Technical report No 28

Baseline projections of selected waste streams

Development of a methodology

Prepared by:
Kim Michael Christiansen
and Christian Fischer, ETC/W

September 1999

Project Managers:
Anton Azkona
Maria Teresa Ribeiro
European Environment Agency

European Environment Agency

Cover design: Rolf Kuchling, EEA

Printed in Copenhagen

Printed on recycled and chlorine-free bleached paper

European Environment Agency
Kongens Nytorv 6
DK-1050 Copenhagen K
Denmark
Tel: +45 33 36 71 00
Fax: +45 33 36 71 99
E-mail: eea@eea.eu.int

Contents

1. Introduction

Waste represents an enormous loss of resources both in the form of materials and energy. Indeed, quantities of waste can be seen as an indicator of the material efficiency of society. Waste generation is increasing in the European Union, and amounted to about 3.5 tonnes of solid waste per person in 1995 (excluding agricultural waste)[1].

Excessive quantities of waste result from:

- inefficient production processes
- low durability of goods
- unsustainable consumption patterns.

Solid waste is also increasingly produced as an attempt to solve other environmental problems such as water and air pollution. Some of these wastes give rise to new problems - examples include sewage sludge and residues from cleaning of flue gases.

Managing waste causes a number of pressures on the environment:

- leaching of nutrients, heavy metals and other toxic compounds from landfills;
- use of land for landfills;
- emission of greenhouse gases from landfills and treatment of organic waste;
- air pollution and toxic by-products from incinerators;
- air and water pollution and secondary waste streams from recycling plants;
- increased transport with heavy lorries.

An increasing part of resources contained in waste is recovered as materials or as energy in incinerators or biogas plants, but more than half is still permanently lost in landfills. Recycling of materials may reduce the environmental impact of waste but is not necessarily without environmental impact. For example, plants processing scrapped cars produce large amounts of shredder waste contaminated with oil and heavy metals and smelting of the metals give rise to emissions of heavy metals, dioxins etc. from secondary steel works and aluminium smelters.

Few resources can be retrieved completely from waste. In most cases recycled material will be of a somewhat lower quality than the virgin material due to contamination or the nature of the recycling material. Even high-quality recycled materials represent a net loss of resources because the energy used for initial production is lost and some material is always lost during collection and treatment.

The quantities of waste are now so large that transport of waste is a significant part of total transport. A French study indicates that about 15% of the total weight of freight transported in France in 1993 was waste and that waste transport accounts for 5% of the total transport sector energy consumption (Ripert, 1997). Rough estimates from Denmark indicate a lower but still significant energy consumption for transport of waste. The French study also shows that transport distances are much higher for waste for recycling than for disposal. This implies that efficient planning tools are needed to control transport resulting from separation of the waste into more and more fractions for advanced treatment - although higher transport distances for recycled materials may in some cases be compensated by reduced need for long-range transport of raw materials.

[1] Environment in the European Union at the turn of the century

1.1. De-linking waste generation from economic growth

Waste production is influenced both by how efficiently we use resources in production and the quantity of goods we produce and consume. The importance of quantity means that in general it is possible to demonstrate a link between Gross Domestic Product (GDP) and waste generation. Reported total waste generation in OECD Europe increased by nearly 10% between 1990 and 1995 (EEA, 1998a) while economic growth was about 6.5 % in constant prices.

The main challenge is to de-link waste generation from economic growth. A closer analysis of the relationship between economic growth and waste generation reveals several different trends.

For waste from energy production no general correlation with economic output can be seen. This probably reflects differences in energy supply systems between countries. Coal fired power plants generate large amounts of fly ash, while hardly any waste is produced from hydroelectric power stations, and nuclear power plants generate a small but dangerous amount of waste.

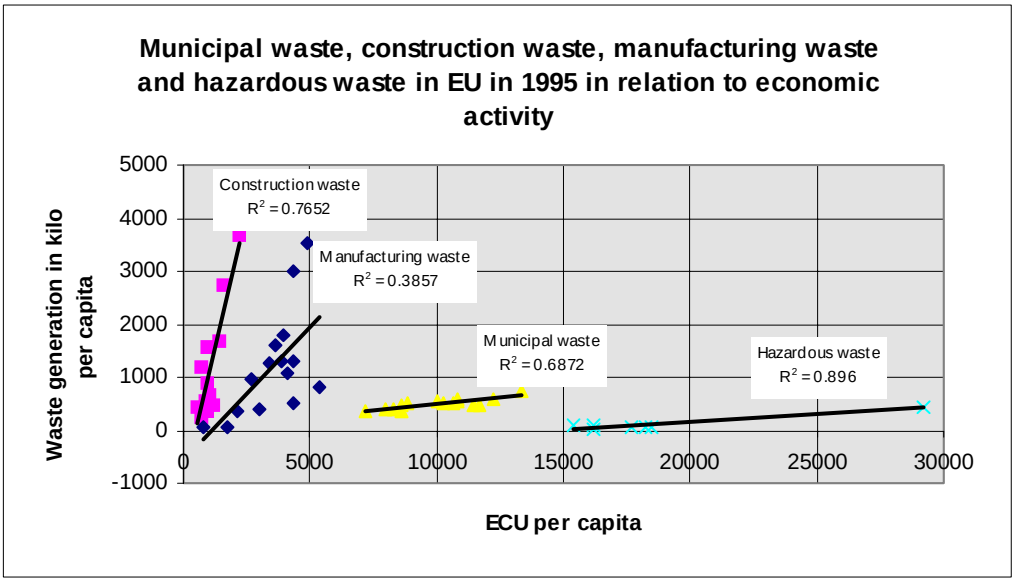


Fig. 1. Total waste/GDP. For each Member State the waste quantity/capita has been plotted against the economic activity related to the selected waste streams. The figure shows that the generation of municipal, construction and hazardous waste seems to relate to the economic activity behind waste generation whereas such a relation does not seem to exist for manufacturing waste. A good correlation is assumed if R^2 values are above 0.7.In relation to municipal waste the economy is stated as final consumption from households in Purchasing Power Standard (PPS). Hazardous waste is related to GDP stated in PPS. Construction and manufacturing waste are related to the part of the GDP r originating from construction and manufacturing activities. Source: OECD, 1997a; OECD, 1997b; NRCs,1998; Eurostat, 1999.

For hazardous waste a correlation between GDP and waste quantities can be demonstrated for data from 1995 but not from 1990. In this period large changes have taken place in both awareness of hazardous waste and in definitions and classification procedures. Thus the apparent correlation in 1995 may be coincidental.

For municipal waste and construction and demolition waste a very close link between economic activity and waste generation can be demonstrated. For manufacturing waste, however, there are significant variations between Member States; in some countries (notably Germany and Denmark) the ratio of waste generation to manufacturing GCP is much lower than in others. This may be an indicator of the use of the cleaner technology (including internal recycling) in the production, but it can also be a result of differences in

industrial structure. As an example much of the heavy industry in Western Europe has been closed in the last decades due to competition from Eastern Europe and Asia. Unfortunately, inadequacies in the waste statistics make it impossible to draw more precise conclusions.

An important fact, however, is that decline in waste from production in some countries – supposedly due to better use of cleaner technology – has not been sufficient to neutralise the increase in total waste amounts due to the growth in the quantity of goods produced and consumed.

1.2. Information gaps

Detailed analysis of developments in waste generation, waste management and waste minimisation is hampered by the lack of comparable definitions and statistical information across Europe. Even for municipal waste and household waste, which are normally thought of as areas with good statistics, confusion prevails. Municipal waste is waste collected by the municipalities independently of the source of the waste. Municipal waste is a management/collection term and the quantities and composition of municipal waste will therefore by nature be different from one country to another depending on the collection systems. Household waste is or rather should be waste from the source households and should therefore be comparable. However, due to the differences between countries, statistical information should only be used with great precaution.

Reliable time-series of data can only be obtained with a great effort in collecting supplementary information and interpretations of the definitions used country by country. These problems can only be overcome by harmonisation of definitions and collection of data on a common platform. The current proposal for a Community regulation on waste statistics is a first step in this direction.

In relation to integration of waste aspects in Life Cycle Analysis of products there is a lack of systematic knowledge of the connection between the composition of individual products and resulting emissions from different treatment types when they end up in the waste stream.

Furthermore there is an urgent need for a much better transfer of information between product developers and producers and the waste management sector in order to develop a system where products and waste management fit better together.

Based on the above, and despite the fact that comprehensive and reliable data on waste are still absent, improved knowledge concerning potential trends in waste levels and their composition will provide important background information for more thorough analysis of waste problems, thus facilitating the development of a comprehensive and overall strategy on waste.

2. Scope and structure of the report

Following Article 2 of Council Regulation 1210/90/EEC on the establishment of the European Environment Agency and the European Environment Information and Observation Network, the Agency shall publish a report on the state of the environment every three years. To respond to the requirement, EEA organised and published 'Environment in the European Union at the turn of the century' which was launched in June 1999.

As part of the preparations of this report, the European Topic Centre on Waste was requested by the Agency to contribute to the reporting by drafting a chapter on waste generation and management, including the development of a methodology to project the future development of a number of selected waste streams in quantitative terms.

The present report, which presents the results from a major part of this contribution, focuses on the development of a projection methodology for the following selected waste streams: household waste/municipal waste, paper and cardboard, glass and end-of-life vehicles. The results cover all EU Member States, except for Luxembourg due to lack of data related to the first waste streams[2].

The report is structured as follows:

In **chapter 3** a brief overview of the scientific research on future developments in waste generation is given and references are made to relevant literature.

The overview is followed up in **chapters 4 and 5**, where recent attempts to prepare projections of the development in the waste amounts at a more political level are described.

A possible projection methodology is developed in **chapter 6**. The chapter is subdivided into 4 major sections. The first one being the general description of the developed methodology, followed by specific sections on the selected waste streams. The main results of the projections are highlighted in each of the sections.

In **annex I** the economic variables applied, including historical observations as well as the projected values necessary to prepare the waste projections are listed. The detailed results of the waste projections are given in **annexes II-V**, including the historical observations and technical estimates of coefficients, t-statistics, plots etc. Because of the magnitude of the documentation behind the projections, the economic variables and technical estimates are only given as an example for one country – Austria. All other relevant documentation are, however, available on request to the European Topic Centre on Waste.

[2] Thus, throughout the report EU14 = EU15 Member States excluding Luxembourg.

3. Scientific research on future developments in waste generation – state of the art

Analysis of future developments in waste generation is critical information in the process of planning future waste policy and in determining the long term consequences of the chosen policy. Little work, however, has been done on forecasting waste amounts. Nagelhout et al. (1990) and Bruvoll & Spurkland (1995) explain future waste generation as proportional to the development of forecasted production and consumption. In Bruvoll & Ibenholt (1997), however, instead of production, the relevant explanatory variable for waste from industry is the material inputs. The change of method is based on the argument that in a material balance perspective, the physical amount of material input ends up either in the product or as waste. Frits Møller Andersen et al. (1998) link the generation of categories of waste to different economic activities and basically assume a proportional change in the waste generated and the relevant economic activities generating waste.

4. The Coopers & Lybrand approach

Coopers & Lybrand (1996) base their projections of future generation of municipal waste in 1997 and 2000 in line with the above studies, i.e. the projection is based on the assumption that the future growth of municipal waste can be decomposed into two components:

- the underlying growth rate (excluding the effect of waste prevention measures); and
- reduction in this underlying growth rate due to waste prevention measures.

As a starting point, Coopers & Lybrand set-up 'baseline projections' of the underlying growth rate as a benchmark against which the success of waste prevention policies can be assessed. The baseline projections are supplemented by two alternative scenarios based on different assumptions about the coverage and success of waste prevention policies.

The baseline projections are derived based on a simplified version of an approach developed by the National Institute of Public Health and the Environment (RIVM) for forecasting the underlying trend growth rate in waste generation in the Netherlands.

Thus, the RIVM model forecasts 'household waste' and 'bulky waste' separately, based on the following relationships derived from regression analysis of historic data:

- the growth in household waste has been broadly in line with real growth in private consumption of foodstuffs and luxury foods; and
- the growth in bulky waste has been closely related to real growth in durable goods consumption.

Assessing the approach against all EU Member States, the conclusion from Coopers & Lybrand is, however, that data on the split between household waste and bulky waste is not available for all Member States, and that macroeconomic forecasts which distinguish between growth in durable and non-durable consumption are also not readily available. Instead, Coopers & Lybrand adopt the simplifying assumption that a similar close relationship exists between total municipal waste generation and total private consumption growth. The simplification is seen by Coopers & Lybrand as intuitively plausible, hence not involving any significant loss of accuracy given that any such future projections of consumer spending growth will be subject to considerable uncertainties in any case. Thus, the model applied by Coopers & Lybrand simply states that $Q_{mw} = f(C_p)$, or that the generation of municipal waste is a simple linear function of the total private consumption.

Where the two supplementary scenarios on coverage and success of waste prevention policies are concerned, the conclusion is that given uncertainties of various kinds, it is not possible to forecast the impact of waste prevention policies with any accuracy. Instead, two alternative scenarios indicating a range of possible outcomes are developed. The high abatement scenario operates with a 5% reduction in waste is by 1997 and a 10% reduction by 2000 relative to the baseline projections, whereas the low abatement scenario operates with a 2.5% reduction by 1997 and a 5% reduction by 2000 relative to the baseline projections. Whereas the high abatement scenario is assumed to apply to all Member States, the low abatement scenario is assumed only to apply to those Member States that have introduced specific legislation aimed at waste reduction.

The overall conclusion of the Coopers & Lybrand study is that the generation of municipal waste will rise, but that the estimates are subject to significant margins of error due to variations in data quality and availability across countries.[3]

[3] The Coopers & Lybrand study is based on the amount of municipal waste and not the amount of household waste. As it is explained later on, data and information on municipal waste are in fact not comparable by nature, thus creating problems for using that kind of data for projections.

5. The DGXI priority study

As part of a DGXI Priority Study, RIVM has been requested to carry out projections of the generation of municipal waste, allocated on the various disposal methods.

The method is briefly described in RIVM (1998). From the description it can be seen that the method is in line with the one applied by Coopers & Lybrand, i.e. a baseline projection assuming proportionality between the generation of total municipal waste and the total private consumption, and a so called BAT scenario, where national targets and Community legislation adopted or in 'pipeline' are implemented. The relevant Community legislation are the Packaging Directive and the proposed Directive on Landfills.

Where the allocation on the various treatment methods is concerned, it is assumed that national targets are reached in 2000, and that the results of the baseline projections and the BAT scenario are the same. From 2000 until 2010, the baseline projection is based on the assumed proportionality with the growth in total private consumption, whereas the BAT scenario is based on the targets of the proposed Directive on Landfills and the Packaging Directive. Thus, it is assumed that the amounts of municipal waste landfilled in 2010 will drop 75%, and that these amounts of waste will be redirected in accordance with the (modified) targets of the Packaging Directive.[4]

[4] From the method described, one should note that the target of a 75% reduction of waste disposed of at landfills is only applicable for biodegradable waste (municipal waste is not biodegradable altogether), and that the proposed Directive has changed significantly during the negotiations in Council. In any case, however, the targets set will not directly influence the amounts of municipal waste generated.

6. Development of baseline projections for selected waste streams

Having reviewed the most recent available scientific literature and the most recent studies carried out for policy making purposes at European level, the starting point for developing baseline projections includes recognition that:

- comprehensive and reliable data on waste is absent;
- no common models have yet been developed for the projection of waste at European level;
- there is a common understanding that the development of waste generation is related to the economic activity;
- efforts have recently been made in order to project municipal waste at European level;
- effects of national waste prevention policies are non-transparent;
- estimates so far are subject to significant margins of error due to variations in data quality and availability.

Despite these limitations, an attempt has been made in the following to develop a consistent methodology in order to project the future generation of selected waste streams until 2010. The selected waste streams are municipal waste/household waste, glass and paper waste and end-of-life vehicles. The methodology takes a starting point in the studies described above.

6.1. Methodological considerations

From the above-mentioned studies it is recognised that there is a relation between the size of the economic activity and the amount of waste generated. However, it is not quite evident how the specific interaction should be formulated.

Due to data limitations the previous studies link waste generation and economic activities at an aggregated level and assume proportionality between the two variables, i.e. when the economic activity increases 10%, the waste generation increases 10%, keeping the ratio between the two variables constant. The starting point of the present study however, is to link the generation of waste and economic activities at a more detailed level and (when data is available) test whether historical data reveal proportionality or not.

In general terms, it is assumed that there is a time dependent relation between the amount of a given category of waste generated and some specific economic activity, i.e.

eq. 1. $W_i^t = f(Y_i^t, T^t)$

where W_i^t is the amount of a given waste category i in period t, Y_i^t is the output of a specific economic activity, expressed in monetary terms, generating the waste category in period t, and T^t is time. The relation f can be specified as a log-linear form in the **estimated equation model**, i.e.

eq. 2 $\log(W_i^t) = a_0 + a_1 \cdot \log(Y_i^t) + a_2 \cdot T^t$

where a_0, a_1 and a_2 are coefficients (a_0 is a constant term, a_1 is a proportionality coefficient between the amount of waste generated and the output of the relevant economic activity and a_2 is a trend almost equal to the annual %-change in the waste coefficient).

Based on historical observations it was attempted to estimate the coefficients. However, due to multi-colinearity, data proved not to be sufficient to determine both a_1 and a_2.

Therefore, the model was simplified assuming that a_1 = 1.0, meaning that the ratio between the amount of waste generated and the corresponding output of economic activity is assumed to follow an exponential trend, with a_2 estimated from historical observations.

Imposing this restriction, the equation reduces to:

$$\log W_i^t - \log\left(Y_i^t\right) = a_0 + a_2 \cdot T^t \Rightarrow$$

$$\text{eq.3 } \log\left(\frac{W_i^t}{Y_i^t}\right) = a_0 + a_2 \cdot T^t$$

Data availability does not always allow for estimates according to eq. 2 and 3. In those cases it is therefore assumed that a_2 equals zero, which reduces eq.3 to the **constant coefficient model**, where $e^{a_2 T}$ equals 1.0 and the waste coefficient therefore equals a_0.

$$\text{eq. 4 } \left(\frac{W_i^t}{Y_i^t}\right) = a_0 \cdot e^{a_2 T^t}$$

This is the assumption made in the scientific studies mentioned previously, with the difference from the present study therefore being the level of aggregation used for the linking of amounts of waste generated to more specific economic activities.

Thus, in the constant coefficient model, a_0 is in practical terms estimated by calculating the average waste coefficient over the analysed period. However, in the present study only the latest observable waste coefficients have been estimated, assuming that the coefficient remains constant over the forecast period. The argument for using the latest observable waste coefficient and not the average over the observation period is that the data for the latest registered year is often assessed to be the most reliable, and because an average coefficient is difficult to interpret and not useful for forecast if the observation period includes data breaks (changes in the data collection method).

In summary, two approaches for making projections have been developed. The estimated equation model approach and the constant coefficient model approach.

With the estimated equation model data on waste generation for past years is estimated and compared with actual reported data for the same years. If there is a good correlation between the historical data predicted by the model and actual reported historical data then the estimated equation model can reasonably be used to make projections into the future, albeit with the usual caveats that attach to the making of projections. A good correlation is assumed if a_2 values are reasonable (between -0.02 and +0.02)[5], t-values significant and R^2 values above 0.6. (60% of variance explained).

Where the correlation is poor, the constant coefficient model approach is considered more suitable. This basically involves plugging the most reliable historical data value into the economic model to generate figures for both the past and the future. Where historical data is of questionable accuracy, this latter approach is probably more reasonable as it relies solely on the best waste data available, albeit for a single year. The constant coefficient model is also, generally, the more conservative of the two approaches.

Projections are calculated for all Member States, where possible, using both the estimated equation approach and the constant coefficients approach. This has the benefit of providing a range for each Member State since, as stated above, the latter approach tends to be more conservative.

[5] An a_2 value of +0.02 implies an annual change in the waste coefficient of 2%, which would produce a 32% larger coefficient in 2010 than the 1996 value

It must be stressed that the projections developed are a best effort at combining available information on waste generation, and available information on economic forecasting for the sectors considered to contribute to the generation. This is, essentially, an academic exercise, and the results should always be considered within the context of the model by which they were produced and should not be quoted out of context.

The above approaches have been developed for municipal waste/household waste, paper & cardboard waste and glass waste.

For end-of-life vehicles, however, a different approach has been taken. The model used for the projection of end-of-life vehicles is based on the CASPER model developed by T. Holtmann et al. The CASPER model has been developed for DGXI and is designed to prepare 25-year projections based on CORINAIR90 data. The general principle of the model is that each activity giving rise to emissions (including vehicles) is broken up into a number of different possible technologies with different emission factors. The projection is then calculated based on assumptions of the activity in the branch and the mix of technologies in the year of calculation. The CASPER model has been amended for the purpose of projecting end-of-life vehicles by Niels Kilde et al. on behalf of the ETC/W. Thus, with the amended version of the model the number of end-of-life vehicles can be calculated by CASPER based on the car fleet, an initial age distribution in 1970 and a calculated life-time function.

For each of the four waste streams, the specific methodology developed is described in turn below.

6.2. Municipal waste/household waste

The starting point is that economic activity, at least to some extent, can explain the amounts of municipal waste/household waste generated. However, assuming a close correlation between the generated amounts of municipal waste/household waste and the overall national income (GDP) will not be the right approach. This is primarily due to the specific origin of the household waste, but also to the fact that fluctuations in national income will not necessarily affect the basic consumption (as an example, a decrease in the growth of national income may well be neutral on the consumption that generates household waste, but have a negative impact on savings).

A more reasonable assumption appears to be in line with the approach adopted by Coopers & Lybrand and RIVM, i.e. the generation of municipal waste can be explained by the share of the national income spent on private consumption. Again, however, this would give too many errors. Thus, there will be a limit as to how much of a growing private consumption could possibly be spent on items generating municipal waste/household waste; once the basic human needs have been satisfied, any additional growth in the private consumption could well be spent on other consumer items like travelling, transport, housing, energy etc.

Therefore, instead of focusing on private consumption in general, this study seeks to identify the various items of consumption that most likely generate municipal waste/household waste, and assumes that the amount of municipal waste/household waste changes proportionally to the consumption of these goods.

The goods assessed to be of particular importance for the generation of municipal/household waste are food and beverage, clothing, furniture and household equipment. The amount of municipal waste/household waste is therefore estimated according to eq. 5 (based on eq. 2):

eq. 5 $\log(W_{mw}^{t}) = a_0 + 1.0 \cdot \log(C_{food}^{t} + C_{cloth}^{t} + C_{furn}^{t}) + a_2 \cdot T^{t}$

where W_{mw} is the amount of municipal waste/household waste and C_{food}, C_{cloth} and C_{furn} are the consumption of food/beverages, clothing and furniture/household equipment respectively.

Because of the rather poor data availability on municipal waste/household waste, the estimate is also derived using eq. 6 (based on eq. 4, i.e. the constant coefficient model):

$$\text{eq.6} \quad W_{mw}{}^{t} = \left(\frac{W_{mw}{}^{t_0}}{C_{food}{}^{t_0} + C_{Cloth}{}^{t_0} + C_{Furn}{}^{t_0}} \right) \cdot (C_{food}{}^{t} + C_{Cloth}{}^{t} + C_{Furn}{}^{t})$$

where the large bracket is the waste coefficient in the base year (the latest year for which observations are available), and the explanatory variable is the sum of the relevant categories of private consumption.

6.2.1. Test and application of the model

In order to test and apply the model, the following information was compiled:

- Historical observations of private consumption, disaggregated into the relevant consumer expenditure items, and stated in fixed prices
- Historical observations of municipal waste/household waste
- Future trends of private consumption in all EEA member countries, disaggregated into the relevant consumer expenditure items.

The required observations of private consumption were found in OECD (1997), where private final consumption expenditure is given by type and purpose. Thus, the consumer expenditure items were selected as follows:

1. food, beverages and tobacco
2. clothing and footwear
3. furniture, furnishings and household equipment and operation

The historical observations of municipal waste/household waste were compiled through the Europe's Environment: the Second Assessment database, OECD (1997), VROM (1996) and national reports.

In compiling the historical observations of municipal waste/household waste, considerations were made on how to distinguish between the two terms. The two terms are very different in substance, but still very often used randomly:

- Municipal waste is a **management/collection** concept. Municipal waste activities, in particular within the commercial and industrial waste markets, vary strongly across EU. Data and information on MW are not comparable by nature.
- Household waste is a concept linked to the **generation** and includes all waste from a single source: households.

Where some countries only have data for municipal waste, others only have data for household waste. Because of this disparate situation, the model has been tested against municipal waste as well as household waste. However, the overall assessment is that the best data is available for household waste. The main results reported in paragraph 6.2.3 below therefore only relates to household waste.

Regarding the future trends of private consumption disaggregated into the relevant consumer expenditure items, the requirement was dictated by the choice of model, with the explanatory variable limited to selected consumer expenditure items. The requirement, however, showed to be the most difficult one, because hardly any official databases or models contain such detailed information (cf. also the conclusions of Coopers & Lybrand (1996)). At the same time, considerations had to be taken of the baseline scenario developed for the DGXI Priority Study by RIVM (1997), and the requirement from the EEA that the projections made as a contribution to the state of the environment report were in line with the baseline scenario. The baseline scenario, however, only contained overall

projections of the European economy by country, purpose and sector, i.e. for the purpose of projecting municipal waste/household waste, the relevant information was limited to the overall and aggregated private consumption per country.

One solution to the problem could have been to base the projections on overall private consumption, i.e. the method applied by Coopers & Lybrand. However, in order to make progress, the future trends of disaggregated consumer expenditure items were estimated based on the historical observations and the overall estimates from RIVM.

Thus, the future trends of disaggregated consumer expenditure items were estimated in two steps:

1. The share of the individual categories of consumer goods in the total private consumption were calculated, and the individual shares were forecast according to a continuation of the past trend in the share.
2. With the projected shares, the selected consumer expenditure items were projected, with the overall private consumption figures from the RIVM study as the aggregated development.

The approach gave a solution to the problem of lacking official data on the disaggregated private consumption, while at the same time securing the requirement of keeping in line with the overall baseline scenario of the European economy.

6.2.2. Main results

Due to data limitations it was only possible to estimate the projections of household waste based on the estimated equation model (eq. 5) for two countries; Austria and the Netherlands, while the constant coefficient model (eq. 6) was applied to all EU14 (being EU15 excluding Luxembourg). The main results are given in tables 6.1 and 6.2 below.

Despite the few estimates based on the estimated equation model, it appears that the constant coefficient model results in a more conservative estimate. This is due to the two different approaches of the model, the coefficients in the estimated equation model continue a historical trend, whereas the coefficient in the constant coefficient model is kept constant.

However, given the development in the amount of municipal waste from 1990 to 1995, reported in the Second Assessment report to reach 11%, the two different levels of the estimates may indicate a possible span for the actual development of household waste over the next 15 years.

Table 6.1. Estimate results for household waste based on the *estimated equation* model

	Estimate results				Test of model			
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate period	Estimated coefficient a_2	T-statistics	R^2
AT	14%	16%	17%	55%	90-96	0.0196	3.748	0.70
NL	20%	20%	20%	74%	90-95	0.0186	2.955	0.83

Table 6.2. Estimate results for household waste based on the *constant coefficient* model

	Estimate results				Test of model	
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate year	Const. coefficient k
BE	4%	5%	5%	15%	1994	0.003
DK	13%	10%	10%	36%	1996	0.029
FI	10%	6%	6%	23%	1994	0.011
FR	1%	-4%	4%	2%	1994	0.037
GR	3%	11%	12%	28%	1992	15.587
IT	3%	5%	5%	13%	1995	0.070
NL	9%	10%	10%	31%	1995	0.074
PT	6%	9%	10%	28%	1995	1.100[1]
ES	8%	8%	8%	25%	1994	1.445[1]
SE	9%	9%	9%	29%	1994	0.140
IE	20%	14%	9%	50%	1995	0.147
UK	11%	10%	11%	36%	1995	0.219
AT	4%	5%	6%	15%	1996	0.008
DE	8%	8%	8%	26%	1993	0.070
Total EU14	7%	6%	8%	22%		

1. Data on household waste not reported for PT and ES. Coefficient and projection estimates based on municipal waste data.
2. The estimated particular low growth of household waste in France is due to the relative share of the historical observed economic variables used to explain the development in the waste amounts compared to the overall GDP, and the continuation of this trend until 2010.

6.3. Glass, paper and cardboard waste

The approach is based on the same considerations and methodology as the one developed for municipal waste/household waste, except that it is not only private consumption that most likely generates glass and paper waste. Also the production within certain industrial sectors seems to be relevant. Thus, for the generation of glass waste, it is assessed that private consumption of food and beverages is of particular importance, but also the production within the manufacturing sector producing food and beverages. For the generation of paper and cardboard waste, it is likewise assessed that private consumption of food, newspapers/ magazines and durable goods like furniture (packaging) is of particular importance, but also the production within sectors like wholesale and retail, transport and communication, financial institutions and insurance.

For the two waste streams, the waste amounts are therefore estimated based on the estimated equation model eq. 2, i.e.:

$$\text{eq. 7}\quad \log(W_g{}^t) = a_0 + 1.0 \cdot \log(C_{Food}{}^t + C_{Bev}{}^t + Q_{Food}{}^t) + a_2 \cdot T^t$$

where W_g is the consumption of glass, C_{Food} and C_{Bev} are the consumption of food and non-alcoholic beverage respectively, and Q_{food} is the production within the manufacturing sector producing food and beverages, and

$$\text{eq. 8}\quad \log(W_p{}^t) = a_0 + 1.0 \cdot \log(C_{food}{}^t + C_{furn}{}^t + C_{recr}{}^t + Y_{wr}{}^t + Y_{tc}{}^t + Y_{fin}{}^t + Y_{ins}{}^t) + a_2 \cdot T^t$$

where W_p is the total consumption of paper and cardboard, C_{food}, C_{furn} and C_{recr} are the consumption of food, furniture etc. and recreational activities respectively, and Y_{wr} , Y_{tc} , Y_{fin} and Y_{ins} are the production within the sectors of wholesale and retail, transport and communication, financial institutions and insurance.

6.3.1. Test and application of the model

In order to test and apply the model, the following information was compiled:

- Historical observations of private consumption in all EEA member countries, disaggregated into the relevant consumers items, and stated in fixed prices
- Historical observations of gross domestic product by kind of activity in all EEA member countries, stated in fixed prices
- Historical observations of glass and paper waste
- Future trends of private consumption in all EEA Member States, disaggregated into the relevant consumer expenditure items
- Future trends of the gross domestic product in all EEA Member States by kind of activity.

The required observations of private consumption and gross domestic product were found in OECD (1997), where private final consumption expenditure is given by type and purpose and gross domestic product by kind of activity. Thus, the consumer expenditure items and gross domestic products were selected as follows:

Glass:

1. private consumption of food and beverages
2. manufacturing of food, beverages and tobacco

Paper:

1. private consumption of food
2. private consumption of furniture, furnishing and household equipment, excl. household operation
3. private consumption of recreational, entertainment, education and cultural services, excl. education
4. transport, storage and communication
5. financial institutions
6. insurance
7. wholesale and retail trade

Eurostat/OECD (1997) frequently publishes data on recycling percentages for glass and paper, but not the absolute figures on glass and paper waste generated. In order to compile the necessary historical observations, contacts were made with Eurostat. However, only few of the absolute figures were available. To fill the gaps contacts were made with European industrial organisations. From CEPI and FEVE unbroken time series were received matching well the few absolute figures given by Eurostat.

Regarding the future trends of private consumption disaggregated into the relevant consumer expenditure items, the estimate were made in line with the method described above in paragraph 6.2.2. The same approach could have been applied to the economic sectors outside households. However, given the partial influence of the sectors concerned, the choice was made only to apply the future trends developed by RIVM (1997), i.e. the baseline scenario.

6.3.2. Main results

The estimated results for the glass consumption in the individual countries are given in table 6.3 and 6.4.

Table 6.3. Estimate results for glass consumption based on the *estimated equation* model

	Estimate results				Test of model			
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate period	Estimated coefficient a_2	T-statistics	R^2
BE	-8%	-7%	-7%	-21%	90-96	-0.0289	-2.088	0.26
DK	14%	10%	10%	38%	90-96	-0.0002	-0.024	0.35
FI	20%	15%	14%	57%	90-96	0.0081	0.66	0.09
FR	24%	19%	27%	87%	90-96	0.0314	6.72	0.92
GR	-1%	5%	6%	10%	90-96	-0.018	0-54	-0.19
IT	14%	16%	16%	53%	90-96	0.0244	4.27	0.76
NL	-5%	-5%	-6%	-15%	90-96	-0.0308	-3.27	-0.07
PT	40%	45%	46%	196%	90-96	0.0461	2.13	0.53
ES	16%	20%	19%	66%	90-96	0.0120	2.16	0.73
SE	23%	23%	23%	87%	90-96	0.0223	1.69	0.61
IE	41%	34%	28%	141%	90-96	0.0325	2.29	0.76
UK	9%	9%	8%	28%	90-96	-0.0032	-0.45	0.11
AT	23%	23%	23%	86%	90-96	0.0288	2.67	0.66
DE	12%	12%	11%	39%	90-96	0.0086	1.23	0.24
Total EU14	15%	15%	17%	53%				

Table 6.4. Estimate results for glass consumption based on the *constant coefficient* model

	Estimate results				Test of model	
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate year	Constant coefficient k
BE	7%	7%	7%	23%	1996	0.250
DK	14%	11%	10%	39%	1996	1.847
FI	15%	10%	10%	39%	1996	0.568
FR	6%	2%	8%	17%	1996	3.058
GR	8%	15%	16%	45%	1996	263.821
IT	1%	3%	3%	6%	1996	4.970
NL	11%	10%	10%	34%	1996	6.374
PT	11%	15%	16%	48%	1996	48.532
ES	9%	13%	12%	39%	1996	61.908
SE	10%	10%	10%	34%	1996	0.795
IE	20%	14%	9%	48%	1996	11.031
UK	11%	10%	10%	34%	1996	3.203
AT	6%	7%	7%	21%	1995	1.077
DE	7%	7%	7%	23%	1996	8.031
Total EU14	7%	7%	8%	24%		

Contrary to the estimates of the municipal waste/household waste, the data available in general allowed for an estimate of the projections based on the estimated equation model. As can be seen from table 6.3 the estimated period is very short, however, and for about half of the countries the estimates are not very convincing (the explanatory power of the equation is very low as shown by the value of R^2, and the estimated coefficient is not significantly different from zero). Therefore, for countries like BE, DK, FI, GR, NL, PT, SE, UK, AT and DE, it is recommended that the model is reduced to the constant coefficient model, cf. the estimate results in table 6.4. For the countries where the estimated equation is statistically significant, it is noticed that the a_2 coefficient is estimated to be positive, i.e.

over the period 1990 to 1996 the waste coefficient (the glass consumption coefficient) has been increasing.

Again it is noticed that the constant coefficient model in isolation results in a more conservative estimate (24% on average for EU14) than the estimated equation model based on a time series of historical waste data (53% on average for EU14).

The summarised estimate results for the paper and cardboard consumption in the individual countries are given in table 6.5 below.

As for glass waste, the data availability allowed in general for an estimate of the projections based on the estimated equation model. Thus, for most countries the statistics and the estimated coefficients are reasonable. For IE and GR, however, the results are not reliable. For IE the explanatory power of the equation is quite small, and for GR the estimated coefficient is very high, implying that the waste coefficient increases by about 4% p.a. For IE and GR, and because of the relatively low value of R^2 for FI, IT and SE, it is recommended that the model is reduced to the constant coefficient model, cf. the estimate results in table 6.6.

Table 6.5. Estimate results for total paper consumption based on the *estimated equation* model

	Estimate results				Test of model			
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate period	Estimated coefficient a_2	T-statistics	R^2
BE	22%	24%	24%	88%	83-96	0.0212	7.18	0.94
DK	10%	7%	6%	25%	90-96	-0.0090	-2.98	0.62
FI	19%	14%	14%	54%	83-96	0.0026	0.52	0.44
FR	20%	16%	20%	66%	83-96	0.0158	7.25	0.95
GR	49%	53%	49%	239%	90-96	0.0416	1.54	0.90
IT	15%	15%	15%	53%	83-96	0.0053	0.49	0.37
NL	19%	18%	17%	64%	86-96	0.0067	1.26	0.92
PT	25%	26%	26%	100%	86-96	0.0093	1.35	0.91
ES	28%	29%	29%	112%	86-96	0.0207	7.96	0.97
SE	0%	0%	-1%	-1%	83-96	-0.0244	-11.08	0.48
IE	14%	4%	0%	19%	86-96	-0.0273	-1.45	0.16
UK	14%	15%	14%	50%	83-96	-0.0034	-1.63	0.96
AT	18%	19%	19%	68%	83-96	0.0127	4.69	0.95
DE	18%	17%	16%	61%	83-96	0.0087	2.83	0.94
Total EU14	18%	18%	18%	64%				

Table 6.6. Estimate results for total paper consumption based on the *constant coefficient* model

	Estimate results				Test of model	
Country	1995-2000	2000-2005	2005-2010	1995-2010	Estimate year	Const. coefficient k
BE	10	12	12	37	1996	0.0008
DK	15	12	11	43	1995	0.0060
FI	17	12	12	48	1996	0.0082
FR	11	7	11	31	1996	0.0063
GR	21	24	21	81	1996	2.3470
IT	12	12	12	41	1996	0.0088
NL	15	14	14	48	1996	0.0106
PT	20	21	21	74	1996	0.1300
ES	16	16	16	56	1996	0.2080
SE	13	13	12	42	1996	0.0035
IE	31	20	14	79	1996	0.0214
UK	18	16	15	57	1996	0.0376
AT	11	12	12	39	1996	0.0021
DE	13	12	12	41	1996	0.0134
Total EU14	14	13	13	45		

Also here it is noticed that the constant coefficient model in isolation results in a more conservative estimate (44% in average for EU14) than the estimated equation model based on a time series of historical waste data (64% in average for EU14).

6.4. End-of-life vehicles

The general principles of CASPER are based on a model for projection of road traffic called FOREMOVE and emissions from cars is probably the field where the model is best due to the very high availability of data on car technologies, numbers and age distribution.

The general equation used in CASPER is:

$C_{ki} = C_{ki-1} + C_{Si} + C_{Ri} + C_{Ei}$

with the following general meaning and specific meaning for cars

C_{ki} = production capacity in the year i = number of cars

C_{ki-1} = production capacity in the year before = number of cars in the year before

C_{Si} = production capacity shut-off in the year i = ELV (for most practical purposes)

C_{Ri} = production capacity replaced in the year i = number of new cars replacing scrapped cars

C_{Ei} = extension of production capacity in operation in the year i = number of additional new cars (growth)

For all practical purposes $C_{Ri} + C_{Ei}$ is equal to the number of registrations in the year i. The model does not take import and export of used equipment into account and an error in the projection of ELV will thus be introduced, because exported used cars will be registered as ELV's. This will however be counterbalanced partly by the fact that registration statistics may also include re-registration of used cars after renovation.

6.4.1. Total number of cars

The basis for the calculation of the total number of cars is historical data (presently a time-series from 1970-1990) except for Denmark where historical data have been updated to 1995. The historical data is used to develop a specific S-shaped curve describing the number of cars pr. 1000 inhabitants country by country. It is important to note that the point of assumed saturation is different from country to country. The difference can be explained by differences in geographical structure, infrastructure development and economic development in the country (including the relative price of cars).

The projection values of the car fleet are calculated from projections of number of inhabitants and the projected number of cars pr. 1000 inhabitants.

6.4.2. End of life vehicles

The number of ELV can be calculated by CASPER based on the car fleet, an initial age distribution in 1970 and a calculated life-time function.

The life-time function has been developed for each country and is a Weibull distribution describing the probability of finding a car of the age t on the market. It should be noted that the parameters T (characteristic service life time) and b (failure steepness) should not be interpreted as physically meaningful entities. They are country specific constants introduced to fit the shape of the life-time function to the actual historical data. Furthermore it should be noted that the factor b is used twice in the equation. The first time it has the dimension 'time' while the second time it is dimension-less.

The starting point is identical age distributions in 1970 for all countries (except for France) whereafter the curve has been fitted based on later historical data for each country using the factors T and b.

6.4.3. Results and evaluation of the projections

The main results of the CASPER projections is given below. Direct comparison of the results of the first projection reported in ETC/W: Methodology report and the CASPER projections is not possible since the projected data of the car fleet itself is different.

Projected scrapping of passenger cars [thousands]				
	1995	2000	2005	2010
Belgium	458	496	528	554
Denmark	146	155	161	170
France	1884	2141	2304	2333
Greece	39	70	90	102
Ireland	69	92	95	106
Italy	1835	2287	2318	2733
Luxembourg	22	26	30	34
Netherlands	636	698	730	768
Portugal	70	91	124	144
Spain	876	1165	1167	1312
UK	2047	2223	2401	2678
West Germany	2289	2674	2915	3036
Total	**10371**	**12120**	**12863**	**13971**

The results only cover the 12 countries constituting the EU at the time of development of the model and data for Germany only cover the former West Germany. From the projected results one can see a trend of an increase of 35% in the number of scrapped cars for the 12 EU-countries covered by the projections.

A comparison of projected results for 1995 with historical data for 1995 shows a wide variation of consistency of the results. As can be seen from the table below the two figures are reasonably in line for Denmark, France and Ireland while large differences of up to 100 % are found for Spain, Portugal, Italy and UK.

Comparison of 1995 projection results with available historical data (unit: 1000 scrapped cars)		
	Projection '95	**Historical '95**
Belgium	458	n.a
Denmark	146	147 (1)
France	1884	1800 (2)
Greece	39	n.a.
Ireland	69	65 (1)
Italy	1835	1265 (2)
Luxembourg	22	n.a.
Netherlands	636	531(1)
Portugal	70	150
Spain	876	438 (4)
UK	2047	1450
West Germany	2289	2950

1) Data from ERM Final Report using a conversion factor of 1 ELV = 800 kg
2) Institut pour une Politique Européenne, July 1996

An evaluation of the method based on this comparison is, however, difficult as the historical data are probably very uncertain for a number of countries. Some sources give the numbers in tonnes of scrapped cars while others give total number of cars. Depending on which conversion factor is used from tonnes to numbers one may get very big variations. Furthermore in many cases the number of scrapped cars is given as the number of cars deregistered, which is only true if all used cars are scrapped in the country and not exported.

It should also be borne in mind that the projected values follow a smooth curve based on projections of population and number of cars per inhabitant while actual numbers of scrapped cars may vary from year to year in an unsystematic way. The number of scrapped cars may change dramatically due to national changes in tax policy, possibilities for taking up loans in houses, regulations on car safety etc.

Due to lack of historical data for 1995 for Belgium, Greece and Luxembourg it was possible to estimate a growth rate based on historical data and projections for only nine EU countries. The total projected number of scrapped cars for the nine countries is 13281000 in 2010, while the total number of scrapped cars for these countries was 8796000 in 1995 according to the (uncertain) historical data. This gives a projected increase of 34 % from 1995 to 2010.

Interestingly this is very close to the growth rate based solely on projected values. This may reflect that even though actual numbers of scrapped cars may vary from year to year within countries these variations are levelled out when looking at the Community level.

6.4.4. Conclusions

It is clear from the above remarks that projections of ELV's should be interpreted carefully and that the results should probably only be used at an aggregated level (geographically or over time) as variations in actual numbers from year to year will be quite large.

The projection result of a 34% increase for 2010 represents an aggregation of a long term trend which is probably not too far from reality when it is considered that the actual growth in the number of new cars today will only be reflected fully in the number of scrapped cars 8-12 years from now.

References

L'Agence de l'Environnement et de la Maîtrise de l'Energie, 1992: Pour la Commission des Communautés Européennes - Vehicules Hors d'Usage.

Andersen, Frits Møller et al., 1998: A Scenario Model for the Generation of Waste.

British Glass, Sheffield: Personal contacts.

Bruvoll, A. and Ibenholt, K., 1997: Future waste generation. Forecasts on the basis of a macroeconomic model, Resources, Conservation and Recycling, 19.

Bruvoll, A. and Spurkland, G., 1995: Waste in Norway up to 2010, reports 95/8, Statistics Norway.

Bundesverband Sekundärstoffe und Entsorgung e.V. (bvse), Bonn: Personal contacts.

Confederation of European Paper Industries (CEPI).

Corinair Workshop in Bratislava, 1997: Personal contacts with participants.

Coopers & Lybrand, 1996: Cost-Benefit Analysis of the Different Municipal Solid Waste Management Systems: Objectives and Instruments for the Year 2000, final report.

Department of the Environment, Transport and the Regions, UK, 1997: Municipal Waste Management 1995/96.

National Institute of Public Health and the Environment (RIVM), 1997: Economic Assessment of Priorities for a European Environmental Policy Plan, first interim report.

National Institute of Public Health and the Environment (RIVM), 1998: Economic Assessment of Priorities for a European Environmental Policy Plan, Annex 17, Waste Management, second interim report.

Environment Protection Agency, Ireland, 1995: National Waste Database Report.

Environmental Resources Management (ERM), 1997: Waste Statistics, Phase III.

European Commission, 1997: Proposal for a Council Directive on Landfills.

European Commission, 1997: Proposal for a Council Directive on End-of-Life Vehicles.

European Environment Agency, 1998: Second Assessment.

European Federation of Waste Management: Personal contacts.

European Organisation for Packaging and the Environment: Personal contacts.

European Parliament and Council, 1994: Directive 94/62/EC on Packaging and Packaging Waste.

European Recovery and Recycling Association: Personal contacts.

Eurostat, 1994: Basic Statistics for the European Union.

Eurostat, 1996: Environment Statistics.

Fachvereinigung Behälterglasindustrie e.V., Düsseldorf: Personal contacts.

Federal Ministry of the Environment, Austria, 1992, 1995, 1998: Federal Waste Management Plans and Reports.

Féderation Européenne du Verre d'Emballage (FEVE), 1997: Glass Gazette, Issue 21 (1995), 22 (1996), 23 (1997) and personal contacts.

Gesellschaft für Glasrecycling und Abfallvermeidung mbH (GGA), Ravensburg: Personal contacts.

Holtmann, T, Samaras Z, et al: Development of a Methodology and a Computer Model for Forecasting Atmospheric Emissions from Relevant and Stationary Sources.

International Confederation of Paper and Board Converters in Europe: Personal contacts.

Institut pour une Politique Européenne de l'Environnement, 1996: Final report to the European Commission on End-of-Life Vehicles.

Kilde, Niels, Larsen, Helge V. Risoe National Laboratory, on behalf of the European Topic Centre on Waste: Scrapping of passenger cars - Calculations based on the CASPAR model.

Miljøstyrelsen, 1995, 1996: Orientering fra Miljøstyrelsen, Affaldsstatistik.

Ministre de l'Environnement, des Ressources Naturelles et de l'Agriculture pour la Region Wallonne, 1997: Horizon 2010, Projet de plan wallon des déchets, Consultation de la Population, du 15 juillet au 30 septembre 1997.

Ministry for Housing, Physical Planning and the Environment (VROM), The Netherlands, 1996: Comparison of household waste figures for various countries in Europe.

Nagelhout, D., Joosten, M. and Wierenga K., 1990: Future waste disposal in the Netherlands, Resources, Conservation and Recycling, 4.

OECD, 1996: Questionnaire on waste management.

OECD, 1993, 1995, 1997: Environmental Data Compendium.

OECD, 1997: National Accounts, Volume II.

Scottish Office, 1996: Statistical Bulletin, Environment Series, Env/1996/5.

Annex I Economic data

I.1. Historical observations

The economic data were compiled from OECD (1997). The data are listed below.

AUSTRIA. Private consumption expenditure by type. Stated in millions of schillings at 1983 prices

	Food, beverages and tobacco (FC1)	Food (FC2)	Non-alcoholic beverages (FC3)	Alcoholic beverages (FC4)	Clothing and footwear (FC6)
1990	177780.000	139070.000	6136.000	16288.000	79793.000
1991	179717.000	140529.000	6287.000	16066.000	79929.000
1992	181260.000	142219.000	6713.000	15848.000	78061.000
1993	180507.000	142359.000	6553.000	15625.000	75169.000
1994	178556.000	140563.000	6728.000	14897.000	72328.000
1995	177432.000	138391.000	7084.000	16454.000	70535.000

	Furniture, furnishing and household equipment and operation (FC10)	Furniture, other (FC12)	Recreational, entertainment, education, cultural services (FC17)	Recreational, other (FC19)	Final consumption (FC19)
1990	71547.000	13773.000	70123.000	66550.000	877120.000
1991	72129.000	14413.000	73179.000	69468.000	906696.000
1992	74470.000	14616.000	74914.000	71281.000	925445.000
1993	75533.000	14943.000	74407.000	70771.000	924270.000
1994	78173.000	15649.000	76794.000	73299.000	925410.000
1995	80761.000	15966.000	77356.000	74052.000	932972.000

AUSTRIA. GDP by kind of activity. Stated in millions of schillings at 1983 prices.

	Manufacturing (FQ10)	Food, beverages and tobacco (FQ11)	Wholesale and retail trade, restaurations and hotels (FQ24)	Wholesale and retail trade (FQ25)	Transport, storage and communication (FQ29)
1990	357345.000	51324.000	281474.000	226058.000	97871.000
1991	370947.000	52893.000	292750.000	235067.000	102065.000
1992	368290.000	55105.000	296805.000	236944.000	105722.000
1993	359803.000	54216.000	294743.000	235716.000	109316.000
1994	372999.000	53475.000	296804.000	238660.000	113020.000
1995	374719.000	44298.000	309402.000	252505.000	114673.000

	Finance, insurance, real estate and business services (FQ32)	Financial institutions (FQ33)	Insurance (FQ34)
1990	235881.000	68270.000	23354.000
1991	249120.000	73675.000	25493.000
1992	262096.000	81490.000	25768.000
1993	274296.000	92881.000	25936.000
1994	269487.000	84965.000	23261.000
1995	281696.000	89048.000	25163.000

I.2. Projection of economic variables

I.2.1. Base-line scenario

The projections of the disaggregated economic variables are based on the base-line scenario developed by RIVM (1997). For documentation purposes the baseline scenario is given below.

Baseline Scenario for Austria: Macroeconomic Assumptions

(all numbers are annualised growth rates except if otherwise indicated)

	Observations		Forecasts								
	1985/90	1990/95	1995/00	2000/05	2005/10	2010/15	2015/20	2020/25	2025/30	1995	2030
Macroeconomic aggregates											
GDP Growth	3,22%	2,28%	2,22%	2,19%	2,14%	1,74%	1,59%	1,51%	1,49%		
Priv. Consumption	3,09%	1,51%	1,72%	1,94%	1,92%	1,56%	1,59%	1,51%	1,49%		
Consumer Price Index	2,18%	3,25%	1,98%	1,90%	1,82%	1,74%	1,66%	1,58%	1,50%		
GDP Deflator	2,89%	3,22%	1,76%	1,72%	1,67%	1,63%	1,59%	1,54%	1,50%		
Exchange Rate ($)	-11,28%	-2,35%	0,88%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%		
Population Total	0,42%	0,64%	0,23%	0,20%	0,15%	0,12%	0,10%	0,05%	0,01%		
Lending Rate (level)	-	-	-	-	-	-	-	-	-		
Sectoral value added										***Share in value added***	
Manufacturing	3,12%	1,36%	2,36%	2,33%	2,20%	1,75%	1,58%	1,47%	1,41%	34,75%	35,14%
- Intensive	5,22%	1,39%	2,18%	2,10%	1,90%	1,67%	1,47%	1,33%	1,26%		
- Metals	5,94%	-1,08%	0,27%	0,80%	1,00%	1,10%	0,90%	0,70%	0,60%	1,51%	1,04%
Iron and Steel	6,41%	-0,71%	-0,16%	0,36%	0,55%	0,64%	0,43%	0,22%	0,11%		
Non-ferrous	5,52%	-1,44%	0,67%	1,20%	1,39%	1,49%	1,28%	1,07%	0,96%		
- Chemicals	6,44%	1,11%	1,37%	1,80%	1,80%	1,65%	1,60%	1,50%	1,50%	2,36%	2,18%
- Paper	6,48%	2,00%	3,18%	2,70%	2,20%	1,80%	1,60%	1,50%	1,40%	2,09%	2,24%
- Building Materials	2,10%	3,12%	3,36%	2,60%	2,20%	1,85%	1,50%	1,30%	1,20%	2,08%	2,20%
- Other Industries	2,39%	2,64%	2,41%	2,40%	2,29%	1,78%	1,62%	1,51%	1,45%		
- Food	2,71%	1,69%	2,26%	2,00%	1,60%	1,30%	1,30%	1,20%	1,00%	3,67%	3,29%
- Textiles	-2,01%	-4,29%	0,46%	0,10%	0,00%	-0,50%	-1,00%	0,00%	0,00%	1,22%	0,61%
- Engineering	2,43%	1,77%	1,71%	2,00%	2,20%	2,00%	1,80%	1,60%	1,60%	10,81%	10,83%
- Others	4,75%	3,33%	1,89%	1,70%	1,50%	1,30%	1,20%	1,00%	1,00%	2,19%	1,87%
- Construction	2,69%	5,34%	3,69%	3,40%	3,00%	2,00%	1,80%	1,70%	1,60%	8,82%	10,88%
Services	3,49%	2,46%	2,29%	2,21%	2,21%	1,80%	1,65%	1,59%	1,59%	57,65%	58,94%
- services	4,44%	3,07%	2,96%	2,95%	2,90%	2,28%	2,03%	1,98%	1,99%	28,55%	35,08%
- non market	1,11%	2,12%	1,80%	1,40%	1,40%	1,15%	1,10%	1,00%	0,95%	15,03%	12,30%
- trade	4,44%	1,63%	1,42%	1,42%	1,40%	1,25%	1,20%	1,10%	1,10%	14,07%	11,56%
Agriculture	1,70%	-1,23%	0,74%	1,20%	1,00%	0,90%	0,80%	0,70%	0,60%	2,92%	2,07%
Energy Sector	2,43%	2,17%	1,20%	1,35%	1,40%	1,30%	1,30%	1,20%	1,10%	4,69%	3,84%

I.2.2. Projection of relevant OECD figures

Based on the base-line scenario developed by RIVM (1997), the relevant economic variables identified in section I.1 are projected.

For detailed sectors, **production** is projected by the same %-change as the aggregated sector. The relevance of calculating detailed sectors with the same %-change as aggregated sectors is that for some categories of waste, even if the economic activity used for projections is aggregations of detailed sectors, each detailed sector has a different weight related to the production of the sector, and the weighed average will therefore depend on these weights.

For **private consumption**, categories of private consumption are projected according to a continuation of past trends in the share of the category of the total private consumption. If total private consumption is Ct and one category of private consumption is food Cf, the share of food of the total private consumption is:

Sf = Cf/Ct (Ct and Cf measured in constant prices)

In economic models the development of this share is normally explained by changes in income and relative prices. In this projection the average annual change in the share (Ap) is simply calculated and the share forecasted by continuing the historical change. For the consumption category food we have:

$$Apf = \left(\sqrt[n]{\frac{Sf_t}{Sf_{(t-n)}}} \right) \quad \Rightarrow \quad Sf_{t+1} = Sf_t * Apf$$

Having projected the share of food Sf and the total private consumption Ct, the consumption of food is calculated as Cf = Ct * Sf.

The results of the projections are given on the following page.

AUSTRIA. Private consumption expenditure by type. Stated in millions of schillings at 1983 prices

	Food, beverages and tobacco (FC1)	Food (FC2)	Non-alcoholic beverages (FC3)	Alcoholic beverages (FC4)	Clothing and footwear (FC6)
1996	177541.766	138614.891	7360.660	16401.500	69309.320
1997	176949.422	138290.375	7617.895	16284.548	67835.750
1998	178633.516	139745.953	7985.800	16376.950	67249.781
1999	180510.266	141355.156	8379.672	16486.008	66734.164
2000	182585.219	143122.797	8801.574	16612.031	66287.297
2005	189959.578	149648.266	11056.153	16956.486	62982.211
2010	197450.109	156327.422	13875.491	17292.176	59786.902

	Furniture, furnishing and household equipment and operation (FC10)	Furniture, other (FC12)	Recreational, entertainment, education, cultural services (FC17)	Recreational, other (FC19)	Final consumption (FC19)
1996	82478.234	16077.624	80372.109	77010.203	944167.688
1997	83899.055	16126.035	83175.750	79770.023	951721.000
1998	86445.023	16383.194	87187.313	83694.406	971707.125
1999	89155.484	16660.756	91481.867	87897.852	993084.688
2000	92040.898	16959.598	96081.883	92402.742	1015925.625
2005	106052.758	18213.646	120656.547	116572.156	1118451.500
2010	122085.375	19542.441	151377.359	146928.281	1230192.250

AUSTRIA. GDP by kind of activity. Stated in millions of schillings at 1983 prices

	Manufacturing (FQ10)	Food, beverages and tobacco (FQ11)	Wholesale and retail trade, restaurations and hotels (FQ24)	Wholesale and retail trade (FQ25)	Transport, storage and communication (FQ29)
1996	383562.375	45299.137	313795.500	256090.563	118067.320
1997	392614.438	46322.898	318251.375	259727.047	121562.117
1998	401880.125	47369.801	322770.563	263415.156	125160.359
1999	411364.469	48440.359	327353.875	267155.656	128865.109
2000	421072.688	49535.113	332002.281	270949.250	132679.516
2005	472467.625	54690.766	356253.438	290740.750	153438.969
2010	526776.563	59208.301	381899.375	311670.594	177016.047

	Finance, insurance, real estate and business services (FQ32)	Financial institutions (FQ33)	Insurance (FQ34)
1996	290034.219	91683.820	25907.826
1997	298619.219	94397.664	26674.697
1998	307458.375	97191.836	27464.270
1999	316559.125	100068.719	28277.213
2000	325929.313	103030.758	29114.219
2005	376925.188	119151.266	33669.520
2010	434842.656	137459.781	38843.098

Annex II Municipal waste/household waste

II.1. Historical observations

Household waste and municipal waste in 15 EU-countries + Iceland + Norway 1990-1996. Stated in '000 tonnes

		1985	1990	1991	1992	1993	1994	1995	1996	Source
Household waste TOTAL	Austria		2504	2426	2477	2509	2569	2644	2775	1, 4
	Belgium		3070		4000		4127			1, 2, 5
	Denmark	1900			1980		2573	2610	2757	2, 3, 6
	Finland		1200				900			2, 3
	France		20420			24500	25741			2, 7, 8
	Germany					38540				8
	Greece	3023	3000		3200					2, 3, 7
	Iceland				80		65			3
	Ireland							1324		9
	Italy							23000		3
	Luxembourg				98					2
	Norway	800	850		1042	1100	1069	1262		2, 3, 8
	Portugal									
	Spain									
	Sweden	2650	3200				3235			3, 8
	The Netherlands	5177	6190	6459	6570	7041	7163	6996		2, 3, 7, 8
	United Kingdom	17000	22153					26408		2, 10, 11
Municipal waste TOTAL	Austria		4783			4472			4168	2, 4, 8
	Belgium		3500		4000		4781			1, 2, 5
	Denmark	2430	2925		2925		2703	2820	2938	2, 3, 6
	Finland		3100				2100			2, 3
	France		30500			31264	34241			2, 7, 8
	Germany	19387	21615			47098				2, 8
	Greece	3023	3000		4200					2, 3, 7
	Iceland				145		149			3
	Ireland	1100	1106					1848		2, 3, 9
	Italy	15000	20000	20000	20033	26386	26900	27000		2, 3, 7
	Luxembourg	131	170		190			218		2, 3
	Norway	1900	2000		2223	2220	2366	2637		2, 3, 8
	Portugal	2350	3000		3270		3500	3600		2, 3, 7
	Spain	10600	12546		13828		14296			2
	Sweden		3900				3998			3, 8
	The Netherlands	6357	7430	7962	7602	8503	8660	8482		2, 3, 7, 8
	United Kingdom							28989		10, 11

Source no.	**Source**
1	OECD/Eurostat questionnaire 1996
2	Eurostat Environment Statistics 1996
3	OECD Environmental Data, Compendium 1997
4	Austrian Federal Waste Management Plans 1992-1998 and data from UBA, Klagenfurt
5	Horizon 2010. Projet de plan Wallon des déchet. Consultation de la Population. Du 15 juillet au 30 septembre 1997
6	Waste Statistics 1995, 1996, Danish EPA and data from Danish Statistical Office
7	ERM Study, 1997
8	Comparison of household waste figures for various countries in Europe, Ministry of Housing, Physical Planning and the Environment, Netherlands, 1996.
9	National Waste Database Report EPA, Ireland 1996
10	The Scottish Office, Statistical Bulletin, Environment Series Env/1996/5
11	Municipal Waste Management 1995/96, Dept. of the Environment, Transport and the Regions, 12/97

II.2. Projection of municipal waste/household waste

The results of the projections are given on the following pages. In section II.2.1 the actual projections are summarised for all countries, while in section II.2.2 technical results of the model run is described, including the estimation of coefficients, t-statistics, plots etc. for one country - Austria.

II.2.1. Summary of projections

Table 1: Waste from households. Projections in 14 EU-countries. Model with *constant coefficients*. Stated in '000 tonnes

	FWHTAT	FWHTBE	FWHTDK	FWHTFI	FWHTFR	FWHTDE	FWHTGR	FWHTIE	FWHTIT	FWHTNL	FWHTPT[1]	FWHTES[1]	FWHTSE	FWHTUK	**Total EU-14**
1990	2.773	4.071	2.374	1.003	25.933	37.067	3.181	1.144	22.588	6.616	3.495	14.075	3.315	25.110	**152.746**
1991	2.796	4.150	2.425	974	25.893	38.949	3.205	1.190	23.079	6.807	3.563	14.408	3.345	24.779	**155.562**
1992	2.813	4.201	2.450	928	25.782	39.127	3.200	1.241	23.104	6.908	3.644	14.586	3.279	24.838	**156.100**
1993	2.791	4.151	2.467	898	25.771	38.540	3.248	1.253	22.449	6.878	3.631	14.263	3.212	25.371	**154.923**
1994	2.773	4.127	2.573	900	25.741	37.938	3.326	1.306	22.778	6.956	3.587	14.296	3.235	26.130	**155.666**
1995	2.770	4.157	2.606	921	25.890	38.343	3.321	1.324	23.000	6.996	3.600	14.412	3.239	26.408	**156.987**
1996	2.775	4.179	2.757	941	25.533	38.755	3.352	1.403	22.909	7.133	3.631	14.511	3.261	26.933	**158.073**
1997	2.770	4.186	2.795	963	25.761	39.095	3.386	1.453	22.753	7.237	3.663	14.725	3.307	27.609	**159.705**
1998	2.800	4.200	2.810	976	25.765	39.712	3.431	1.497	22.961	7.358	3.703	14.973	3.366	28.284	**161.838**
1999	2.835	4.249	2.884	994	25.972	40.420	3.481	1.543	23.243	7.496	3.754	15.256	3.440	28.843	**164.409**
2000	**2.873**	**4.310**	**2.941**	**1.015**	**26.260**	**41.262**	**3.422**	**1.593**	**23.622**	**7.644**	**3.814**	**15.560**	**3.526**	**29.423**	**167.264**
2005	**3.025**	**4.542**	**3.240**	**1.075**	**25.228**	**44.695**	**3.806**	**1.821**	**24.768**	**8.391**	**4.163**	**16.791**	**3.857**	**32.453**	**177.855**
2010	**3.196**	**4.785**	**3.554**	**1.136**	**26.351**	**48.138**	**4.262**	**1.987**	**26.027**	**9.192**	**4.594**	**18.087**	**4.194**	**35.951**	**191.454**

1) Data on household waste not available for PT and ES. Municipal waste data applied.

Table 2: Waste from households. Projections in 14 EU-countries. Model with *constant coefficients*. Growth in %

	FWHTAT	FWHTBE	FWHTDK	FWHTFI	FWHTFR	FWHTDE	FWHTGR	FWHTIE	FWHTIT	FWHTNL	FWHTPT[1]	FWHTES[1]	FWHTSE	FWHTUK	**Total EU-14**
1990-91	0,81	1,94	2,12	-2,91	-0,16	5,08	0,73	4,02	2,18	2,89	1,96	2,37	0,89	-1,32	**1,84**
1991-92	0,61	1,22	1,05	-4,69	-0,43	0,46	-0,15	4,25	0,11	1,49	2,26	1,24	-1,98	0,24	**0,35**
1992-93	-0,77	-1,18	0,69	-3,26	-0,04	-1,50	1,51	0,97	-2,84	-0,43	-0,35	-2,22	-2,03	2,15	**-0,75**
1993-94	-0,65	-0,59	4,32	0,22	-0,12	-1,56	2,40	4,26	1,47	1,13	-1,21	0,23	0,72	2,99	**0,48**
1994-95	-0,10	0,72	1,25	2,31	0,58	1,07	-0,16	1,36	0,97	0,57	0,37	0,81	0,13	1,07	**0,85**
1995-96	0,18	0,54	5,81	2,23	-1,38	1,07	0,92	5,97	-0,40	1,96	0,87	0,68	0,69	1,99	**0,69**
1996-97	-0,20	0,15	1,39	2,33	0,90	0,88	1,03	3,59	-0,68	1,46	0,88	1,48	1,39	2,51	**1,03**
1997-98	1,11	0,35	0,54	1,34	0,01	1,58	1,33	3,00	0,92	1,67	1,08	1,68	1,79	2,44	**1,34**
1998-99	1,23	1,15	2,64	1,84	0,81	1,78	1,44	3,10	1,22	1,87	1,39	1,89	2,19	1,98	**1,59**
1999-2000	1,34	1,45	1,97	2,14	1,11	2,08	-1,69	3,20	1,63	1,98	1,59	1,99	2,49	2,01	**1,74**
1995-2000	**3,71**	**3,69**	**12,89**	**10,28**	**1,43**	**7,61**	**3,04**	**20,30**	**2,71**	**9,26**	**9,16**	**7,91**	**8,85**	**11,42**	**6,55**
2000-2005	**5,30**	**5,37**	**10,16**	**5,90**	**-3,93**	**8,32**	**11,22**	**14,30**	**4,85**	**9,77**	**10,33**	**7,72**	**9,40**	**10,30**	**6,33**
2005-2010	**5,66**	**5,35**	**9,67**	**5,67**	**4,45**	**7,70**	**11,99**	**9,11**	**5,08**	**9,55**	**8,78**	**5,69**	**8,73**	**10,78**	**7,65**
1995-2010	**15,39**	**15,10**	**36,38**	**23,41**	**1,78**	**25,55**	**28,34**	**50,04**	**13,16**	**31,39**	**27,60**	**25,49**	**29,48**	**36,14**	**21,96**

1) Data on household waste not available for PT and ES. Municipal waste data applied.

Table 3: Waste from households. Projections in 2 EU-countries. Model with *estimated equations*. Stated in '000 tonnes

	FWHTAT	FWHTNL
1990	2.410	6.192
1991	2.477	6.490
1992	2.541	6.710
1993	2.572	6.807
1994	2.606	7.013
1995	2.654	7.186
1996	2.712	7.464
1997	2.760	7.716
1998	2.846	7.991
1999	2.938	8.294
2000	3.036	8.616
2005	3.526	10.380
2010	4.110	12.480

Table 4: Waste from households. Projections in 2 EU-countries Model with *estimated equations*. Growth in %.

	FWHTAT	FWHTNL
1990-91	2,78	4,81
1991-92	2,58	3,39
1992-93	1,22	1,45
1993-94	1,32	3,03
1994-95	1,84	2,47
1995-96	2,19	3,87
1996-97	1,77	3,38
1997-98	3,12	3,56
1998-99	3,23	3,79
1999-2000	3,34	3,88
1995-2000	14,39	19,90
2000-2005	16,14	20,47
2005-2010	16,56	20,23
1995-2010	54,86	73,67

II.2.2. Run of model (Austria)

WASTE FROM HOUSEHOLDS

EQUATION MODEL

equations: eqwhtat

```
                                CONSTANTS:

                   A1
VALUE            1.000

NOTE => The model is linear in the parameters.
Working space used: 275
                                STARTING VALUES

                   A0            A2
VALUE            0.000         0.000

F=   2.5545     FNEW=  -2.7846     ISQZ=  0 STEP=  1.0000     CRIT=  4.9999

CONVERGENCE ACHIEVED AFTER   1 ITERATIONS


    2 FUNCTION EVALUATIONS.

              Log of Likelihood Function =     16.3703
                  Number of Observations =      7

                      Standard
Parameter  Estimate      Error     t-statistic
A0         -6.681      .4855       -13.76
A2         .0196       .5219E-02   3.748

Standard Errors computed from   quadratic form of analytic first
derivatives (Gauss)

                            Equation    EQWHTAT
                            ====================

Dependent variable: LWHTAT

 Mean of dependent variable = 7.846           Std. error of regression = .0276
Std. dev. of dependent var. = .0455                        R-squared = .6952
   Sum of squared residuals = .3814E-02          Adjusted R-squared = .6342
      Variance of residuals = .7627E-03       Durbin-Watson statistic = 1.174

ID     ACTUAL(*)   FITTED(+)                        RESIDUAL(0)
                                                                  0
1990    7.8256     7.7833      +     *                 0.04231    +   |  +  0
1991    7.7940     7.8109       *  +                 -0.01693    +0  |  +
1992    7.8148     7.8365          *  +              -0.02174    0   |  +
1993    7.8276     7.8483            *  +            -0.02070    0   |  +
1994    7.8513     7.8614               * +           -0.01011    + 0 |  +
1995    7.8800     7.8799                  +         0.0001048    +   0  +
1996    7.9284     7.9013                     +   *     0.02708    +   |  +0


Current sample:  1990 to 1995

                           NONLINEAR LEAST SQUARES
                           =======================
```

RESULTS:

	FWHTAT
1990	2409.507
1991	2477.022
1992	2541.400
1993	2571.655
1994	2605.517
1995	2654.432
1996	2711.924
1997	2760.185
1998	2846.025
1999	2937.917
2000	3036.267
2005	3526.504
2010	4109.852
2015	4726.185

Current sample: 1990 to 1995

NONLINEAR LEAST SQUARES
==========

CONSTANT COEFFICIENT MODEL

RESULTS:

	FWHTAT
1990	2773.236
1991	2795.608
1992	2812.595
1993	2790.839
1994	2772.706
1995	2769.933
1996	2775.000
1997	2769.564
1998	2800.270
1999	2834.578
2000	2872.610
2005	3024.966
2010	3196.252
2015	3332.460

MUNICIPAL WASTE

EQUATION MODEL

equations: eqwmtat

RESULTS:

Data not adequate for Austria.

CONSTANT COEFFICIENT MODEL

RESULTS:

	FWMTAT
1990	4165.351
1991	4198.953
1992	4224.467
1993	4191.789
1994	4164.554
1995	4160.390
1996	4168.000
1997	4159.835
1998	4205.956
1999	4257.486
2000	4314.608
2005	4543.444
2010	4800.713
2015	5005.295

Annex III Paper and cardboard waste

III.1. Historical observations

Table 1. Paper and cardboard waste quantities (1000 tonnes)

Country	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Austria				**849**	**958**	**1005**	**959**	**1001**	**1083**	**1172**	**1283**	**1368**	**1368**	**1327**	**1490**	**1468**	**1500**
Belgium				**1486**	**1607**	**1612**	**1703**	**1840**	**1939**	**1971**	**2091**	**2181**	**2242**	**2037**	**2474**	**2589**	**2668**
Denmark	844			*998*	*998*	998	*998*	*998*	*998*	*998*	1157	*1157*	1193	*1193*	1228	*1228*	*1228*
Finland				**1053**	**1214**	**1140**	**1202**	**1066**	**1370**	**1362**	**1313**	**1192**	**1164**	**1249**	**1255**	**1336**	**1444**
France	6220	6231	6292	6517	6809	6556	6956	7262	8085	8452	8833	8867	9092	8924	**9734**	9700	**9369**
Germany				**9821**	**10772**	**10625**	**11286**	**11687**	**12536**	**13070**	15461	15937	15739	15649	16335	15834	**15349**
Greece											503.6	**644**	640	**657**	**842**	**903**	**912**
Ireland				**245**	**269**	**261**	**277**	**323**	**384**	**407**	**356**	**356**	**352**	**335**	**358**	**432**	**371**
Italy				**4880**	**5327**	5296	5520	6058	6357	6861	7099	7117	7661	7509	4262	**8435**	**8251**
Luxembourg																	
Netherlands				*2435*	*2435*	2435	2557	2629	2771	2978	3143	3295	3400	3134	2502	2460	*2460*
Portugal				**490**	**526**	**544**	**578**	**602**	**665**	**698**	**755**	**779**	**858**	**660**	**739**	**802**	**836**
Spain				**2778**	**2986**	**2943**	**3372**	**3534**	**3897**	**4110**	**4341**	**4582**	**4870**	**4691**	**5055**	**5150**	**5171**
Sweden				**1699**	**1814**	**1777**	**1808**	**1806**	**1806**	**1914**	**1953**	**1894**	**1741**	**1753**	**1648**	**1831**	**1758**
UK				7159	7586	7711	8068	8741	9367	9684	9362	9178	9568	10603	**11334**	**11432**	**11505**
Iceland																	
Norway	530			*620*	*620*	620	*620*	*620*	*620*	*620*	725	*725*	719	*719*	829	835	*835*

Note 1: Estimated waste quantities are based on apparent consumption figures for each country
Note 2: Source of data: Data in normal text from Eurostat; data in italics are estimates based on Eurostat data; data in bold are from Confederation of European Paper industries dataset

III.2. Projection of paper and cardboard waste arisings

The results of the projections are given on the following pages. In section III.2.1 the actual projections are summarised for all countries, while in section III.2.2 the technical results of the model run is described, including the estimation of coefficients, t-statistics, plots etc. for one country – Austria.

III.2.1. Summary of projections

Table 1: Waste paper and cardboard projections in 14 EU Countries. Model with estimated equations. Stated in '000 tonnes

	FWPTSAT	FWPTBE	FWPTDK	FWPTFI	FWPTFR	FWPTDE	FWPTGR	FWPTIE	FWPTIT	FWPTNL	FWGSPT	FWPTES	FWPTSE	FWPTUK	**Total EU-14**
1990	1.246,75	2.071,50	1.142,77	1.393,99	8.594,17	14.103,84	550,01	325,66	6.649,32	3.080,02	752,21	4.336,42	1.898,32	9.859,34	**56.004,32**
1991	1.313,92	2.196,52	1.141,60	1.319,08	8.793,63	15.095,30	586,81	337,15	6.792,14	3.197,85	805,99	4.509,42	1.860,45	9.687,00	**57.636,85**
1992	1.365,62	2.287,40	1.149,79	1.230,23	8.965,45	15.492,52	628,26	357,00	6.916,95	3.283,36	871,30	4.642,82	1.791,14	9.923,60	**58.905,43**
1993	1.411,39	2.332,00	1.165,12	1.229,54	9.015,27	15.554,56	666,17	368,11	6.976,45	3.306,35	713,43	4.727,20	1.709,40	10.296,22	**59.471,23**
1994	1.424,25	2.418,95	1.224,17	1.242,78	9.373,93	15.820,35	818,15	383,30	7.142,24	2.398,46	738,27	4.933,86	1.752,07	10.902,13	**60.572,93**
1995	1.485,10	2.507,28	1.235,74	1.301,10	9.648,42	16.304,79	881,57	390,99	7.319,22	2.470,53	769,30	5.179,43	1.746,01	11.186,93	**62.426,39**
1996	1.533,01	2.608,56	1.265,18	1.347,53	9.934,40	16.805,34	954,26	404,50	7.500,86	2.558,81	803,47	5.425,96	1.738,07	11.516,20	**64.396,15**
1997	1.580,71	2.709,91	1.284,51	1.396,32	10.330,23	17.305,90	1.034,14	415,18	7.681,97	2.645,31	839,40	5.700,92	1.735,34	11.874,45	**66.534,27**
1998	1.636,79	2.817,62	1.303,87	1.440,68	10.703,15	17.882,63	1.122,84	425,40	7.904,83	2.736,94	877,85	5.994,85	1.735,54	12.241,48	**68.824,47**
1999	1.695,63	2.938,81	1.332,01	1.489,84	11.127,39	18.497,04	1.220,42	436,16	8.141,80	2.833,99	919,36	6.308,76	1.738,66	12.602,19	**71.282,05**
2000	**1.757,39**	**3.068,89**	**1.360,50**	**1.542,79**	**11.583,59**	**19.160,52**	**1.316,13**	**447,49**	**8.395,92**	**2.935,69**	**963,80**	**6.641,77**	**1.744,00**	**12.795,00**	**73.713,45**
2005	**2.093,95**	**3.808,93**	**1.450,48**	**1.756,71**	**13.416,01**	**22.473,48**	**2.010,12**	**467,09**	**9.695,35**	**3.453,33**	**1.219,09**	**8.559,84**	**1.739,76**	**14.746,40**	**86.890,53**
2010	**2.500,44**	**4.725,17**	**1.543,19**	**1.997,41**	**16.049,89**	**26.172,67**	**2.986,07**	**465,32**	**11.169,20**	**4.053,56**	**1.540,67**	**11.001,21**	**1.724,52**	**16.739,97**	**102.669,30**

Table 2: Waste paper and cardboard projections in 14 EU Countries. Model with estimated equations. Growth in %.

	FWPTSAT	FWPTBE	FWPTDK	FWPTFI	FWPTFR	FWPTDE	FWPTGR	FWPTIE	FWPTIT	FWPTNL	FWGSPT	FWPTES	FWPTSE	FWPTUK	**Total EU-14**
1990-91	5,39	6,04	-0,10	-5,37	2,32	7,03	6,69	3,53	2,15	3,83	7,15	3,99	-1,99	-1,75	**2,92**
1991-92	3,93	4,14	0,72	-6,74	1,95	2,63	7,06	5,89	1,84	2,67	8,10	2,96	-3,73	2,44	**2,20**
1992-93	3,35	1,95	1,33	-0,06	0,56	0,40	6,04	3,11	0,86	0,70	-18,12	1,82	-4,56	3,75	**0,96**
1993-94	0,91	3,73	5,07	1,08	3,98	1,71	22,81	4,13	2,38	-27,46	3,48	4,37	2,50	5,88	**1,85**
1994-95	4,27	3,65	0,94	4,69	2,93	3,06	7,75	2,00	2,48	3,00	4,20	4,98	-0,35	2,61	**3,06**
1995-96	3,23	4,04	2,38	3,57	2,96	3,07	8,25	3,46	2,48	3,57	4,44	4,76	-0,45	2,94	**3,16**
1996-97	3,11	3,89	1,53	3,62	3,98	2,98	8,37	2,64	2,41	3,38	4,47	5,07	-0,16	3,11	**3,32**
1997-98	3,55	3,97	1,51	3,18	3,61	3,33	8,58	2,46	2,90	3,46	4,58	5,16	0,01	3,09	**3,44**
1998-99	3,59	4,30	2,16	3,41	3,96	3,44	8,69	2,53	3,00	3,55	4,73	5,24	0,18	2,95	**3,57**
1999-2000	3,64	4,43	2,14	3,55	4,10	3,59	7,84	2,60	3,12	3,59	4,83	5,28	0,31	1,53	**3,41**
1995-2000	**18,33**	**22,40**	**10,10**	**18,58**	**20,06**	**17,51**	**49,30**	**14,45**	**14,71**	**18,83**	**25,28**	**28,23**	**-0,12**	**14,37**	**18,08**
2000-2005	**19,15**	**24,11**	**6,61**	**13,87**	**15,82**	**17,29**	**52,73**	**4,38**	**15,48**	**17,63**	**26,49**	**28,88**	**-0,24**	**15,25**	**17,88**
2005-2010	**19,41**	**24,06**	**6,39**	**13,70**	**19,63**	**16,46**	**48,55**	**-0,38**	**15,20**	**17,38**	**26,38**	**28,52**	**-0,88**	**13,52**	**18,16**
1995-2010	**68,37**	**88,46**	**24,88**	**53,52**	**66,35**	**60,52**	**238,72**	**19,01**	**52,60**	**64,08**	**100,27**	**112,40**	**-1,23**	**49,64**	**64,46**

Table 3: Waste paper and cardboard projections in 14 EU Countries. Model with constant coefficients Stated in '000 tonnes

	FWPTSAT	FWPTBE	FWPTDK	FWPTFI	FWPTFR	FWPTDE	FWPTGR	FWPTIE	FWPTIT	FWPTNL	FWGSPT	FWPTES	FWPTSE	FWPTUK	**Total EU-14**
1990	1316,49	2406,09	1050,88	1517,27	8911,01	13571,88	781,45	253,57	7550,63	2160,97	656,75	4679,17	1658,59	9650,85	**56165,60**
1991	1369,91	2497,78	1059,29	1432,01	8974,88	14400,13	799,76	269,77	7672,03	2228,65	697,19	4766,16	1665,66	9514,46	**57347,69**
1992	1405,84	2546,57	1076,54	1332,08	9006,81	14651,03	821,35	293,56	7771,72	2272,97	646,71	4806,62	1643,22	9780,04	**58055,05**
1993	1434,63	2541,77	1100,75	1327,89	8914,88	14582,29	835,44	311,07	7797,14	2273,60	763,32	4793,72	1606,96	10181,83	**58465,27**
1994	1429,43	2581,22	1167,00	1338,70	9124,24	14702,98	849,76	332,88	7940,24	2336,95	782,58	4900,78	1687,76	10817,72	**59992,25**
1995	1471,69	2619,36	1188,68	1397,88	9244,20	15021,95	878,31	348,95	8093,98	2391,10	807,92	5039,30	1723,46	11138,11	**61364,89**
1996	1500,00	2668,00	1228,00	1444,00	9369,00	15349,00	912,00	371,00	8251,00	2460,00	836,00	5171,00	1758,00	11505,00	**62822,01**
1997	1527,15	2713,52	1258,03	1492,39	9589,58	15669,25	948,07	391,34	8405,55	2526,18	865,30	5321,73	1798,59	11903,31	**64409,99**
1998	1561,38	2762,19	1288,54	1535,81	9780,01	16051,19	987,44	412,07	8603,68	2596,23	896,57	5481,46	1843,23	12313,02	**66112,82**
1999	1597,09	2820,57	1328,24	1584,09	10008,27	16458,86	1029,53	434,19	8814,76	2670,34	930,27	5650,31	1892,15	12719,00	**67937,67**
2000	1634,37	2883,62	1368,92	1636,13	10255,27	16901,55	1065,03	457,80	9041,83	2747,70	966,21	5826,69	1944,84	13139,87	**69869,80**
2005	1827,07	3219,03	1526,63	1838,94	10975,34	18980,07	1321,14	547,73	10168,17	3125,70	1166,61	6771,04	2191,86	15189,83	**78849,16**
2010	2048,07	3591,73	1698,96	2063,90	12132,70	21163,31	1594,03	625,47	11407,56	3548,11	1407,35	7846,58	2454,57	17539,00	**89121,34**

Table 4: Waste paper and cardboard projections in 14 EU Countries. Model with constant coefficients. Growth in %

	FWPTSAT	**FWPTBE**	**FWPTDK**	**FWPTFI**	**FWPTFR**	**FWPTDE**	**FWPTGR**	**FWPTIE**	**FWPTIT**	**FWPTNL**	**FWGSPT**	**FWPTES**	**FWPTSE**	**FWPTUK**	**Total EU-14**
1990-91	4,06	3,81	0,80	-5,62	0,72	6,10	2,34	6,39	1,61	3,13	6,16	1,86	0,43	-1,41	**2,10**
1991-92	2,62	1,95	1,63	-6,98	0,36	1,74	2,70	8,82	1,30	1,99	-7,24	0,85	-1,35	2,79	**1,23**
1992-93	2,05	-0,19	2,25	-0,32	-1,02	-0,47	1,71	5,96	0,33	0,03	18,03	-0,27	-2,21	4,11	**0,71**
1993-94	-0,36	1,55	6,02	0,81	2,35	0,83	1,71	7,01	1,84	2,79	2,52	2,23	5,03	6,25	**2,61**
1994-95	2,96	1,48	1,86	4,42	1,31	2,17	3,36	4,83	1,94	2,32	3,24	2,83	2,12	2,96	**2,29**
1995-96	1,92	1,86	3,31	3,30	1,35	2,18	3,84	6,32	1,94	2,88	3,48	2,61	2,00	3,29	**2,37**
1996-97	1,81	1,71	2,45	3,35	2,35	2,09	3,96	5,48	1,87	2,69	3,50	2,91	2,31	3,46	**2,53**
1997-98	2,24	1,79	2,43	2,91	1,99	2,44	4,15	5,30	2,36	2,77	3,61	3,00	2,48	3,44	**2,64**
1998-99	2,29	2,11	3,08	3,14	2,33	2,54	4,26	5,37	2,45	2,85	3,76	3,08	2,65	3,30	**2,76**
1999-2000	2,33	2,24	3,06	3,29	2,47	2,69	3,45	5,44	2,58	2,90	3,86	3,12	2,78	3,31	**2,84**
1995-2000	**11,05**	**10,09**	**15,16**	**17,04**	**10,94**	**12,51**	**21,26**	**31,19**	**11,71**	**14,91**	**19,59**	**15,63**	**12,85**	**17,97**	**13,86**
2000-2005	**11,79**	**11,63**	**11,52**	**12,40**	**7,02**	**12,30**	**24,05**	**19,65**	**12,46**	**13,76**	**20,74**	**16,21**	**12,70**	**15,60**	**12,85**
2005-2010	**12,10**	**11,58**	**11,29**	**12,23**	**10,55**	**11,50**	**20,66**	**14,19**	**12,19**	**13,51**	**20,64**	**15,88**	**11,99**	**15,47**	**13,03**
1995-2010	**39,16**	**37,12**	**42,93**	**47,64**	**31,25**	**40,88**	**81,49**	**79,24**	**40,94**	**48,39**	**74,19**	**55,71**	**42,42**	**57,47**	**45,23**

Table 5: Waste paper and cardboard projections in 14 EU Countries. Stated in '000 tonnes. Recommendations [1]

	FWPTSAT	FWPTBE	FWPTDK	FWPTFI	FWPTFR	FWPTDE	FWPTGR	FWPTIE	FWPTIT	FWPTNL	FWGSPT	FWPTES	FWPTSE	FWPTUK	**Total EU-14**
1990	1.246,75	2.071,50	1.142,77	1.517,27	8.594,17	14.103,84	781,45	253,57	7.550,63	3.080,02	752,21	4.336,42	1.658,59	9.859,34	**56.948,53**
1991	1.313,92	2.196,52	1.141,60	1.432,01	8.793,63	15.095,30	799,76	269,77	7.672,03	3.197,85	805,99	4.509,42	1.665,66	9.687,00	**58.580,46**
1992	1.365,62	2.287,40	1.149,79	1.332,08	8.965,45	15.492,52	821,35	293,56	7.771,72	3.283,36	871,30	4.642,82	1.643,22	9.923,60	**59.843,79**
1993	1.411,39	2.332,00	1.165,12	1.327,89	9.015,27	15.554,56	835,44	311,07	7.797,14	3.306,35	713,43	4.727,20	1.606,96	10.296,22	**60.400,05**
1994	1.424,25	2.418,95	1.224,17	1.338,70	9.373,93	15.820,35	849,76	332,88	7.940,24	2.398,46	738,27	4.933,86	1.687,76	10.902,13	**61.383,71**
1995	1.485,10	2.507,28	1.235,74	1.397,88	9.648,42	16.304,79	878,31	348,95	8.093,98	2.470,53	769,30	5.179,43	1.723,46	11.186,93	**63.230,09**
1996	1.533,01	2.608,56	1.265,18	1.444,00	9.934,40	16.805,34	912,00	371,00	8.251,00	2.558,81	803,47	5.425,96	1.758,00	11.516,20	**65.186,94**
1997	1.580,71	2.709,91	1.284,51	1.492,39	10.330,23	17.305,90	948,07	391,34	8.405,55	2.645,31	839,40	5.700,92	1.798,59	11.874,45	**67.307,27**
1998	1.636,79	2.817,62	1.303,87	1.535,81	10.703,15	17.882,63	987,44	412,07	8.603,68	2.736,94	877,85	5.994,85	1.843,23	12.241,48	**69.577,42**
1999	1.695,63	2.938,81	1.332,01	1.584,09	11.127,39	18.497,04	1.029,53	434,19	8.814,76	2.833,99	919,36	6.308,76	1.892,15	12.602,19	**72.009,89**
2000	**1.757,39**	**3.068,89**	**1.360,50**	**1.636,13**	**11.583,59**	**19.160,52**	**1.065,03**	**457,80**	**9.041,83**	**2.935,69**	**963,80**	**6.641,77**	**1.944,84**	**12.795,00**	**74.412,75**
2005	**2.093,95**	**3.808,93**	**1.450,48**	**1.838,94**	**13.416,01**	**22.473,48**	**1.321,14**	**547,73**	**10.168,17**	**3.453,33**	**1.219,09**	**8.559,84**	**2.191,86**	**14.746,40**	**87.289,34**
2010	**2500,443**	**4725,167**	**1543,185**	**2063,899**	**16049,89**	**26172,67**	**1594,028**	**625,465**	**11407,56**	**4053,561**	**1540,671**	**11001,21**	**2454,571**	**16739,97**	**102472,29**

1.The recommendation is primarily based on the estimated equations, except for FI, GR, IE, IT and SE for which the constant coefficient is recommended.

Table 6: Waste paper and cardboard projections in 14 EU Countries. Growth in %. Recommendations [1]

	FWPTSAT	FWPTBE	FWPTDK	FWPTFI	FWPTFR	FWPTDE	FWPTGR	FWPTIE	FWPTIT	FWPTNL	FWGSPT	FWPTES	FWPTSE	FWPTUK	**Total EU-14**
1990-91	5,39	6,04	-0,10	-5,62	2,32	7,03	2,34	6,39	1,61	3,83	7,15	3,99	0,43	-1,75	**2,87**
1991-92	3,93	4,14	0,72	-6,98	1,95	2,63	2,70	8,82	1,30	2,67	8,10	2,96	-1,35	2,44	**2,16**
1992-93	3,35	1,95	1,33	-0,32	0,56	0,40	1,71	5,96	0,33	0,70	-18,12	1,82	-2,21	3,75	**0,93**
1993-94	0,91	3,73	5,07	0,81	3,98	1,71	1,71	7,01	1,84	-27,46	3,48	4,37	5,03	5,88	**1,63**
1994-95	4,27	3,65	0,94	4,42	2,93	3,06	3,36	4,83	1,94	3,00	4,20	4,98	2,12	2,61	**3,01**
1995-96	3,23	4,04	2,38	3,30	2,96	3,07	3,84	6,32	1,94	3,57	4,44	4,76	2,00	2,94	**3,09**
1996-97	3,11	3,89	1,53	3,35	3,98	2,98	3,96	5,48	1,87	3,38	4,47	5,07	2,31	3,11	**3,25**
1997-98	3,55	3,97	1,51	2,91	3,61	3,33	4,15	5,30	2,36	3,46	4,58	5,16	2,48	3,09	**3,37**
1998-99	3,59	4,30	2,16	3,14	3,96	3,44	4,26	5,37	2,45	3,55	4,73	5,24	2,65	2,95	**3,50**
1999-2000	3,64	4,43	2,14	3,29	4,10	3,59	3,45	5,44	2,58	3,59	4,83	5,28	2,78	1,53	**3,34**
1995-2000	**19,15**	**24,11**	**6,61**	**12,40**	**15,82**	**17,29**	**24,05**	**19,65**	**12,46**	**17,63**	**26,49**	**28,88**	**12,70**	**15,25**	**17,30**
2000-2005	**19,41**	**24,06**	**6,39**	**12,23**	**19,63**	**16,46**	**20,66**	**14,19**	**12,19**	**17,38**	**26,38**	**28,52**	**11,99**	**13,52**	**17,39**
2005-2010	**17,59**	**22,12**	**4,06**	**9,10**	**18,60**	**13,91**	**18,32**	**12,27**	**10,63**	**15,00**	**23,57**	**25,96**	**9,42**	**10,12**	**15,32**
1995-2010	**68,37**	**88,46**	**24,88**	**47,64**	**66,35**	**60,52**	**81,49**	**79,24**	**40,94**	**64,08**	**100,27**	**112,40**	**42,42**	**49,64**	**62,06**

1.The recommendation is primarily based on the estimated equations, except for FI, GR, IE, IT and SE for which the constant coefficient is recommended.

III.2.2.Run of model (Austria)

EQUATION MODEL

Eauations: EQWPTAT

```
                                  CONSTANTS:

                  A1AT
VALUE            1.000

NOTE => The model is linear in the parameters.
Working space used: 315
                                STARTING VALUES

                  A0AT          A2AT
VALUE            0.000         0.000

F=   3.1508     FNEW=  -1.9577     ISQZ=  0 STEP=  1.0000     CRIT=  12.000

CONVERGENCE ACHIEVED AFTER   1 ITERATIONS


    2 FUNCTION EVALUATIONS.

               Log of Likelihood Function =     26.0156
                   Number of Observations =     14

                      Standard
Parameter  Estimate      Error     t-statistic
A0AT       -7.376      .2421       -30.47
A2AT       .0127       .2702E-02   4.690

Standard Errors computed from   quadratic form of analytic first
derivatives (Gauss)

                             Equation    EQWPTAT
                             ==========

Dependent variable: LWPTAT

 Mean of dependent variable = 7.075           Std. error of regression = .0408
Std. dev. of dependent var. = .1920                        R-squared = .9584
   Sum of squared residuals = .0199                Adjusted R-squared = .9549
      Variance of residuals = .1661E-02         Durbin-Watson statistic = 2.010

ID     ACTUAL(*)   FITTED(+)                          RESIDUAL(0)
                                                                    0
1983    6.7441     6.8024      * +                      -0.05836 0 +    |   +
1984    6.8648     6.8177         +*                     0.04712   +    |   +0
1985    6.9127     6.8577          + *                   0.05502   +    |   + 0
1986    6.8659     6.8946          *+                   -0.02871   +0   |   +
1987    6.9088     6.9413            *+                 -0.03257   +0   |   +
1988    6.9875     7.0071              *+               -0.01957   + 0  |   +
1989    7.0665     7.0658                 +             0.0006812  +    0   +
1990    7.1570     7.1262                   +*           0.03080   +    |  0+
1991    7.2211     7.1786                     +*         0.04250   +    |   0
1992    7.2211     7.2172                      +         0.003934  +    0   +
1993    7.1907     7.2501                      * +      -0.05943 0 +    |   +
1994    7.3065     7.2592                         +*     0.04738   +    |   +0
1995    7.2917     7.3010                          +    -0.009305  +  0 |   +
1996    7.3132     7.3327                           *+   -0.01947   + 0  |   +

                           NONLINEAR LEAST SQUARES
                           =======================
```

RESULTS:

	FWPTAT
1990	1246.750
1991	1313.920
1992	1365.617
1993	1411.387
1994	1424.251
1995	1485.097
1996	1533.012
1997	1580.710
1998	1636.792
1999	1695.631
2000	1757.385
2005	2093.947
2010	2500.443
2015	2940.382

CONSTANT COEFFICIENT MODEL

RESULTS:

	FWPTAT
1990	1316.492
1991	1369.911
1992	1405.843
1993	1434.625
1994	1429.432
1995	1471.689
1996	1500.000
1997	1527.152
1998	1561.378
1999	1597.093
2000	1634.370
2005	1827.559
2010	2048.071
2015	2260.238

Annex IV Glass waste

IV.1. Historical observations

Glass waste quantities (1000 tonnes)

Country	1990	1991	1992	1993	1994	1995	1996
AT	225	260	273	275	267	262	
BE	346	405	400	396	351	336	339
DK	153	171	156	161	161	165	185
FI	52	48	52	52	56	60	52
FR	2210	2407	2500	2609	2708	2800	2800
D	3317	3643	3783	3677	3684	3712	3594
GR	113	118	150	126	128	109	134
IRE	68	70	74	72	90	97	93
IT	1494	1440	1483	1608	1648	1640	1687
NL	470	514	518	507	477	465	469
N	38	45	55	49	50	52	53
PT	200	167	207	245	222	217	286
E	1126	1148	1156	1131	1197	1256	1303
S	143	130	131	139	170	157	167
UK	1771	1833	1765	1728	1757	1856	1909

Source: FEVE

IV.2. Projection of glass waste arisings

The results of the projections are given on the following pages. The actual projections are summarised on section IV.2.1 for all countries, while in section IV.2.2 the technical results of the model run is described, including the estimation of coefficients, t-statistics, plots etc. for one country – Austria.

IV.2.1 Summary of projections

Table 1: Waste glass projections in 14 EU Countries. Model with *estimated equations*. Stated in tonnes

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990	238.606	385.268	151.065	51.144	2.286.471	3.467.627	127.408	65.029	1.430.232	505.663	183.126	1.103.861	132.237	1.850.931	**11.978.668**
1991	249.551	384.262	158.966	51.309	2.380.135	3.622.312	127.377	69.927	1.483.141	489.312	193.002	1.136.573	135.393	1.739.599	**12.220.859**
1992	262.408	377.121	163.862	51.799	2.446.775	3.615.958	128.742	77.254	1.528.678	494.315	205.798	1.171.795	140.407	1.771.494	**12.436.407**
1993	268.872	366.593	163.810	52.723	2.557.236	3.587.657	130.018	81.095	1.571.729	486.776	219.363	1.193.156	146.023	1.764.384	**12.589.435**
1994	273.511	358.244	166.601	53.608	2.669.176	3.599.979	133.146	87.518	1.612.216	484.451	230.614	1.217.793	154.434	1.831.687	**12.872.977**
1995	266.088	350.994	166.951	55.059	2.790.491	3.670.404	132.002	88.880	1.642.451	475.625	245.304	1.245.319	160.300	1.856.540	**13.146.408**
1996	276.030	344.935	173.557	57.195	2.874.838	3.742.329	131.669	97.171	1.673.617	471.163	261.878	1.275.182	165.714	1.887.525	**13.432.803**
1997	285.516	338.033	175.996	59.459	3.014.350	3.810.049	131.462	103.854	1.701.585	465.205	279.589	1.312.720	172.282	1.922.277	**13.772.376**
1998	298.247	331.817	178.259	61.352	3.139.496	3.899.561	131.593	110.366	1.752.670	459.966	298.935	1.353.779	179.696	1.957.134	**14.152.869**
1999	311.797	327.666	185.284	63.543	3.289.815	3.997.179	131.849	117.409	1.809.767	455.416	320.302	1.397.939	188.042	1.989.519	**14.585.528**
2000	**326.225**	**324.300**	**190.096**	**65.960**	**3.455.274**	**4.106.418**	**130.573**	**125.033**	**1.874.781**	**451.231**	**343.686**	**1.444.499**	**197.265**	**2.022.591**	**15.057.931**
2005	**402.814**	**301.365**	**210.024**	**75.624**	**4.115.792**	**4.606.533**	**136.962**	**167.354**	**2.173.150**	**426.761**	**497.953**	**1.736.008**	**243.317**	**2.194.694**	**17.288.349**
2010	**495.475**	**278.901**	**230.657**	**86.360**	**5.219.936**	**5.117.275**	**145.629**	**214.180**	**2.519.682**	**402.481**	**727.002**	**2.066.062**	**299.234**	**2.371.867**	**20.174.739**

Table 2: Waste glass projections in 14 EU Countries. Model with *estimated equations*. Growth in %

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990-91	4,59	-0,26	5,23	0,32	4,10	4,46	-0,02	7,53	3,70	-3,23	5,39	2,96	2,39	-6,01	**2,02**
1991-92	5,15	-1,86	3,08	0,95	2,80	-0,18	1,07	10,48	3,07	1,02	6,63	3,10	3,70	1,83	**1,76**
1992-93	2,46	-2,79	-0,03	1,78	4,51	-0,78	0,99	4,97	2,82	-1,53	6,59	1,82	4,00	-0,40	**1,23**
1993-94	1,73	-2,28	1,70	1,68	4,38	0,34	2,41	7,92	2,58	-0,48	5,13	2,06	5,76	3,81	**2,25**
1994-95	-2,71	-2,02	0,21	2,71	4,55	1,96	-0,86	1,56	1,88	-1,82	6,37	2,26	3,80	1,36	**2,12**
1995-96	3,74	-1,73	3,96	3,88	3,02	1,96	-0,25	9,33	1,90	-0,94	6,76	2,40	3,38	1,67	**2,18**
1996-97	3,44	-2,00	1,41	3,96	4,85	1,81	-0,16	6,88	1,67	-1,26	6,76	2,94	3,96	1,84	**2,53**
1997-98	4,46	-1,84	1,29	3,18	4,15	2,35	0,10	6,27	3,00	-1,13	6,92	3,13	4,30	1,81	**2,76**
1998-99	4,54	-1,25	3,94	3,57	4,79	2,50	0,19	6,38	3,26	-0,99	7,15	3,26	4,64	1,65	**3,06**
1999-2000	4,63	-1,03	2,60	3,80	5,03	2,73	-0,97	6,49	3,59	-0,92	7,30	3,33	4,91	1,66	**3,24**
1995-2000	**22,60**	**-7,61**	**13,86**	**19,80**	**23,82**	**11,88**	**-1,08**	**40,68**	**14,15**	**-5,13**	**40,11**	**15,99**	**23,06**	**8,94**	**14,54**
2000-2005	**23,48**	**-7,07**	**10,48**	**14,65**	**19,12**	**12,18**	**4,89**	**33,85**	**15,91**	**-5,42**	**44,89**	**20,18**	**23,34**	**8,51**	**14,81**
2005-2010	**23,00**	**-7,45**	**9,82**	**14,20**	**26,83**	**11,09**	**6,33**	**27,98**	**15,95**	**-5,69**	**46,00**	**19,01**	**22,98**	**8,07**	**16,70**
1995-2010	**86,21**	**-20,54**	**38,16**	**56,85**	**87,06**	**39,42**	**10,32**	**140,98**	**53,41**	**-15,38**	**196,37**	**65,91**	**86,67**	**27,76**	**53,46**

Table 3: Waste glass projections in 14 EU Countries. Model with constant waste coefficients. Stated in tonnes

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990	271.165	318.730	160.604	49.172	2.688.633	3.506.211	116.809	76.027	1.668.756	418.534	263.457	1.212.017	152.038	1.836.478	**12.738.631**
1991	275.551	327.219	169.054	48.932	2.712.256	3.631.255	118.901	79.139	1.688.776	417.669	265.155	1.233.047	152.233	1.731.548	**12.850.737**
1992	281.523	330.555	174.313	49.001	2.702.005	3.593.844	122.358	84.636	1.698.668	435.137	269.997	1.256.095	154.390	1.729.004	**12.881.525**
1993	280.269	330.749	174.310	49.473	2.736.692	3.535.185	125.815	86.003	1.704.407	441.904	274.827	1.263.736	157.023	1.767.494	**12.927.887**
1994	277.010	332.693	177.333	49.897	2.768.187	3.516.950	131.183	89.847	1.706.170	453.550	275.906	1.274.445	162.406	1.840.796	**13.056.372**
1995	261.842	335.518	177.759	50.835	2.804.545	3.555.044	132.418	88.327	1.696.268	459.215	280.258	1.287.706	164.857	1.871.752	**13.166.343**
1996	263.914	339.394	184.848	52.381	2.800.000	3.593.671	134.483	93.478	1.686.793	469.136	285.714	1.302.857	166.667	1.909.091	**13.282.427**
1997	265.234	342.355	187.502	54.015	2.845.125	3.627.370	136.710	96.712	1.673.641	477.692	291.295	1.325.212	169.451	1.950.471	**13.442.785**
1998	269.194	345.914	189.970	55.284	2.871.645	3.680.798	139.333	99.491	1.682.333	487.086	297.418	1.350.359	172.845	1.992.205	**13.633.875**
1999	273.435	351.602	197.516	56.797	2.916.121	3.740.634	142.139	102.455	1.695.265	497.353	304.320	1.377.775	176.884	2.031.662	**13.863.957**
2000	**277.967**	**358.194**	**202.706**	**58.482**	**2.968.108**	**3.809.952**	**143.320**	**105.618**	**1.713.834**	**508.196**	**311.825**	**1.406.586**	**181.468**	**2.072.052**	**14.118.306**
2005	**297.195**	**384.609**	**224.292**	**64.389**	**3.021.805**	**4.094.078**	**164.491**	**120.165**	**1.758.426**	**560.658**	**358.783**	**1.592.108**	**200.216**	**2.284.627**	**15.125.841**
2010	**316.534**	**411.276**	**246.697**	**70.612**	**3.275.623**	**4.356.581**	**191.370**	**130.722**	**1.804.664**	**616.795**	**415.982**	**1.784.458**	**220.249**	**2.508.884**	**16.350.444**

Table 4: Waste glass projections in 14 EU Countries. Model with *constant waste coefficients*. Growth in %

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990-91	1,62	2,66	5,26	-0,49	0,88	3,57	1,79	4,09	1,20	-0,21	0,64	1,74	0,13	-5,71	**0,88**
1991-92	2,17	1,02	3,11	0,14	-0,38	-1,03	2,91	6,95	0,59	4,18	1,83	1,87	1,42	-0,15	**0,24**
1992-93	-0,45	0,06	0,00	0,96	1,28	-1,63	2,83	1,62	0,34	1,56	1,79	0,61	1,71	2,23	**0,36**
1993-94	-1,16	0,59	1,73	0,86	1,15	-0,52	4,27	4,47	0,10	2,64	0,39	0,85	3,43	4,15	**0,99**
1994-95	-5,48	0,85	0,24	1,88	1,31	1,08	0,94	-1,69	-0,58	1,25	1,58	1,04	1,51	1,68	**0,84**
1995-96	0,79	1,16	3,99	3,04	-0,16	1,09	1,56	5,83	-0,56	2,16	1,95	1,18	1,10	1,99	**0,88**
1996-97	0,50	0,87	1,44	3,12	1,61	0,94	1,66	3,46	-0,78	1,82	1,95	1,72	1,67	2,17	**1,21**
1997-98	1,49	1,04	1,32	2,35	0,93	1,47	1,92	2,87	0,52	1,97	2,10	1,90	2,00	2,14	**1,42**
1998-99	1,58	1,64	3,97	2,74	1,55	1,63	2,01	2,98	0,77	2,11	2,32	2,03	2,34	1,98	**1,69**
1999-2000	1,66	1,87	2,63	2,97	1,78	1,85	0,83	3,09	1,10	2,18	2,47	2,09	2,59	1,99	**1,83**
1995-2000	6,16	6,76	14,03	15,04	5,83	7,17	8,23	19,58	1,04	10,67	11,26	9,23	10,08	10,70	**7,23**
2000-2005	6,92	7,37	10,65	10,10	1,81	7,46	14,77	13,77	2,60	10,32	15,06	13,19	10,33	10,26	**7,14**
2005-2010	6,51	6,93	9,99	9,66	8,40	6,41	16,34	8,79	2,63	10,01	15,94	12,08	10,01	9,82	**8,10**
1995-2010	20,89	22,58	38,78	38,90	16,80	22,55	44,52	48,00	6,39	34,31	48,43	38,58	33,60	34,04	**24,18**

Table 5: Waste glass projections in 14 EU Countries. Stated in tonnes. Recommendations [1]

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990	271.165	318.730	160.604	49.172	2.286.471	3.506.211	116.809	65.029	1.430.232	418.534	263.457	1.103.861	152.038	1.836.478	**13.022.791**
1991	275.551	327.219	169.054	48.932	2.380.135	3.631.255	118.901	69.927	1.483.141	417.669	265.155	1.136.573	152.233	1.731.548	**12.207.295**
1992	281.523	330.555	174.313	49.001	2.446.775	3.593.844	122.358	77.254	1.528.678	435.137	269.997	1.171.795	154.390	1.729.004	**12.364.625**
1993	280.269	330.749	174.310	49.473	2.557.236	3.535.185	125.815	81.095	1.571.729	441.904	274.827	1.193.156	157.023	1.767.494	**12.540.264**
1994	277.010	332.693	177.333	49.897	2.669.176	3.516.950	131.183	87.518	1.612.216	453.550	275.906	1.217.793	162.406	1.840.796	**12.804.427**
1995	261.842	335.518	177.759	50.835	2.790.491	3.555.044	132.418	88.880	1.642.451	459.215	280.258	1.245.319	164.857	1.871.752	**13.056.639**
1996	263.914	339.394	184.848	52.381	2.874.838	3.593.671	134.483	97.171	1.673.617	469.136	285.714	1.275.182	166.667	1.909.091	**13.320.106**
1997	265.234	342.355	187.502	54.015	3.014.350	3.627.370	136.710	103.854	1.701.585	477.692	291.295	1.312.720	169.451	1.950.471	**13.634.604**
1998	269.194	345.914	189.970	55.284	3.139.496	3.680.798	139.333	110.366	1.752.670	487.086	297.418	1.353.779	172.845	1.992.205	**13.986.358**
1999	273.435	351.602	197.516	56.797	3.289.815	3.740.634	142.139	117.409	1.809.767	497.353	304.320	1.397.939	176.884	2.031.662	**14.387.273**
2000	**277.967**	**358.194**	**202.706**	**58.482**	**3.455.274**	**3.809.952**	**143.320**	**125.033**	**1.874.781**	**508.196**	**311.825**	**1.444.499**	**181.468**	**2.072.052**	**14.823.747**
2005	**297.195**	**384.609**	**224.292**	**64.389**	**4.115.792**	**4.094.078**	**164.491**	**167.354**	**2.173.150**	**560.658**	**358.783**	**1.736.008**	**200.216**	**2.284.627**	**16.825.641**
2010	**316.534**	**411.276**	**246.697**	**70.612**	**5.219.936**	**4.356.581**	**191.370**	**214.180**	**2.519.682**	**616.795**	**415.982**	**2.066.062**	**220.249**	**2.508.884**	**19.374.837**

Note: The recommendation is primarily based on the constant coefficient, except for FR, IE, IT and ES for which the equations are recommended.

Table 6: Waste glass projections in 14 EU Countries. Growth in %. Recommendations1

	FWGSAT	FWGSBE	FWGSDK	FWGSFI	FWGSFR	FWGSDE	FWGSGR	FWGSIE	FWGSIT	FWGSNL	FWGSPT	FWGSES	FWGSSE	FWGSUK	**Total EU-14**
1990-91	1,617556	2,66335	5,261325	-0,48737	4,096467	3,566357	1,791278	7,532846	3,699329	-0,2068	0,644733	2,963405	0,128596	-5,71367	**1,9075704**
1991-92	2,167154	1,019471	3,110922	0,139933	2,799841	-1,03026	2,907424	10,47814	3,070291	4,182366	1,825946	3,098998	1,416433	-0,14687	**1,2888194**
1992-93	-0,4455	0,058509	-0,0016	0,96343	4,514545	-1,6322	2,825279	4,971743	2,816216	1,555149	1,788932	1,822865	1,70575	2,226108	**1,4205006**
1993-94	-1,16282	0,587833	1,734164	0,857719	4,377383	-0,51582	4,266091	7,920872	2,575977	2,635327	0,392644	2,06485	3,428138	4,147249	**2,1065128**
1994-95	-5,47552	0,849122	0,2399	1,879599	4,545055	1,083169	0,94147	1,555307	1,875314	1,249132	1,577325	2,260391	1,509382	1,68165	**1,9697266**
1995-96	0,791311	1,155267	3,988457	3,041468	3,022631	1,086541	1,559399	9,328677	1,897561	2,160309	1,946844	2,397989	1,097502	1,994862	**2,0178815**
1996-97	0,500056	0,872594	1,435441	3,118851	4,852883	0,937732	1,65602	6,877495	1,671111	1,823819	1,953175	2,943766	1,670803	2,167537	**2,3610757**
1997-98	1,493187	1,039435	1,316228	2,350578	4,151666	1,472899	1,918469	6,27082	3,002193	1,966591	2,102198	3,127713	2,002935	2,139675	**2,5798598**
1998-99	1,575407	1,644385	3,972284	2,735837	4,788014	1,625633	2,014122	6,381656	3,257716	2,10777	2,320553	3,262046	2,336545	1,980569	**2,8664708**
1999-2000	1,657272	1,874846	2,627604	2,966635	5,029424	1,853108	0,830976	6,492702	3,592376	2,180174	2,465989	3,330599	2,591618	1,988028	**3,0337548**
1995-2000	**6,158142**	**6,75862**	**14,03434**	**15,04265**	**23,82314**	**7,170312**	**8,233171**	**40,67632**	**14,14533**	**10,66618**	**11,26338**	**15,99427**	**10,07583**	**10,7012**	**13,534175**
2000-2005	**6,917364**	**7,374526**	**10,64902**	**10,10042**	**19,11623**	**7,45747**	**14,77148**	**33,84822**	**15,91489**	**10,32325**	**15,05934**	**20,18062**	**10,33102**	**10,25915**	**13,504641**
2005-2010	**6,507129**	**6,933391**	**9,989137**	**9,664657**	**26,82699**	**6,41178**	**16,34087**	**27,98052**	**15,94606**	**10,01254**	**15,94246**	**19,01223**	**10,0058**	**9,815903**	**15,150661**
1995-2010	**20,88718**	**22,57942**	**38,78196**	**38,90394**	**87,06153**	**22,54647**	**44,51957**	**140,978**	**53,40989**	**34,31489**	**48,42827**	**65,90619**	**33,59961**	**34,03931**	**48,390693**

Note: The recommendation is primarily based on the constant coefficients, except for FR, IE, IT and ES for which the equations are recommended

IV.2.2. Run of model (Austria)

EQUATION MODEL

EQUATIONS: EQWGSAT

```
                                  CONSTANTS:

                  A1AT
VALUE            1.000

NOTE => The model is linear in the parameters.
Working space used: 259
                                STARTING VALUES

                  A0AT          A2AT
VALUE            0.000         0.000

F= -0.39867     FNEW=  -2.4051     ISQZ=  0 STEP=  1.0000     CRIT=  3.9277


CONVERGENCE ACHIEVED AFTER   1 ITERATIONS


     2 FUNCTION EVALUATIONS.

               Log of Likelihood Function =     11.2920
                   Number of Observations =      6

                       Standard
Parameter  Estimate      Error     t-statistic
A0AT       -2.398      .9981       -2.403
A2AT       .0288       .0108       2.671

Standard Errors computed from   quadratic form of analytic first
derivatives (Gauss)

                              Equation    EQWGSAT
                              ==========

Dependent variable: LWGSAT

 Mean of dependent variable = 12.47            Std. error of regression = .0451
Std. dev. of dependent var. = .0740                        R-squared = .7257
   Sum of squared residuals = .8147E-02          Adjusted R-squared = .6572
      Variance of residuals = .2037E-02       Durbin-Watson statistic = 1.533

ID     ACTUAL(*)   FITTED(+)                          RESIDUAL(0)
                                                                  0
1990    12.3239    12.3836     *     +                  -0.05973 0 +    |   +
1991    12.4684    12.4284               +   *           0.04000   +    |   0
1992    12.5188    12.4787                    +   *      0.04014   +    |   0
1993    12.5245    12.5030                      + *      0.02149   +    | 0 +
1994    12.4954    12.5201                     *  +     -0.02475   + 0  |   +
1995    12.4755    12.4926                   * +        -0.01715   +  0 |   +


Current sample:  1990 to 2015

Current sample:  1990 to 2000, 2005 to 2005, ..., 2015 to 2015  (14 obs.)
```

RESULTS:

	FWGSAT
1990	238606.313
1991	249550.563
1992	262408.156
1993	268872.156
1994	273510.531
1995	266088.375
1996	276030.313
1997	285516.094
1998	298246.531
1999	311796.625
2000	326225.438
2005	402813.906
2010	495474.781
2015	600408.500

CONSTANT COEFFICIENT MODEL

RESULTS:

	FWGSAT
1990	271165.188
1991	275551.438
1992	281523.063
1993	280268.875
1994	277009.844
1995	261842.109
1996	263914.094
1997	265233.813
1998	269194.250
1999	273435.156
2000	277966.719
2005	297194.688
2010	316533.531
2015	332128.813

Annex V End-of-life-vehicles

Data from CASPER

Country

#	1	2	3	4	5	6	7	8	9	10	11	12
Name	Belgium	Netherlands	Italy	France	W-Germany	Luxembourg	UK	Ireland	Greece	Spain	Portugal	Denmark

Weibull parameters for scrapping cars, vintage > 1952

# 1	15	15	22	21	19	15	18	18	34	21	31	16
# 2	6	5,8	8	8,5	5,5	6	7	7	9,5	8,5	9	4,2

Vintages 1940 to 1952 : See note below.

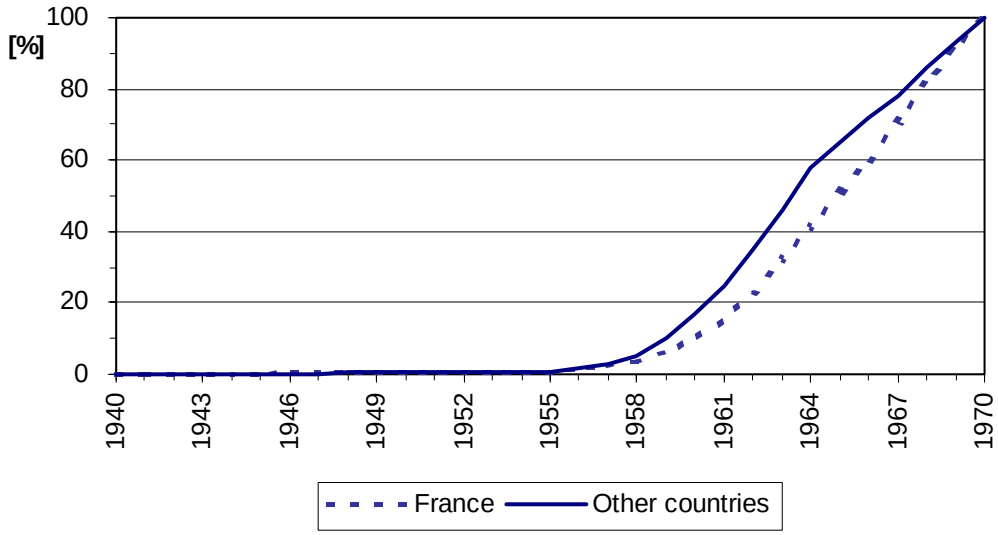
Number of passenger cars

1970	2059659	2562722	10150756	12469948	13949730	83000	11669246	393444	226898	2385188	580225	1076917
1971	2170324	2745396	11196695	13102472	15110563	88000	12206968	418302	264028	2860470	666201	1121634
1972	2280785	2927308	12240505	13735027	16055016	92000	12744711	443171	303123	3348167	728380	1166532
1973	2391306	3108200	13270202	14367442	17023115	97000	13282346	468085	346729	3826138	791292	1211243
1974	2502051	3289490	14300026	14999888	17341239	101000	13820098	492968	377180	4308987	851478	1255926
1975	2613889	3493389	15059661	15519940	17898179	106000	13948872	515583	438577	4806806	909101	1294926
1976	2738000	3719731	15929915	15900117	18919736	110000	14249975	556034	509317	5351001	964952	1338106
1977	2871059	3903943	16469884	16699907	20020035	115000	14180024	578018	620788	5944935	1024923	1374892
1978	2973090	4159194	16239942	17399903	21212218	119000	14639998	643000	728238	6529878	1087703	1407945
1979	3076507	4398653	17073269	18439933	22535541	122828	15188433	686896	822017	7057388	1150209	1423499
1980	3158801	4549421	17686269	19129997	23191506	128295	15619081	738114	862654	7556492	1204742	1389547
1981	3206342	4609936	18603400	19750070	23730558	133096	15821945	778200	911202	7943239	1278057	1366974
1982	3230853	4669772	19615932	20299853	24104680	138113	16282029	713787	996307	8354028	1347927	1358291
1983	3262548	4770298	20388670	20599887	24580459	141235	16611913	723837	1069386	8714053	1423384	1390257
1984	3300148	4840597	20888245	20800115	25217748	145769	17213090	716808	1154960	8874258	1491693	1440106
1985	3342636	4851275	22494486	21089847	25844476	151557	17737032	715291	1263328	9266294	1576389	1501034
1986	3408790	4919630	23495293	21499924	26917380	155415	18354906	717286	1359227	9627436	1671034	1558032
1987	3497747	5019458	24320250	21969923	27852382	162001	18858934	742806	1431717	10187976	1786790	1587729
1988	3620444	5173170	25290077	22524314	28891108	168206	19935806	755719	1501157	10735641	1966620	1595990
1989	3763080	5351193	26337278	23083575	30162432	179721	20944026	767640	1615211	11388394	2124784	1598250
1990	3909491	5535318	27403252	23688259	31145230	189352	21530003	774267	1740386	11885023	2295331	1592607
1991	3875801	5548813	26500004	23888847	31374873	192160	21002547	830759	1766513	11924949	2113046	1591555
1992	3942479	5644607	27288615	24516634	32042625	196869	21483838	853603	1854757	12254909	2187539	1602183
1993	4007438	5737873	28071031	24920700	32694146	204554	21964183	874989	1940027	12557941	2261118	1615336
1994	4070654	5833732	28847522	25313039	33329231	212383	22443736	896560	2024266	12846211	2334164	1613550
1995	4125821	5881527	29636566	25470040	33947576	216239	22933529	910904	2093035	13215693	2403721	1677665
1996	4184298	5961707	30418935	25821687	34561201	222964	23410944	929848	2166299	13512031	2473512	1744443
1997	4241073	6039325	31193794	26162472	35158220	229140	23886811	948866	2237763	13795866	2542226	1716284
1998	4296185	6114551	31961430	26492877	35738519	235899	24360345	967952	2306948	14067568	2609801	1732787
1999	4349662	6187549	32720313	26813385	36302052	242674	24832176	987101	2374252	14327543	2676182	1748916
2000	4401541	6258471	33470823	27124244	36848801	249156	25301529	1006309	2439210	14576220	2741323	1764621
2001	4451855	6321185	34187473	27411495	37274545	255634	25747596	1025571	2502979	14809632	2805181	1779217
2002	4500645	6381665	34894114	27690298	37680389	261788	26190676	1044880	2564661	15032546	2867722	1793442
2003	4547947	6440831	35590195	27960862	38066558	268567	26630424	1064232	2624271	15245057	2928917	1807310
2004	4593802	6498418	36275475	28223633	38433306	274685	27066265	1083623	2681836	15448379	2988744	1820835
2005	4638250	6554342	36949444	28479027	38780904	281110	27498994	1103047	2737261	15642617	3047184	1834030
2006	4681329	6598952	37550538	28702595	39109658	287516	27909412	1122501	2790968	15814710	3104225	1846874
2007	4723081	6642062	38138731	28919374	39419888	293555	28315586	1141978	2842623	15978802	3159858	1859447
2008	4763546	6683973	38713681	29129743	39711943	299557	28717431	1161475	2892403	16134578	3214078	1871728
2009	4802764	6724780	39275384	29334073	39986180	305523	29114888	1180988	2940633	16282867	3266887	1883729
2010	4840771	6764771	39823516	29532470	40242963	311811	29508136	1200512	2986837	16424307	3318287	1895462
2011	4939419	6797385	40286805	30075453	40482678	320866	30092691	1223010	3121874	16956352	3421557	1903963
2012	4991735	6829321	41279032	30334686	40705725	327576	30535514	1243503	3188140	17167976	3485753	1912165
2013	5044197	6860043	41862445	30594903	40912497	334333	30979524	1264112	3254443	17379511	3550009	1920150
2014	5096805	6890423	42443848	30856595	41103397	341138	31424725	1284837	3321367	17591798	3614328	1927894
2015	5149557	6919918	43023253	31118783	41278846	347992	31871368	1305679	3388319	17803985	3678708	1935408

Luxembourg : See note below.

Age distribution for the car stock in 1970												
1940	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
1941	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
1942	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
1943	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
1944	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
1945	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
1946	0,2	0,2	0,2	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
1947	0,2	0,2	0,2	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
1948	0,3	0,3	0,3	0,4	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
1949	0,3	0,3	0,3	0,4	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
1950	0,3	0,3	0,3	0,5	0,3	0,3	0,3	0,3	0,3	0,3	0,3	0,3
1951	0,4	0,4	0,4	0,5	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
1952	0,4	0,4	0,4	0,6	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
1953	0,4	0,4	0,4	0,6	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
1954	0,5	0,5	0,5	0,7	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
1955	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8	0,8
1956	1,6	1,6	1,6	1,2	1,6	1,6	1,6	1,6	1,6	1,6	1,6	1,6
1957	2,8	2,8	2,8	2,1	2,8	2,8	2,8	2,8	2,8	2,8	2,8	2,8
1958	4,9	4,9	4,9	3,6	4,9	4,9	4,9	4,9	4,9	4,9	4,9	4,9
1959	10,0	10,0	10,0	6,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0	10,0
1960	17,0	17,0	17,0	10,0	17,0	17,0	17,0	17,0	17,0	17,0	17,0	17,0
1961	25,0	25,0	25,0	16,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0	25,0
1962	35,0	35,0	35,0	23,0	35,0	35,0	35,0	35,0	35,0	35,0	35,0	35,0
1963	46,0	46,0	46,0	32,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0	46,0
1964	58,0	58,0	58,0	41,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0	58,0
1965	65,0	65,0	65,0	51,0	65,0	65,0	65,0	65,0	65,0	65,0	65,0	65,0
1966	72,0	72,0	72,0	60,0	72,0	72,0	72,0	72,0	72,0	72,0	72,0	72,0
1967	78,0	78,0	78,0	71,0	78,0	78,0	78,0	78,0	78,0	78,0	78,0	78,0
1968	86,0	86,0	86,0	82,0	86,0	86,0	86,0	86,0	86,0	86,0	86,0	86,0
1969	93,0	93,0	93,0	92,0	93,0	93,0	93,0	93,0	93,0	93,0	93,0	93,0
1970	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Age distribution in 1970



Vintages 1940 to 1952 :

The stock of vintages 1940 - 1952 in 1969 is assumed to be scrapped by 50 % in each of the years 1970 and 1971.
That is, the number of scrapped cars in 1970 and 1971 equals the stock of vintages 1940 - 1969 in 1970.

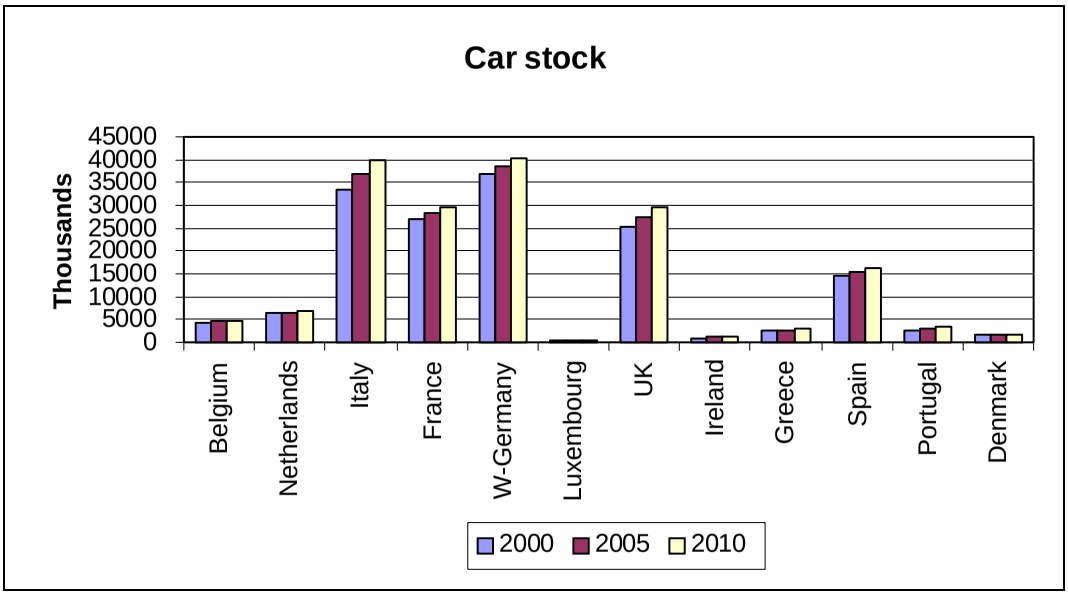
This rule has been introduced to avoid numerical problems.

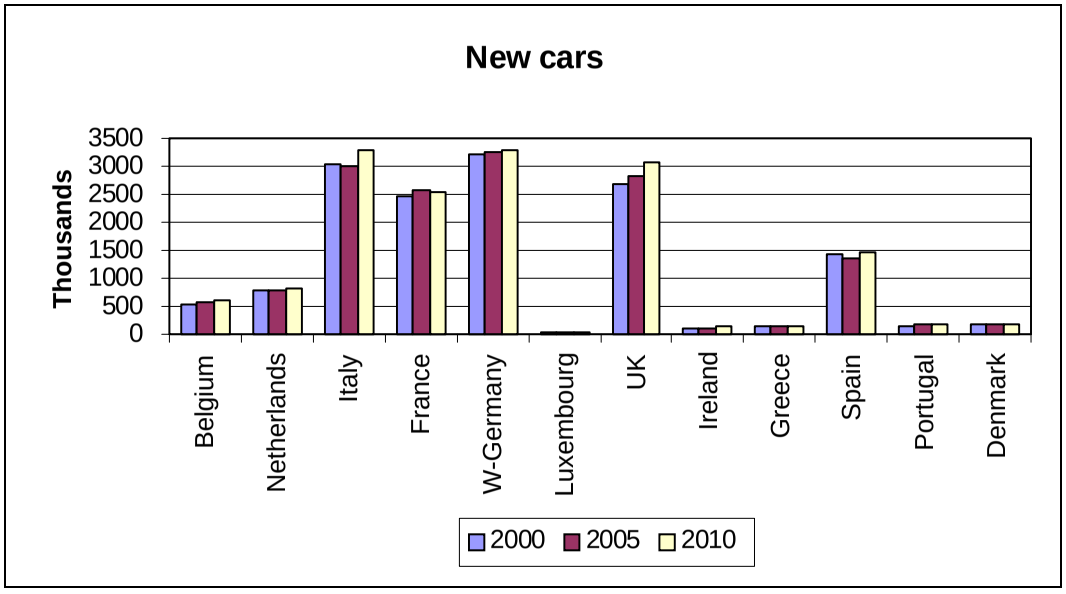
Luxembourg

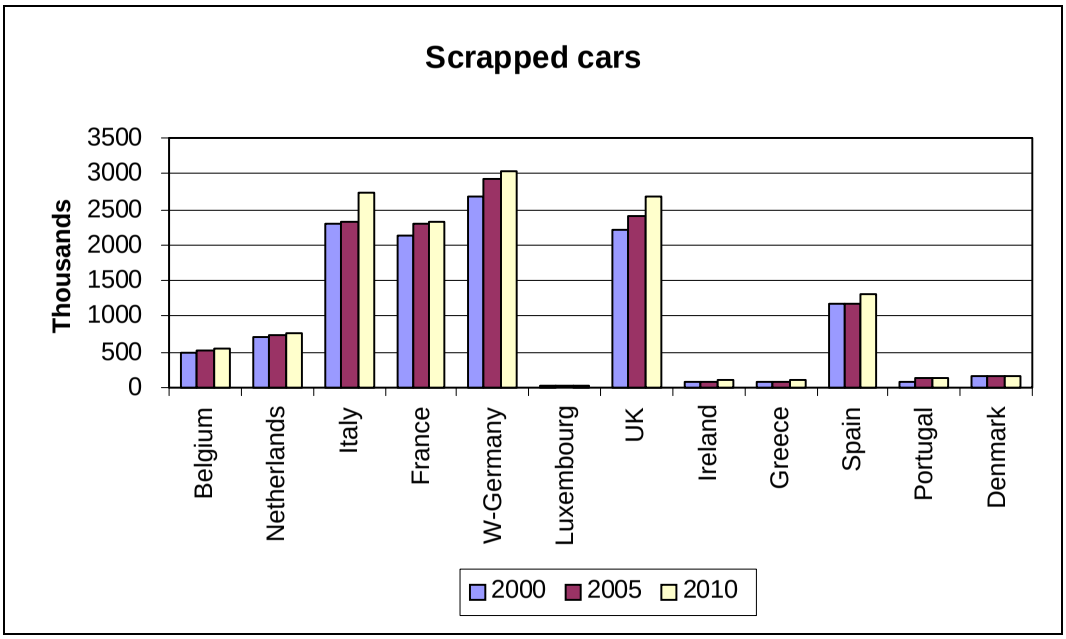
Number of passenger cars :

Missing values for 1970 - 1978.

The values for 1979 to 1986 have been extrapolated back to 1970.


Car stock
Thousands
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
Belgium
Netherlands
Italy
France
W-Germany
Luxembourg
UK
Ireland
Greece
Spain
Portugal
Denmark
2000
2005
2010


New cars
Thousands
3500
3000
2500
2000
1500
1000
500
0
Belgium
Netherlands
Italy
France
W-Germany
Luxembourg
UK
Ireland
Greece
Spain
Portugal
Denmark
2000
2005
2010


Scrapped cars
Thousands
3500
3000
2500
2000
1500
1000
500
0
Belgium
Netherlands
Italy
France
W-Germany
Luxembourg
UK
Ireland
Greece
Spain
Portugal
Denmark
2000
2005
2010