not been conducted - might well reveal that a deposit/refund system together with a packaging charge is easier and cheaper to administer than the combination of the Dual System and these additional regulatory requirements.

### 4.3. Anti-trust Issues

It has been claimed that the inefficiencies of the Dual System are partly due to the fact that the Dual System is controlled by a small number of firms which set prices different

---

[9] Some preliminary estimates have been done in Switzerland for one-way versus reusable containers for liquids. See, e.g., Eckardt (1989).

those under a perfectly competitive system and that the DSD itself - together with the Interseroh - is a monopoly without incentives to allocate the collection and sorting activities in an efficient manner.

As far as the DSD is concerned, the licensing fees for the "green dot" at the moment do not represent collection and sorting costs. But they do not seem to be designed to reap potential monopoly rents either. It is rather more likely that insufficient information about the cost structure of the Interseroh prevent a more cost oriented pricing policy. The DSD has as members more than 400 companies which in one way or the other are involved in handling packaging material; it is therefore unlikely that they will allow the DSD to follow monopolistic pricing policies.

The other question is wether the fees for the reprocessing guarantees given by the respective packaging industries and the reprocessing firms which have been founded by the different industries could be used to establish a cartel behaviour among the participating firms. Such a commonly owned firm could obviously become a forum for the coordination of activities, but this is pure speculation as long as such an event has not been observed. This case can not be ruled out because there are only two suppliers of tin-plate packaging. The plastic packaging and the glass container industry also is composed of few producers.

The desire to subsidize high reprocessing costs - or to redistribute the gains from low reprocessing costs - is very limited as long as there is competition among producers of different packaging materials. In the long run industries will have an incentive to pass on cost savings to packers and fillers in order to improve the competitiveness of their respective packaging material. Similarly, a subsidization of the reprocessing firm will eventually be reflected in higher prices of the packaging material in question.

Also unsubstantiated seems to be the fear that the global reprocessing guarantees could be used as entry barriers to foreign or new suppliers. All contracts with the DSD about reprocessing guarantees have the provision to accept all packaging waste of the type in question. Packaging material from particular producers or packers and fillers is not excluded.

### 4.4. The "Green Dot" as a Trade Barrier

With the internal market in the EC to start in 1992, the Dual System should not erect non-tariff trade barriers between member countries, neither should it erect trade barriers against third countries. There has been concern about entry barriers for foreign suppliers not being able to get access to the "green dot". The DSD does not discrimi-

nate against foreign suppliers in granting the "green dot" and the global reprocessing guarantees extend over all packaging including foreign packaging materials. Hence, the requirement of retailers to accept only products with the "green dot" can not be considered discrimination since foreign as well as domestic firms must meet it.

Previous regulation by the German government with respect to plastic containers for beverages has been opposed by the Commission of the EC on the ground that, although it formally does not discriminate against foreign suppliers, it effectively does so because only foreign companies produce beverages in plastic containers. In the Dual System all packaging materials are subject to the same rule, hence such discrimination can not take place.

One could also argue that the requirement to maintain a high percentage of refillable containers for beverages (§ 9,2 VerpackVO) and some subsequent differentiations as they are demanded by the Bundesrat could function like trade barriers either because the management of a deposit/refund system for refillable containers is not practical for exporters due to high transport costs or because one-way containers are traditionally supplied by exporters but not by domestic producers.

From a traditional trade policy perspective, regulations can be considered barriers to trade if they discriminate against foreign suppliers. This is certainly not the case for the quota for refillable containers of beverages since this quota must be met by all suppliers, domestic and foreign. Hence this quota can not formally be considered a (discriminatory) trade barrier.

One could argue, however, that despite the absence of discrimination it can effectively prevent market access of foreign suppliers raising the question whether this entry barrier is Pareto-efficient. In order to illustrate this possibility it is helpful to investigate a Pareto-efficient allocation of beverages with refillable and non-refillable containers. The following assumptions are made:

A1: There are domestic and foreign producers of beverages.

A2: Foreign producers have transport costs for using refillable containers whereas domestic producers do not.

A3: Non-refillable containers have negative external effects after consumption.

A4: Refillable containers have lower production costs than non-refillable ones.

A5: The costs of non-refillable containers are lower than those of refillable ones including transport costs.

By assumptions A4 and A5 it is clear that foreign producers would use non-refillable containers whereas domestic producers would use refillable ones. A Pareto-efficient allocation would be achieved by charging, e.g., a Pigouvian tax on non-refillable containers which internalizes the externality according to A3 and having imports of beverages in non-refillable but domestic production in refillable containers. The same allocation would result if a quota for refillable containers is imposed which is just as large as the domestic production. Therefore such a quota - provided it has the optimal size - can not be a barrier to trade.

If we assume that the quota on refillable containers imposed by the VerpackVO roughly represents the efficient mix of packaging materials, then it is per se not a trade barrier nor a barrier to entry nor an impediment for efficiency. If it is too large or too low it simply is not set efficiently. It may be perhaps easier to set the Pigouvian tax according to the estimated external effect of the non-refillable container than to impose the quantity restriction.

Although the quota per se can not be a barrier to trade, the form in which it is administered, i.e to whom the quota rights are given, may create a barrier to trade. Suppose the quota is not given to the foreign producers but to domestic producers, then foreign suppliers loose their comparative advantage and will be eliminated from domestic markets. The trade barrier is therefore not embodied in the quota but in the discriminatory use of that quota.

This is exactly what could perhaps happen with the quota in the Dual System. §9,2 VerpackVO only requires a specific percentage of refillable containers. It does not provide a rule as to how the remaining non-refillable containers should be allocated among the interested packers and fillers. Since it is likely that foreign suppliers will more strongly demand the right to use non-refillable containers, the question is how the DSD will ensure that §9,2 VerpackVO will be met.

The problem has been alleviated somewhat through the provision that the quota has to be met for all beverage containers together and not - as had been previously planned - for each category of beverages separately. E.g., a separate quota for wine where about 50% of all bottles and 100% of imported wine sold are non-refillable would most likely have created entry barriers for foreign wine producers.

If, e.g., the quota rights would be auctioned then they could go predominantly to foreign producers since they gain the most from the use of non-refillable containers. The quota revenue would remain in the hands of the DSD although from a welfare point of

view it should go to the German treasury as a payment which internalizes the external effect of non-refillable containers.

At present the percentage of refillable containers in Germany is below the required 72%, hence the DSD has to find some way to meet the provisions of the VerpackVO. How this will be done is as yet not decided in the DSD. Nevertheless, it is unlikely that the efforts at meeting the global requirement on refillable containers will create trade barriers for foreign suppliers.

## 5. Implementation Problems

So far only the conceptual structure of the Dual System has been evaluated and the incentive and efficiency issues have been discussed on a level which has abstracted from the practical problems of implementing the Dual System. Since the DSD has started the collection and sorting in August 1991 in seven cities and counties empirical evidence on implementation problems is not yet available. In the following several issues are mentioned which might create problems for the Dual System.

One of the central questions is whether the households will be willing to participate in the Dual System. The DSD has planned to expand the already existing bring systems for glass and paper/cardboard to about one container per 500 citizens. In addition, each household gets a so called "Value Bin" ("Wert-Tonne") for all other packaging materials which is collected at kerbside. This collection system is introduced with intensive public relation as well as visits of "waste consultants" at the households. With this system the DSD is confident to reach the required coverage ratios of the VerpackVO.

There exists some experience with local collection systems which one can use to assess the chances for the proposed system of the DSD. The results of a study by Gallenkemper and Doedens (1988) are shown in table 4. They find that the bring systems for glass and paper/cardboard will not suffice to reach the required coverage quota of 80%. If one is very optimistic the desired goal may be reached through kerbside collection. Tests with the collection of plastic waste come to a 33% recovery, by far too little for meeting the requirements of the VerpackVO (Brandrup, 1991). Experience or numbers for metal, or compound packaging waste are not available.

It can be argued that the growing public awareness about waste problems together with the public relation activities of the DSD for its collection system will improve the compliance of households. Still, given past experiences, reaching a recovery ratio of 80% in 1995 will become very difficult. May be not so much for glass and paper which are easy to handle but for plastic and compound packaging waste.

Table 4: Recovery ratios of waste in alternative collection systems (in per cent of household waste).

| | Paper | Glass |
|---|---|---|
| Bring System | 25 - 50 | 38 - 64 |
| "Value Bin" | 50 - 83 | 31 - 77 |
| Kerbside collection | 58 - 92 | 38 - 77 |

Source: Gallenkemper/Doedens (1988).

A related issue concerns the separation of the primary packaging part in the waste. The DSD is designed to collect and sort only such waste. Usually households do not distinguish between packaging waste and other waste of the same material structure. The DSD then involuntarily collects not only packaging material thus raising its collection costs. Only about 20% of paper waste is packaging material, 84% of plastic waste, whereas the other materials consist of practically 100% packaging. In the case of paper the packaging material can be sorted out such that the DSD buys from the local waste authorities only packaging material. Whether for plastic materials such sorting is possible is unknown. The DSD therefore incurs additional costs which may not be covered through the license fees for the "green dot".

Another involuntary collection through the DSD comes from more than six million tons of commercial waste which is collected through the local waste authorities. The packaging waste proportion of this group probably does contain a large share of transport packaging which is not subject to collection and sorting through the DSD. Since it can not be sorted out, the DSD currently treats this material like household waste. This also adds to the costs of the DSD.

Whereas the capacities for collecting packaging waste can be developed relatively fast, sorting and reprocessing facilities take more time to be established. Whether these capacities can be build within the time frame set by the VerpackVO is unknown.

One of the major unresolved problems is the reprocessing of plastic waste. Todays reprocessing technologies produce only materials which compete with other building material like concrete, wood or stone. This limits the size of the potential market as well as the revenue that can be made with such products. It will be necessary to develop technologies which produce plastic material which can be reused in the plastic industry.

The market price for reprocessed materials will hardly cover sorting and reprocessing costs. Even if one ignores sorting costs which are covered - and possibly subsidized - through the DSD and the Interseroh, the recycling of PE-material costs about 1,550 DM/ton whereas it can be sold for about 1,200 DM/ton leaving a loss of about 350 DM/ton (Brandrup 1991). Assuming that 700,000 tons of plastic packaging is produced per year and the collection and sorting percentages are reached then the plastic industry will incur a yearly loss of about 135 million DM.

## 6. Conclusions and Suggestions

The Dual System is entirely a private institution founded for administering the reprocessing of primary packaging from households. Since it has just started to operate, conclusions can only be drawn with respect to the proposed structure of the Dual System and - rather speculatively - with respect to its likely functioning in reality. The major conclusions can be summarized as follows:

1. The Dual System will significantly reduce the deposition of primary packaging material. This reduction will predominantly come through increased reprocessing of materials. The prevention of primary packaging will probably be of minor importance.
2. It will be very difficult to meet by 1995 the coverage ratios of 80% as required by the VerpackVO. The DSD has not developed strategies for this case. Similarly, the quota on refillable beverage containers can not be met at the moment and it remains to be seen whether this problem will solve itself since there are no plans on the side of the DSD in this respect.
3. It is not known yet whether all retailers will participate in the Dual System, a necessary condition for a successful functioning.
4. The Dual System does - through its price structure for the "green dot" - not provide the incentives for an efficient allocation since the fees do not reflect marginal collection and sorting costs.
5. The technical opportunities for reprocessing packaging waste are not developed in all cases. Capacities for sorting and reprocessing have to be build.
6. Economic efficiency from a welfare point of view can not be achieved through the Dual System since it does not correct for distortions in market prices thus leaving external effects untouched.
7. The Dual System is most likely not discriminating against foreign suppliers. Only the required quota on refillable containers may create difficulties for some foreign sup-

pliers. This is rather unlikely, however, and will depend on the way in which the quota will be allocated.

8. Anti-trust issues do not seem to be relevant at the moment.

The evaluation of the chances of the Dual System to operate as planned depends to a large extent on the optimism with which one approaches the problem. Representatives of the DSD necessarily possess or at least show this optimism. Whether they are correct remains open.

Suggestions to improve the Dual System will therefore focus on some structural deficiencies of the VerpackVO which should be eliminated independently from the functioning of the Dual System. They will also include improvements of the VerpackVO which could help the Dual System to operate effectively.

1. The VerpackVO establishes that the liability for packaging material is with the producers and the packers and fillers. In §6,3 VerpackVO, however, this liability is transferred to the Dual System thus creating enforcement problems for the DSD. It would be easier to make participation in the Dual System mandatory such that every packer and filler has to obtain the "green dot". He could still have the option to prove reprocessing through different channels than the Dual System in order to receive a waiver from the "green dot".

2. The Dual System is only involved in the reprocessing of primary packaging materials. This creates unnecessary costs of separating identical materials which are not primary packaging. As long as the industry is not required to recycle these other materials as well, the DSD can not profitably offer collection and sorting services for them. The Federal Government is already preparing a directive for print products. It is not clear, however, why transport and secondary packaging should not be handled in the Dual System. A comprehensive recycling of identical materials would lower costs for all participants.

3. The reprocessing of packaging waste through the Dual System is allocated according to existing market prices. Since these prices do in many cases not reflect environmental effects an internalization of these externalities can not be provided by the Dual System. The Dual System should therefore be supplemented by product or waste charges for those residual damages to the environment which are not internalized otherwise.

4. The internal structure of the DSD does not allow marginal cost pricing. One might therefore consider some form of public supervision for the setting of licensing fees for the "green dot". It is also conceivable that the function of the DSD remains with the public authorities, whereas the reprocessing is done on a private basis like in

the current system. It is not apparent what the advantage of the DSD in collecting and sorting activities is since these tasks are subcontracted with the local suppliers anyway.

**Appendix: An Estimate of Primary Packaging Waste in Germany**

The regular German statistics on waste management (Statistisches Bundesamt, Fachserie 19, Reihe 1.1 and 1.2) mainly distinguish between municipal and industrial waste. Concerning the issue at hand only the former category is of interest. Municipal waste includes:

1. household waste (i.e. waste from private households which are served by the regular public collection system),
2. public and commercial waste (i.e. waste from public and commercial generators which is collected together with household waste), and
3. bulky waste (i.e. waste from private households which is collected separately because of its bulkiness, like e.g. scraped kitchen appliances).

**Table A1:** Generation of municipal waste in the FRG 1977 - 1987.

| | 1977 | 1980 | 1982 | 1984 | 1987 |
|---|---|---|---|---|---|
| Weight (mio t) | 22.4 | 23.5 | 23.1 | 22.1 | 22.9 |
| Volume (mio $m^3$) | . | 124.0 | . | 137.5 | . |

Source: Statistisches Bundesamt 1985, 1990a; Umweltbundesamt 1989.

Table A1 shows the FRG's annual generation of municipal waste by weight and volume between 1977 and 1987.[10] As can be seen from this table, the amount by weight has remained almost constant over time while the amount by volume has increased considerably between 1980 and 1984. According to the German Umweltbundesamt (1989, p.420) this increase in volume can, at least in part, be traced back to an increasing share of packaging waste.

The category of municipal waste is not further disaggregated within the regular statistics on waste management. However, for the years 1979/80 and 1985 two additional surveys are available which focus on this issue. Table A2 shows the composition of mu-

[10] All data presented in this and the following tables exclusively refer to the FRG without the former GDR.

nicipal waste by household waste, public/commercial waste and bulky waste. These figures indicate that almost two thirds of municipal waste can be classified as household waste.

**Table A2:** Composition of municipal waste by categories (estimates).

| | 1979/80 | | 1985 | |
|---|---|---|---|---|
| | mio t | % | mio t | % |
| Household waste | 14.9 | 63.4 | 14.0 | 63.3 |
| Public/commercial waste | 6.4 | 27.2 | 6.4 | 29.0 |
| Bulky Waste | 2.2 | 9.4 | 1.7 | 7.7 |

Source: Statistisches Bundesamt 1985, 1990a; Länderarbeitsgemeinschaft Abfall 1987.

Comprehensive information about the composition of municipal waste by materials is only available for the category of household waste. Concerning the composition of public/commercial waste and bulky waste only a few local figures are known (see Länderarbeitsgemeinschaft Abfall 1987, pp. 1101-1102). Ewringmann/Mark (1990, p. 34) argue that waste materials generated by the use of packaging subject to the dual system ("Primary packaging") are almost exclusively attributable to the category of household waste. Hence, to obtain a rough guess of the potential amount of primary packaging waste to be treated by the Dual System an analysis of packaging materials contained in household waste seems to be the most appropriate way.

Table A3 indicates the composition of household waste by materials in 1979/80 and 1985. As can be seen from these figures, waste materials which are - at least in part - attributable to packaging waste (i.e. paper, paperboard, package compound, metals, glass and plastics) account for appr. 41,5% of total household waste in 1979/80 and appr. 35.6% in 1985. According to the Länderarbeitsgemeinschaft Abfall (1987, p. 1000) this decrease in packaging related materials is due to enhanced activities concerning both the minimization of material input in the production of packaging and the separate collection of paper, paperboard, glass and ferrous metals.

**Table A3:** Composition of household waste by materials (estimates).

| | 1979/80 | | 1985 | |
|---|---|---|---|---|
| | mio t | % | mio t | % |
| Paper | 2.18 | 14.6 | 1.68 | 12.0 |
| Cardboard | 0.61 | 4.1 | 0.56 | 4.0 |
| Package compound | 0.18 | 1.2 | 0.27 | 1.9 |
| Ferrous metals | 0.52 | 3.5 | 0.39 | 2.8 |
| Non-ferrous metals | 0.06 | 0.4 | 0.06 | 0.4 |
| Glass | 1.73 | 11.6 | 1.27 | 9.1 |
| Plastics | 0.91 | 6.1 | 0.76 | 5.4 |
| Textiles | 0.22 | 1.5 | 0.28 | 2.0 |
| Vegetable fraction | 3.99 | 26.8 | 4.19 | 29.9 |
| Others[1] | 4.50 | 30.2 | 4.55 | 32.5 |

[1] Mainly minerals and unsorted components smaller than 40 mm.

Source: Länderarbeitsgemeinschaft Abfall 1987.

However, due to two reasons the information contained in table A3 alone does not facilitate a straightforward assessment of the amounts of waste materials to be treated by the dual system:

1. A comprehensive assessment of the amounts of packaging waste does not only require information on the composition of household waste by materials, as presented in table A3, but also on its functional composition (i.e. packaging/non-packaging waste).
2. There is an increasing amount of waste materials from private households which is already collected separately and therefore not accounted for in table A3.

Except for the case of package compound, which obviously can be labelled as packaging waste, only little information is available about the division between packaging and non-packaging waste. According to Brahms et al. (1989) appr. 20% of the household waste's paper fraction and appr. 84% of its plastic fraction can be classified as packaging waste. Corresponding figures for paperboard, glass, and metals are not available.

However, it seems to be reasonable to assume that these proportions are almost 100% for each of the above mentioned materials (see Table A4).

Table A4: Share of packaging waste on total household waste by materials in 1985 (estimates).

| Waste material | Share of packaging | Data source |
|---|---|---|
| Paper | about 20 % | Brahms et. al (1989) |
| Cardboard | almost 100 % | Own estimate |
| Package compound | 100 % | - - |
| Metals | almost 100 % | Own estimate |
| Glass | almost 100 % | Own estimate |
| Plastics | about 84 % | Brahms et. al (1989) |

Source: Brahms et al. 1989; own estimates.

Applying these estimates to the 1985 data presented in table 3 leads to an assessment of the amount of packaging materials contained in household waste in 1985. The resulting figures are presented in the first row of table A5.

The second row of table A5 indicates the amounts of packaging materials which are already separately collected from private households. These data are compiled from different sources:

- According to the annual report of the Bundesverband Papierrohstoffe (1989) appr. 1.25 mio tons of paper and paperboard have been collected from private households in 1985. Of this quantity approximately 25% can be classified as packaging material (Beuth 1991).
- According to Ewringmann/Mark (1990) the collection of scrap metals from private households amounted to appr. 0.03 mio tons in 1985 which are assumed to be almost exclusively attributable to packaging waste (see table A4). It should be noted, however, that in addition large amounts of ferrous metals are extracted from municipal waste at incineration plants by magnetic separation. According to Sprenger (1986) in 1984 more than 0.2 mio tons of ferrous metals had been separated from municipal waste in such a way.

- According to a report published by the Bundesverband der Deutschen Rohstoffwirtschaft (1989) appr. 0.97 mio tons of packaging glass have been collected in 1985.
- Finally, the amount of plastic packaging separately collected from private households is estimated to amount to appr. 5,000 tons in 1984 (see Ewringmann/Mark 1984).

Table A5 indicates that the annual potential of primary packaging materials to be treated by the Dual System amounts to appr. 4.8 mio tons based on 1985 data. Roughly 25% of this quantity are already subject to separate collection while the remaining 75% are still disposed off together with the regular household waste.

**Table A5:** Potential amounts of packaging waste materials from private households (mio t, estimates based on 1985 data).

| | Packaging material contained in household waste | Separately collected packaging waste from private households | Total |
|---|---|---|---|
| Paper | 0.34 | 0.31 | 1.21 |
| Cardboard | 0.56 | | |
| Package comp. | 0.27 | 0.00 | 0.27 |
| Metals | 0.41 | 0.03 | 0.44 |
| Glass | 1.27 | 0.97 | 2.19 |
| Plastics | 0.64 | 0.005 | 0.645 |
| Total | 3.49 | 1.315 | 4.805 |

Source: Own calculations, based on 1985 data.

Finally, it should be noted that although the estimates presented in table A5 use all currently available information about the composition of household waste, it is likely that it does not reflect the current German situation concerning packaging waste in a fully adequate manner. This is due to (at least) two reasons:

1. The production of primary and secondary packaging considerably increased between 1985 and 1988 (which is the last available statistic). The respective rates are

(see Statistisches Bundesamt 1990b): 11.4% for paper and cardboard, 5.9% for metals, 15.4% for glass, and 15.8% for plastics. It seems reasonable to assume, that these rates also apply to the total amount of primary packaging waste to be treated by the Dual System.

2. The separate collection of waste materials from private households also increased considerably between 1985 and 1988. 1.85 mio tons of paper and cardboard have been collected in 1988 (see Bundesverband Papierrohstoffe 1990) and the respective figure for glass is 1.18 mio tons (see Bundesverband der Deutschen Rohstoffwirtschaft 1989). Data on the separate collection of packaging-related metalls and plastics in 1988 are not available.

These trends suggest that the total quantity of primary packaging waste actually to be treated by the Dual Systems may be about 10 - 15% higher than indicated in table A5, whilst the partitioning of 1/4 separately collected and 3/4 contained in household waste may roughly be stable.

This projection, however, does not account for the effects of the German unification. No comprehensive and reliable data concerning the amounts of packaging waste in the "New States" is currently available. But it is very likely that after a certain period of adjustment the per capita amount of packaging waste will differ between the 'old' and the 'new' states. Hence, it can be assumed that the unification will lead to an further increase in packaging waste of about 25 - 30%. This finally leads to an amount of waste materials potentially to be treated by the dual system of roughly 6.5 - 7 mio tons of primary packaging per year.

**Bibliography**

Aumann, R.S. (1981): Essays in Game Theory and Mathematical Economics. Mannheim.

Axelrod, R. (1984): The Evolution of Cooperation, New York.

Beuth (1991): Personnel communication with K.P. Beuth from Interseroh AG (Bonn).

Bongartz, T., D. Naumann (1990): Entsorgungskostenstruktur - Bundesweite Erhebung bei Landkreisen und Kreisfreien Städten, Arbeitsgemeinschaft PVC und Umwelt e.V. (Hrsg.), Bonn.

Brahms, E., G. Eder, B. Greiner (1989): Papier-Kunststoff-Verpackungen, Erich Schmidt Verlag, Berlin.

Brandrup, J. (1991): "Grenzen der stofflichen Wiederverwertung". Packung und Transport No. 8, 1991.

Bundesverband Papierrohstoffe (1989): Geschäftsbericht 1988/89. Köln.

Bundesverband Papierrohstoffe (1990): Geschäftsbericht 1989/90. Köln.

Bundesverband der Deutschen Rohstoffwirtschaft (1989): Rohstoffrecycling. Köln.

Coggins, C., D. Cooper, R. Brown (1991): "Kerbside and Drop-off Recycling Schemes: Some Comparisons between the U.K. and USA". European Environment, Vol.1, No.2, pp. 21-24.

Eckardt, N. (1989): Zeitfragen zur Verpackung - Ökologiebilanz zum Thema Einweg - Mehrweg. Ökontor Verlag für Umwelt, Politik und Technik, Struxdorf.

Ewringmann, D. ,M. Mark (1990): Aufgaben, Organisation und Finanzierung eines von der Wirtschaft selbst getragenen Fonds zur Abfallverminderung. Bonn.

Faber, M., G. Stephan, P. Michaelis (1988): Umdenken in der Abfallwirtschaft: Vermeiden, Verwerten, Beseitigen. Heidelberg.

Fudenberg, D., J. Tirole (1989): Perfect Bayesian and Sequential Equilibria. Harvard Insitute of Economic Research, Discussion Paper No. 1436, Cambridge, Massachussetts.

Gallenkemper, B., H. Doedens (1988): Getrennte Sammlung von Wertstoffen des Hausmülls. Berlin.

Kreps, D., P. Milgram, J. Roberts, R. Wilson (1982): "Rational cooperation in the Finitely - Repeated Prisoner's Dilemma". Journal of Economic Theory, 27, pp.245-252.

Länderarbeitsgemeinschaft Abfall (1987): Informationsschrift 'Verwertung von festen Siedlungsabfällen' der Länderarbeitsgemeinschaft Abfall (LAGA). Gemeinsames Amtsblatt des Landes Baden-Württemberg, Vol.35, No.39, p.1093-1122.

Michaelis, P. (1991a): "Duale Abfallwirtschaft auf dem Prüfstand". Die Weltwirtschaft, Heft 1, 1991, pp.117-131.

Michaelis, P. (1991b): Theorie und Politik der Abfallwirtschaft. Heidelberg.

Schönborn, H. (1988): Wiederverwerten von Kunststoffabfällen. Süddeutsches Kunststoff-Zentrum, Würzburg.

Shubik, M. (1983): Game Theory in the Social Sciences. The M.I.T. Press, Cambridge, Massachusetts.

Sprenger, W. (1986): "Verpackungsrecycling - Möglichkeiten und Grenzen". BlechBox 1986, No.2, pp. 5-10.

Statistisches Bundesamt (1985): Fachserie 19, Reihe 1.1 (Öffentliche Abfallbeseitigung), Berichtsjahr 1982. Stuttgart.

Statistisches Bundesamt (1990a): Fachserie 19, Reihe 1.1 (Öffentliche Abfallbeseitigung), Berichtsjahr 1987. Stuttgart.

Statistisches Bundesamt (1990b): Umweltinformationen der Statistik. Ausgabe 1990. Stuttgart.

Umweltbundesamt (1989): Daten zur Umwelt 1988/89. Berlin.