

Modelling the impact of lifestyle changes on household waste arisings

Defra Waste Research Evidence Programme Project (WR0107)

Annex 5: Supplementary Divergent Trend Analysis Report May 2007

This research was commissioned and funded by Defra. The views expressed reflect the research findings and the author's interpretation. The inclusion of or reference to any particular policy in this report should not be taken to imply that it has, or will be, endorsed by Defra.



Important Research Update (September 2009)

The innovative input-output model (forecasting tool) that was constructed as a part of this research, was developed using the most up-to-date data on waste arisings available in 2005, at the project start, i.e. up to and including data for 2003/04. Following completion of the initial research and model development in July 2006, new data on waste arisings became available, which highlighted a divergence between the model predictions and reported data from 2002-2006.

Additional research indicated that it would be necessary to include a range of as-yet-not-understood factors within the model in order to develop more accurate predictions. Defra have commissioned further research to try to understand other factors that may have influenced changes in waste growth patterns. The Information Note published with this report gives more detail on this research and the background.

The divergence observed between the model forecasts and recent waste growth currently limits the application of the model for policy purposes, and means that caution should be used with respect to interpreting the figures contained in this report and the associated research documents (e.g. quantification of future waste tonnages). However, this project still allows exploration of future trends in waste composition, if not total quantity.

Introductory Note

The Defra Waste Resources Evidence Programme funded an innovative research project (WR0107) – “Modelling the Impact of Lifestyle Changes on Household Waste Arisings” that has resulted in the development of a forecasting tool to gain a better understanding of the composition of household waste and also how those arisings might grow in the future. The model takes into account the impact of economic, social and consumer trends on the composition and magnitude of household waste arisings to provide a range of alternative projections on the impact of different lifestyle trends on the future of household waste composition in England through to 2020. The model was designed to enable policy-makers to see the effect of probable trends in the main economic and social drivers on household waste arisings, such as increasing affluence and decreasing household occupancy levels. It also enables policy-makers to identify which sources of the waste stream are most sensitive to potential policy interventions and therefore provides evidence on which to prioritise and target policies.

The innovative input-output model (forecasting tool) that has been constructed was developed using the most up-to-date data on waste arisings available at that time. Following completion of the initial research and model development in July 2006, new data on waste have become available. Defra therefore commissioned additional work to investigate possible refinements to the model; in particular to investigate the short-term rates of growth in household waste (these have turned out to be rather lower than what the model would have predicted); at the same time, Defra wished to see if the model could be used to quantify the potential impacts of qualitative future waste scenario research being conducted in parallel (WR0104) – “Lifestyle Scenarios: Futures for Waste Composition”.

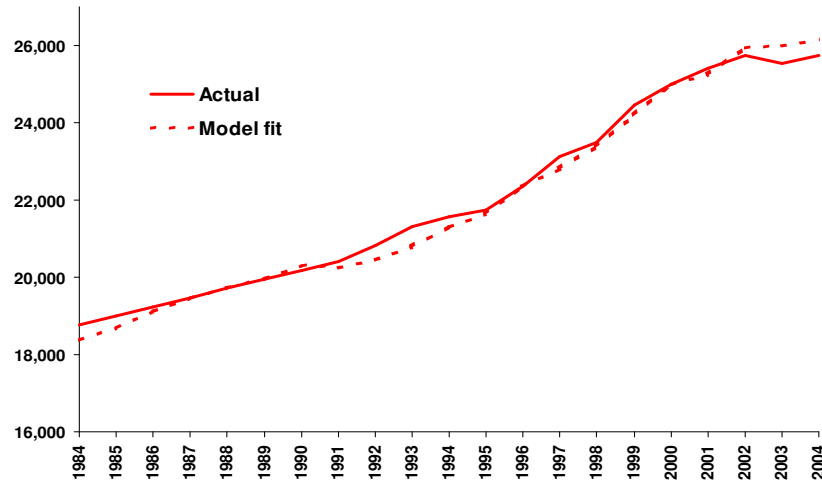
This Annex documents a specific element of the additional research (that was undertaken between July 2006 and August 2007) to investigate possible explanations for recent divergences observed between forecast and actual levels of waste arisings (in particular 2003-2005).

The report follows the format of the presentation provided to a Defra Steering Group on 14th May 2007.

Background

- When the original FF/AEA model of household waste arisings was built over the period 2005 – 2006 it was appreciated that the model was over predicting waste arisings in recent years, particularly for the two years 2003 and 2004
- In December 2006 we undertook an analysis to ask ‘what would we have said for growth 2000 – 2004 if we had undertaken the analysis in 2000’
- This showed that the forecasts would have over predicted reported waste by an even greater amount

Household Waste Arisings in England (000s tonnes) Model fit



Model fit and '2000 forecast' compared to Actual %difference from actual

	Model fit	Model parameters 1980 - 2000, assumptions made in 2000
2000	0.0%	0.0%
2001	-0.6%	1.6%
2002	0.8%	2.0%
2003	1.8%	3.5%
2004	2.4%	3.6%

Model fit and '2000 forecast' compared to Actual 000 tonnes from actual

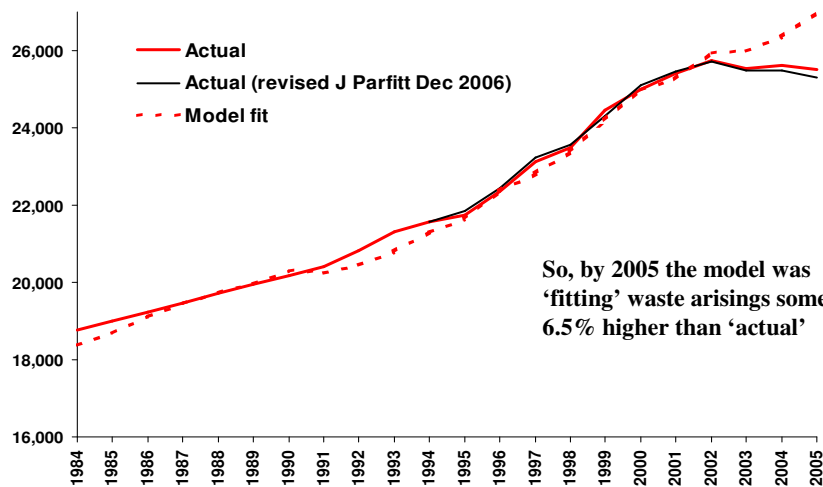
	Model fit	Model parameters 1980 - 2000, assumptions made in 2000
2000	-7.5	-7.5
2001	-157.9	412.5
2002	196.1	513.9
2003	455.4	899.9
2004	605.8	925.7

Background

- When the original FF/AEA model of household waste arisings was built over the period 2005 – 2006 it was appreciated that the model was over predicting waste arisings in recent years, particularly for the two years 2003 and 2004
- In December 2006 we undertook an analysis to ask 'what would we have said for growth 2000 – 2004 if we had undertaken the analysis in 2000'
- This showed that the forecasts would have over predicted reported waste by an even greater amount
- We therefore concluded at the time that :
 1. The reported data was understating the actual levels of waste in recent years
 2. The assumptions put into the model (for recent years) were incorrect (e.g for garden waste per week per household with a garden, for average weight of product, proportion of waste diverted outside waste stream etc)
 3. that a new factor not incorporated (e.g the wide scale introduction of large wheelie bins during the 1990s) had biased some of the parameters in the model

1. The reported data was understating the actual level of waste in recent years

Julian Parfitt carried out an analysis of the Defra data and concluded that the actual figures were probably slightly less than those reported Household Waste Arisings in England (000s tonnes)



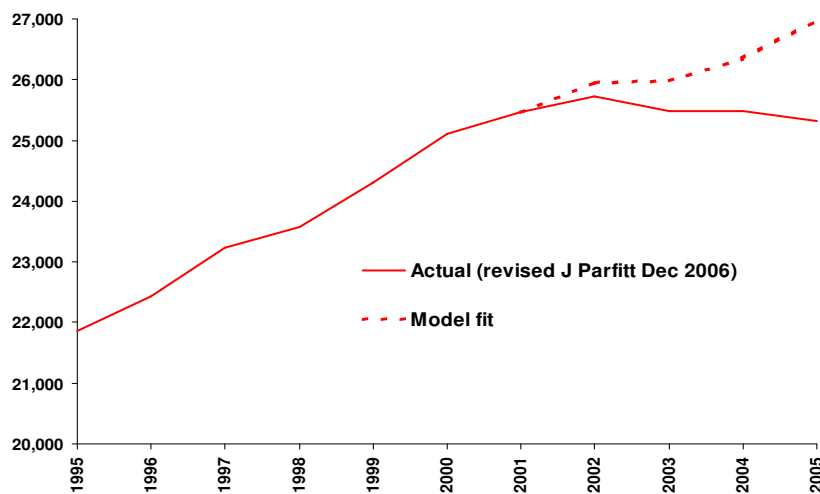
2. The assumptions put into the model (for recent years) were incorrect

- For a number of the drivers we had very limited information and we therefore had to use a series of assumptions on how these had moved in recent years. These assumptions included such things as garden waste per week per household with a garden, average weight of product, proportion of waste diverted outside waste stream etc.
- For most we assumed that there had been small and gradual changes over time. It is possible, however, that there had been some more pronounced shifts over the last few years.
- To test how changes to the assumptions might affect predicted waste arisings we have gone through the key drivers on a sequential basis.
- For each assumption we have input a change in the driver that gets the model to fit the actual data for 2002 – 2005 more accurately.

N.B. This was a hypothetical exercise to illustrate the degree of change in that one assumption that would be required to fit the reported data. In all cases, that actual degree of individual change is not considered likely.

So, can we explain the discrepancy between the ‘actual’ level of waste arisings and that predicted by the model on the basis of the assumptions within the model?

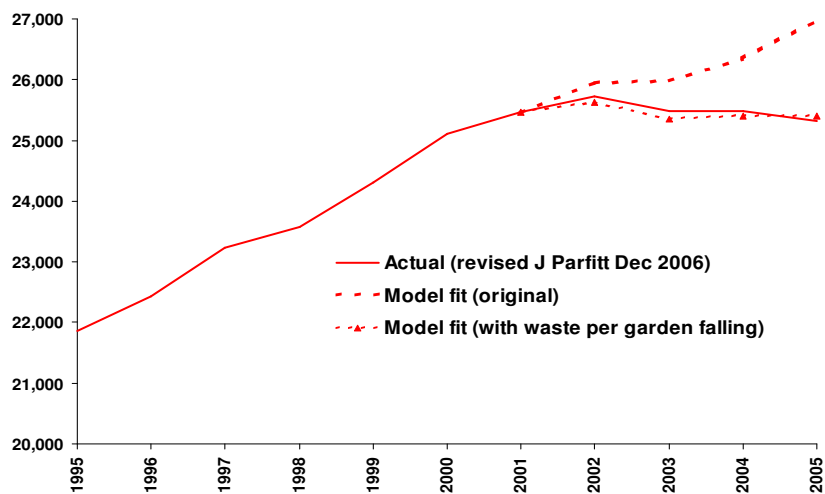
Household Waste Arisings in England (000s tonnes)



Garden waste

- Our 'model' for garden waste looks at the number of households, proportion of hhs with gardens, average waste per garden and the proportion of garden waste going into the hh waste stream
- To calibrate we used J Parfitt's original estimate of garden waste, which suggested garden waste accounted for around 23% of total hh waste in the early 2000s, plus figures from the OU, which allowed us to estimate the amount of garden waste home composted
- If, however, we assume that :
 - The amount of garden waste produced fell by 25% between 2001 and 2005 (rather than unchanged as assumed in the original model)
 - The amount of garden waste going to CA stabilised at 2001 levels (rather than gradually increasing as assumed in the original model)
- then the model tracks 'actual' data accurately
- This also suggests that garden waste's share of total arisings fell from 23% in the early 2000s to 18% by 2005

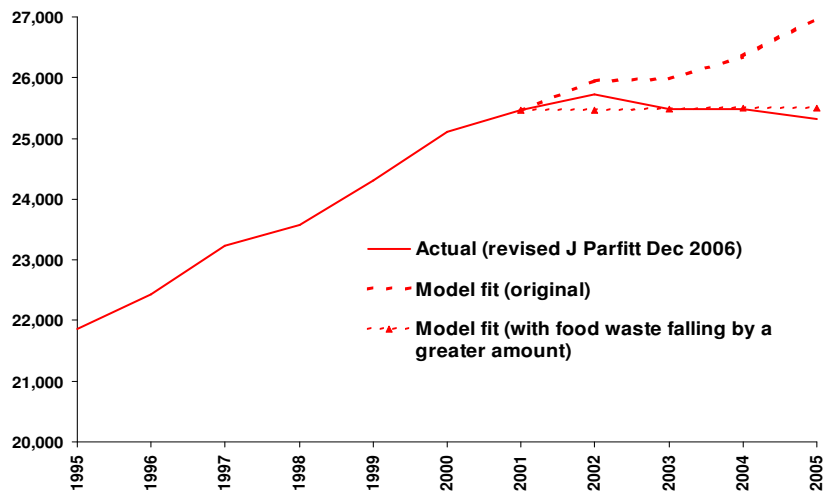
Household Waste Arisings in England (000s tonnes)



Proportion of product that ends up as waste

- For some products (e.g electrical goods) 100% of the product weight will eventually end up as waste (with a time lag and possibly in a non hh waste stream)
- However, with food items only a relatively small proportion will end up as waste
- In our original model we had assumed that the proportion of food waste ending up in the hh waste stream had fallen by around 6% between 2001 and 2005 (i.e less food was being wasted)
- If we adjust this assumption to say that the proportion of food being wasted actually fell by 25% between 2001 and 2005 then the model accurately tracks the 'actual' data

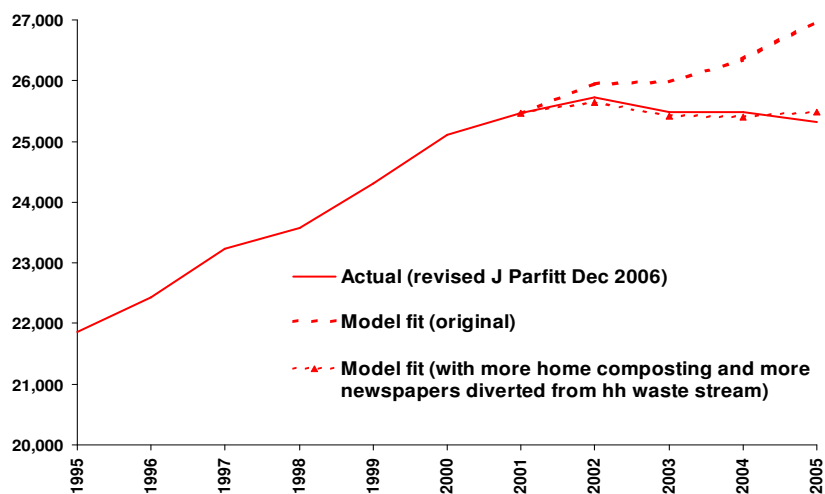
Household Waste Arisings in England (000s tonnes)



Proportion of waste that gets diverted outside the hh waste stream

- In our model we have assumed that a certain proportion of waste from each consumption category is diverted from the hh waste stream
- This would include home composting of garden waste, home composting of food items, newspapers going to a commercial waste stream, clothing going to charity shops and then a commercial waste stream etc
- Where relevant we had assumed that this proportion had gradually increased over time
- If we assume that :
 - The proportion of food waste home composted increases from 10% to 33% (compared to an increase from 10% to 12% in the original model)
 - The proportion of newspapers diverted outside the hh waste stream increases from 6% to 12% (compared to no change in the original model)
- the model then tracks the 'actual' data accurately

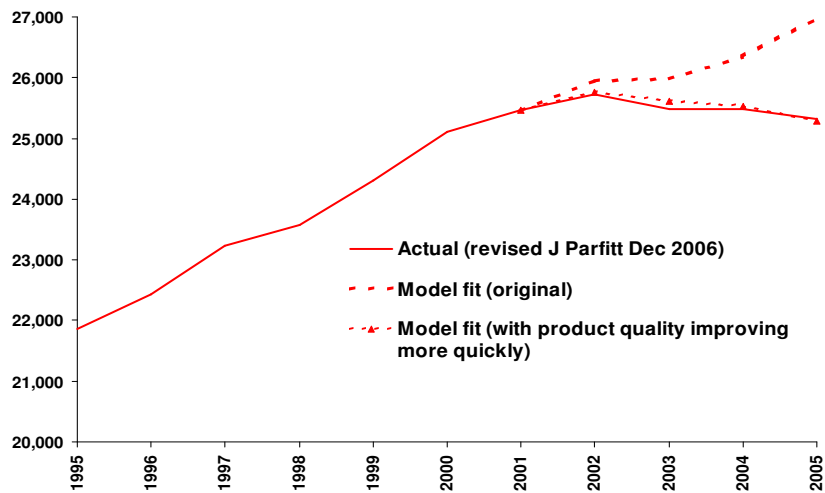
Household Waste Arisings in England (000s tonnes)



Quality improvements

- Our analysis has assumed that in many categories there have been quality improvements in the products (particularly in electronic goods and food)
- These quality changes are reflected in the 'constant price' growth figures published by ONS
- We have used the historical 'constant' price data to provide an indication of 'volume' growth, so we have had to incorporate a factor for a number of the expenditure categories to 'strip out quality changes
- In most instances changes have been relatively small e.g 1%pa for food
- If we change this to, say, 5%pa (and make similar changes to other categories) we can again get the model to fit the 'actual' data quite closely

Household Waste Arisings in England (000s tonnes)



Other factors

- Another important element of waste is packaging (accounting for around 16% of all waste)
- In the original model we have assumed that the amount of packaging per kg of product had gradually fallen in recent years
- To explain the difference between 'actual' and model fit packaging would have to have fallen from 16% to around 10% of all waste over the past four years
- A fall in the actual weight of product could also explain the difference between actual and model fit.
- However, given we are fairly certain that there has been little change in the average weight of product in most categories, for the ones where there may have been changes (electronics), these changes would have had to be very significant (especially taking time lags into account)
- Finally, the length of time goods between purchase and disposal into the waste stream could have increased. This is difficult to simulate historically in the model. Given the time lags though, the changes would again have to be very significant to explain the differences

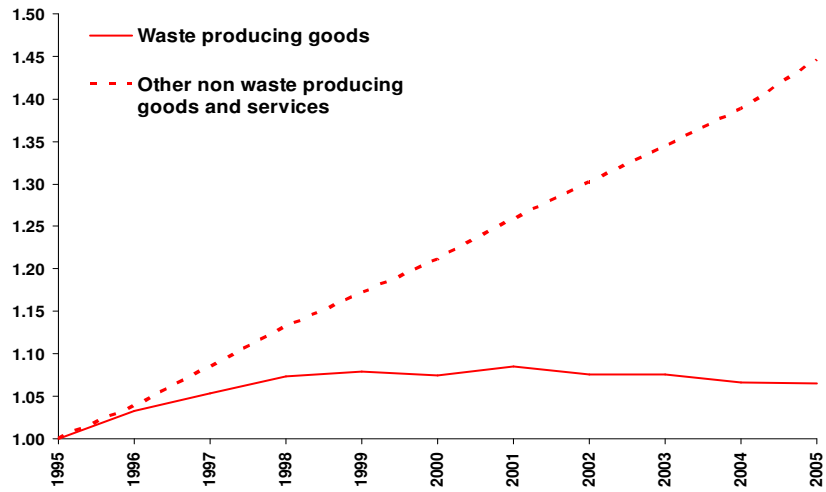
BL presented data suggesting that expenditure on waste producing goods has seen a steady decline since 2000

Real expenditure 1995=100 (nominal expenditure deflated by the general RPI index)



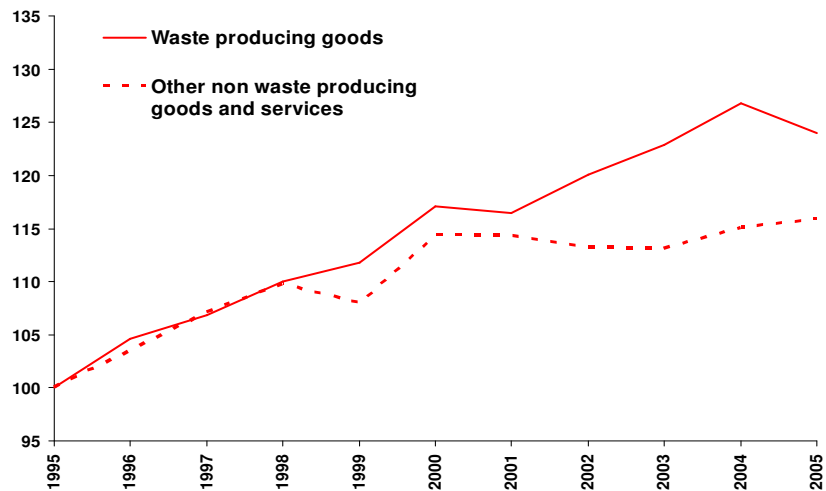
... however, as we know, the price of services have increased significantly faster than the price of goods

Price indices 1995=1



We therefore get a completely different picture if we deflate expenditure by appropriate price indices

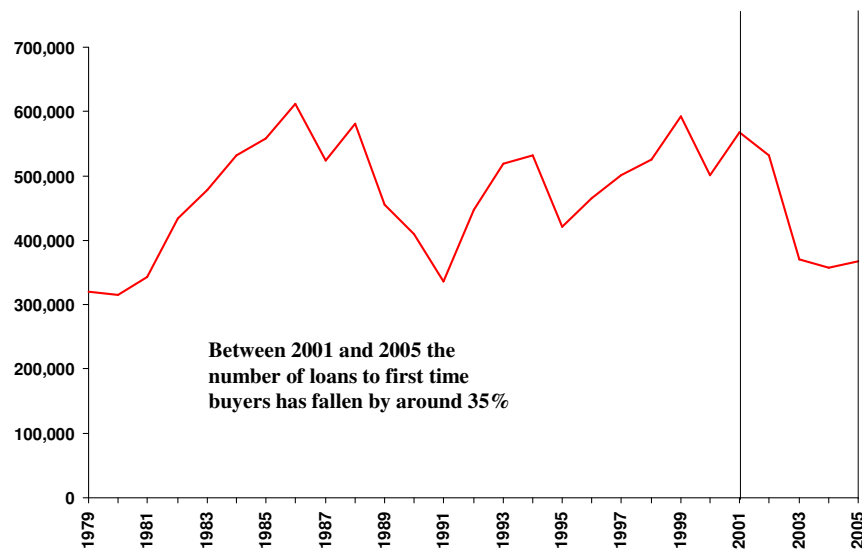
Constant price expenditure 1995=100



First time house buying

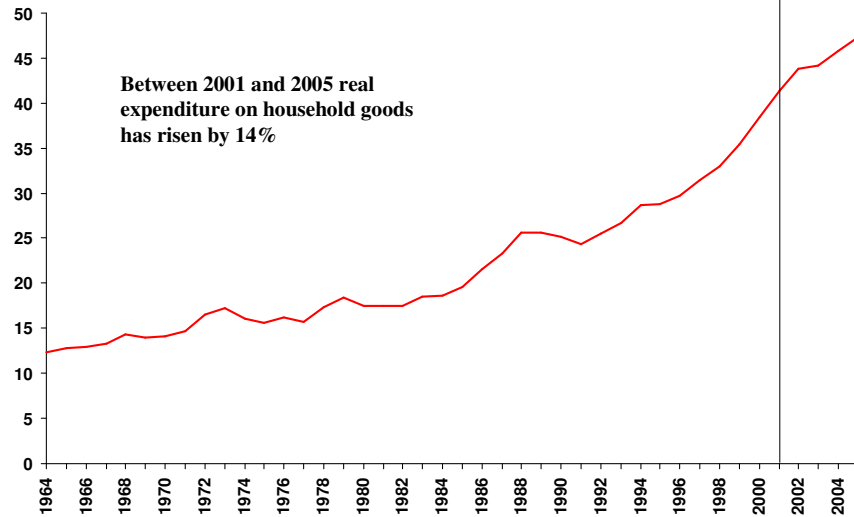
- It was suggested that a slow down in house purchases by first time buyers over the past few years may have had an impact on the purchase of 'household goods'. Between 2001 and 2005 loans to first time buyers fell by 35%
- We have looked at constant price expenditure on 'household goods', including :
 - Furniture and furnishings
 - Carpets and other floor coverings
 - Household textiles
 - Household appliances
 - Glassware and tableware
 - Tools and equipment
 - Audio visual equipment
 - Decorating products
- However, there is no evidence that expenditure on these items have fallen (increasing by 14% between 2001 and 2005)
- Also given the time lags for these kinds of items waste is likely to be more related to expenditure in the mid to late 1990s when constant price expenditure was increasing by around 4.8%pa

Loans to first time buyers



Expenditure on 'household' goods

£bn, 2005 constant prices



Conclusions (1)

- If we are happy that the waste data and ONS consumer expenditure data accurately reflect what has happened in recent years, and there has been no significant changes in product weight, then between 2001 and 2005 hh waste arisings fell by around 1% while the weight of waste producing goods increased by 7%
- The model is highly dependent on the input of a range of assumptions on a whole variety of factors (garden waste per average garden, proportion of product that ends up as waste etc)
- Limited information was available to provide estimates for these assumptions (for either absolute levels or trends over time)
- In most cases we used estimates that were 'reasonable', and that meant the model fairly closely tracked the overall waste arisings' data for the years 1980 – 2004

Conclusions (2)

- As we have seen it is relatively easy to change these assumptions to get the model to better fit the reported data for the period 2002 - 2005
- It seems unlikely (given the size of adjustments required) that the mismatch between model fit and 'actual' is a result of just one assumption
- It is more likely that it would be a combination of several of the factors (e.g the hot weather in recent years has reduced the amount of garden waste, more home composting is happening, people are throwing away a little less food, packaging weights have fallen a little etc)
- Without any information though, it is not possible to accurately re calibrate the model

Conclusions (3)

- We have seen through previous work that a scenario where waste arisings do not grow over the period to 2020 can be generated using a range of 'reasonable' assumptions
- It is likely that policy changes will make such an outcome more likely (although certainly not inevitable) e.g the move to fortnightly waste collections will encourage less food to be thrown away, more waste to be diverted from the hh waste stream etc
- However, with the weight of waste producing goods likely to continue to grow at around 1.5%pa to 2020, it does seem likely that growth in hh arisings will re assert itself, possibly though at a much more modest rate than occurred in the late 1990s