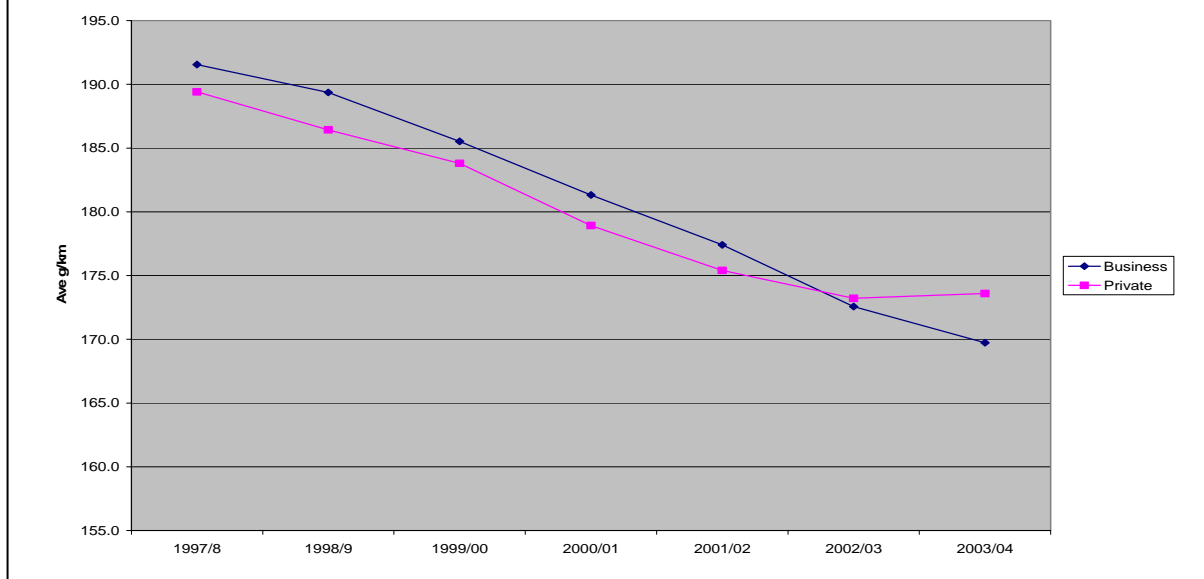


Passenger Cars: CO₂ Emissions and Vehicle Excise Duty

Key Points:

- Overall the steady downward trend in average CO₂ emissions from new cars appears to be continuing, and this can be seen in changes in the populations of the different VED bands – *Figure 1*.
- There is some evidence that the current VED bands do have an impact at the margins on purchasing behaviour, but this seems only to be significant at the boundary of Bands A and AA.- *Figure 2*
- Changes at the top end of the market are complex, and there is not a downward trend *within* VED band D. *Figures 2, 10, 11*
- Over the past year, average CO₂ emissions from new Private Cars have increased, while emissions from Company Cars are have decreased – *Figure 12*
- The total ‘CO₂ burden’ of new cars is growing year on year, as very strong sales performance has outweighed CO₂ reduction- *Figures 7, 8, 9s*.

Figure 12: Development of Average CO₂ Emissions for Private and Business Purchases 1997/8 – 2003/4



Analysis of Car CO₂ Data

Introduction and Methodology

Year on year car sales data were purchased in spreadsheet form from the SMMT. These data give quarterly sales figures for each of the years 1997/8 through 2003/4, although for the purposes of this exercise, these were annualised to give figures for each financial year.

Detailed sales figures are available for each make, model and variant of cars sold. In addition, each record contains the following specific information:

- Fuel type
- Engine capacity
- Purchaser type (ie private, fleet, etc)
- Market segment
- CO₂ emissions rating

On the basis of this, all sales were assigned to a VED band, a CO₂ band and an aggregated sales category (ie business or private).

The data were then analysed, and the results presented in graphic format in the Figures at the end of this report.

Results of the Analysis

Changing Populations of VED Bands over Time

Turning first to **Figure 1**, the impact of steadily declining average new car CO₂ figures over time are clearly illustrated in the changing size of VED bands over time.

In 1997/8 (before the graduated VED bands were actually introduced), it can be seen that Band D would have been the largest band in terms of sales volume, with progressively fewer sales in Bands C, B, and A successively. Since that time, however, sales in Band B, and subsequently Band A, have grown markedly, to the extent that A is now the largest volume band in terms of new sales. Subsequently Bands AA and AAA have also begun to be populated as well, although Band AAA is populated only in the last year and is still too small to register on the chart.

Throughout the period, however, as sales have grown to exceed 2.5 million new cars per year, Band C has clearly been squeezed in size, but Band D has remained substantial and has declined only slightly in terms of number of sales.

Vehicle CO₂ Distribution

Figure 2 provides a snapshot of the most recent full year data, illustrating the relationship between VED Bands and a more detailed CO₂ distribution. This distribution approximates to a beta-distribution, with the highest incidence of sales in the 141-150g bracket, but with a long 'tail' extending well beyond 320g/km. From this it can also be seen that, while no other band exceeds 30g/km in spread, Band D is

much broader. While the majority of Band D cars fall within the range 186-220g/km, significant numbers of cars have much higher emission levels.

This distribution curve is relatively smooth and consistent, but does appear to show modest discontinuities at some of the VED band boundaries, suggesting at least that VED may be having a greater impact on vehicle choices at the margin than is commonly supposed. This is most obviously seen at the boundary of Band AA and Band A, where sales below the 120g/km mark are significantly higher than those above, while the overall shape of the curve would suggest the opposite. Less clear discontinuities can also be discerned at the boundaries of Bands A and B, and of Bands C and D. However, more detailed investigation using 5g/km band widths suggests that the other discontinuities are artefacts of the data rather than real effects of VED. However the boundary effect between Bands A and AA is confirmed and seems very most likely to be the direct result of the VED bands – possibly suggesting that this section of the market is significantly more sensitive to CO₂ levels than elsewhere.

Figure 3 shows the same distribution split down between private and business purchases. The two subsectors are of approximately equal size, as they have been for many years. Note, however, that corporate sales are not all what is commonly understood to be ‘company cars’. In addition to cars provided as a ‘perk’ to employees, this category includes substantial numbers of fleet cars, cars offered for rental or lease, etc, and many of the latter are not subject to the company car taxation regime.

Nonetheless, it is perhaps surprising to find that company sales predominate in most of the mid-range CO₂ categories (from 141 to 200g/km), while private sales are consistently higher in all categories above this. This, arguably, suggests that the new company car tax system is having some significant influence in the mid-range, given that the lowest tax rate is on vehicles below 160g/km. Given the perception of a ‘company car factor’ whereby company purchased cars are on average larger (as indeed they once were), this phenomenon merits further investigation below.

Company sales also predominate slightly in the 111-130g/km bracket, but this appears to be against the trend and is unlikely to be a result of the company car tax regime, as this does not offer stronger incentives at the low end. It is not therefore immediately apparent why this should be the case.

Development of CO₂ Bands over Time

Figure 4 shows the development in terms of CO₂ bands for three selected years. This illustrates that sales have fallen more or less consistently for cars in the range 171 to 250g/km, while they have grown quite dramatically in all categories in the range 111 to 160g/km. The trend has been much less clear above 250g/km, however.

Car Purchases by Segment over Time

Figure 5 first illustrates the change in CO₂ emissions by car segment over time. The first point to note is that most categories have fallen over time in a way fairly consistent with the overall trend. The main exception is sports cars, which have actually risen, but these in any case constitute a relatively small segment with little change in sales over time. The largest reduction has been in the average for MPVs,

which has fallen by nearly 50g/km, presumably as a result of dieselisation, other technology changes, and the introduction of some smaller models into the class.

Secondly, and not surprisingly, it is the mini and supermini classes that offer clearly the lowest emissions on average. Equally unsurprising, the Upper and Lower Medium classes fall slightly above and below the fleet average respectively. Classes which fall substantially above the average are (in descending order) Luxury; Dual Purpose; Sports; Executive and Multipurpose.

Next, **Figure 6** illustrates the development of sales by class over time. The first point to note is the dramatic increase in total sales over the past three years: a step change to over two and a half million per year, with three successive record years in a row. Within this, the largest part of the increase has been accounted for in the Supermini class, where sales have increased by around 60 per cent over the period. The two Medium classes have remained broadly stable, while the other area of growth is in Dual Purpose and Multipurpose vehicles.

The Total 'CO₂ Burden' of New Cars

To illustrate the total impact of these trends, **Figure 7** illustrates the CO₂ 'burden' of each vehicle class, by giving the product of the number of sales per class and the average CO₂ in a given year. This gives a reasonable indication of the total CO₂ impact of different parts of the fleet, although it does not of course reflect differences in the distances driven by each class of vehicle, nor variations in the numerous factors which can influence actual on-road emission rates.

This calculation illustrates that the total burden has in fact risen over the past three years: that is, the increase in sales has been sharper than the reduction in average CO₂. The contribution of the Medium classes has been approximately stable over the period. The total contribution of Superminis has increased by 46 per cent, but the largest rises are for the Multipurpose (112 per cent) and Dual Purpose (70 per cent) categories. The five high-CO₂ classes now constitute 19 per cent of the sales, but 24 per cent of the CO₂ emissions.

Figures 8 and 9 then show the same figures broken down by vehicle class, and illustrate the significant divergence between the two markets. In the business segment, the total burden is virtually unchanged over the past five years, with sales growth almost exactly offset by steady improvements in average CO₂. Here the two Medium classes predominate in terms of CO₂ impact, with Superminis making relatively little impact, but the high-emitting classes also growing relatively slowly. The five high-CO₂ classes constitute 16 per cent of the sales, and 21 per cent of the CO₂ emissions.

In contrast private sales exhibit a much more bipolar distribution between classes. That is, Superminis have made a much faster expansion and are now the largest class in terms of both sales and emissions, while the Upper Medium class makes a relatively modest contribution. At the top end, however, the growing impact of Dual Purpose purchases is evident. Here, the five high-CO₂ classes now constitute 21 per cent of the sales, and 28 per cent of the total CO₂ emissions. The combination of these various trends, overlaid with rising sales, is that the total CO₂ burden from private sales is rising fairly steadily.

Reflecting these changes in sales composition, **Figure 10** focuses on the high end of the CO₂ spectrum for private purchases, but shows no clear downward trend over time. In contrast, **Figure 11** illustrates that business purchases in VED Band D have, for almost all the top CO₂ categories, fallen quite consistently over time. This illustrates a very different trend over time between private and business purchases, presumably driven at least in part by recent changes in company car taxation, but also by commercial concerns over fuel costs.

Trends in Average CO₂ by Market Subsectors

The net result of these divergent trends can be found in **Figure 12**. This illustrates that the average CO₂ emissions from cars purchased by businesses have indeed historically been higher than those from private purchases, as expected. In the past two years, however, the steady improvement over the period in the average for business buyers has if anything accelerated, presumably owing at least in part to the reform of company car taxation.

For private buyers, however, the reverse is true, with an equally steady downward trend slowing and then even reversing over the past two years, such that the lines have now crossed and private purchases are significantly above those of businesses in terms of average CO₂. This phenomenon does much to explain the rather disappointing aggregate CO₂ figures of the past two years, in spite of the positive influence of company car tax reform.

Conclusions

From the above analysis, the following broad conclusions can be drawn:

- Overall the steady downward trend in average CO₂ emissions from new cars appears to be continuing, and this can be seen in changes in the populations of the different VED bands.
- There is some evidence that the current VED bands do have an impact at the margins on purchasing behaviour, but this seems only to be significant at the boundary of Bands A and AA.
- There is clearly a very long ‘tail’ in the distribution of emissions levels in Band D, and changes at the top end of the market are complex, and do not show a downward trend.
- Business purchases in show a steady downward trend in average CO₂. This precedes the introduction of the new company car tax regime based on emissions levels, but the latter appears to have accelerated or at least helped to perpetuate the trend. The change in sales distribution towards the mid range of the car market in terms of CO₂ emissions appears to have been accelerated by the tax changes, but these do not give incentives to go beyond this.
- In contrast, progress on the average emissions of private purchases has now stalled and even reversed, such that the average is now for the first time above that for company cars. The distribution of purchases here is much more bipolar, with strong sales in the AA VED band, but also in Band D.
- The total ‘CO₂ burden’ of new cars is growing year on year, as very strong sales performance has outweighed CO₂ reductions.

Figure 1: New Car Sales by Current VED Band, 1997-2004

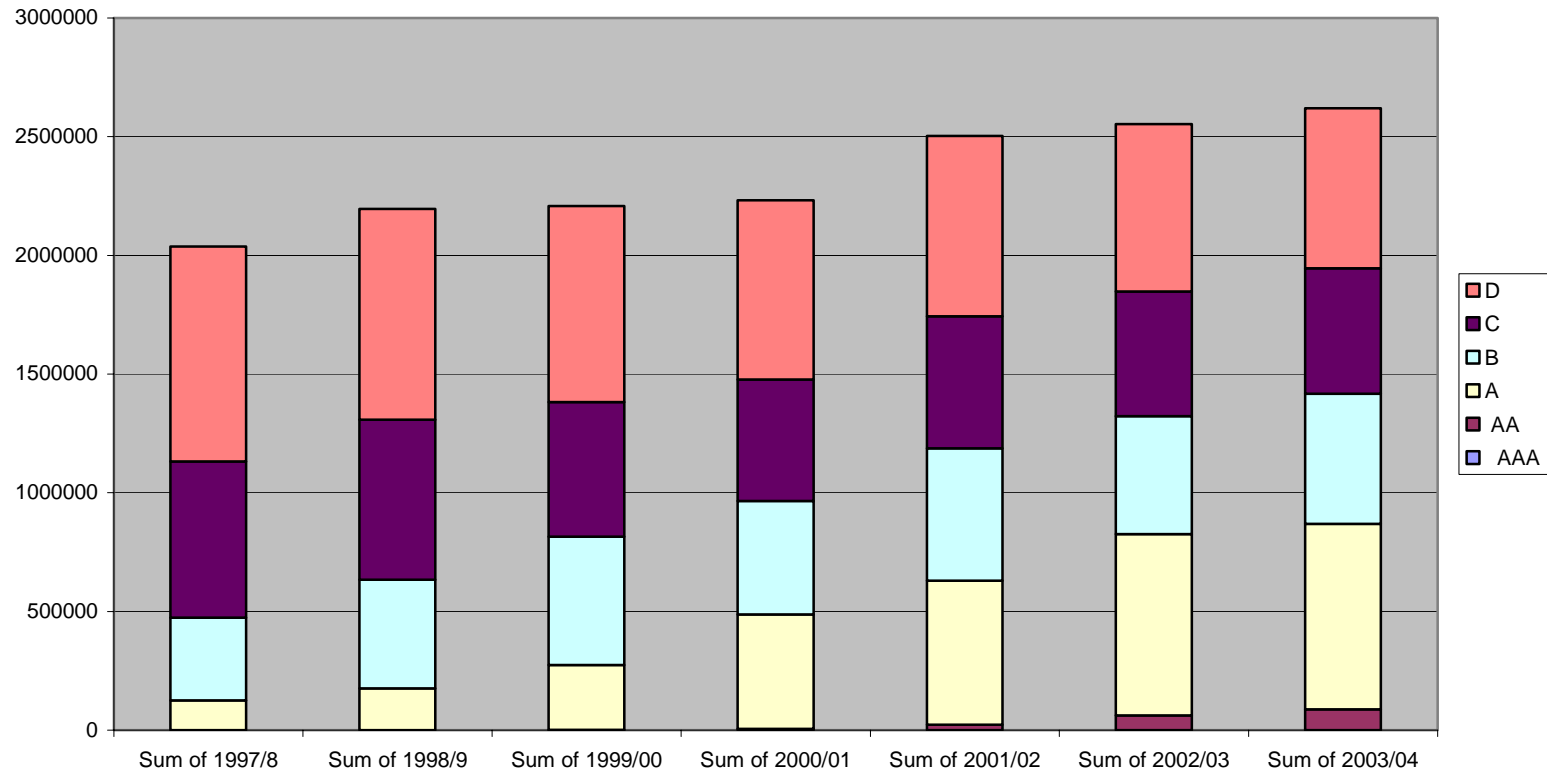


Figure 2: Distribution of CO₂ Emissions within VED Bands, 2003/4

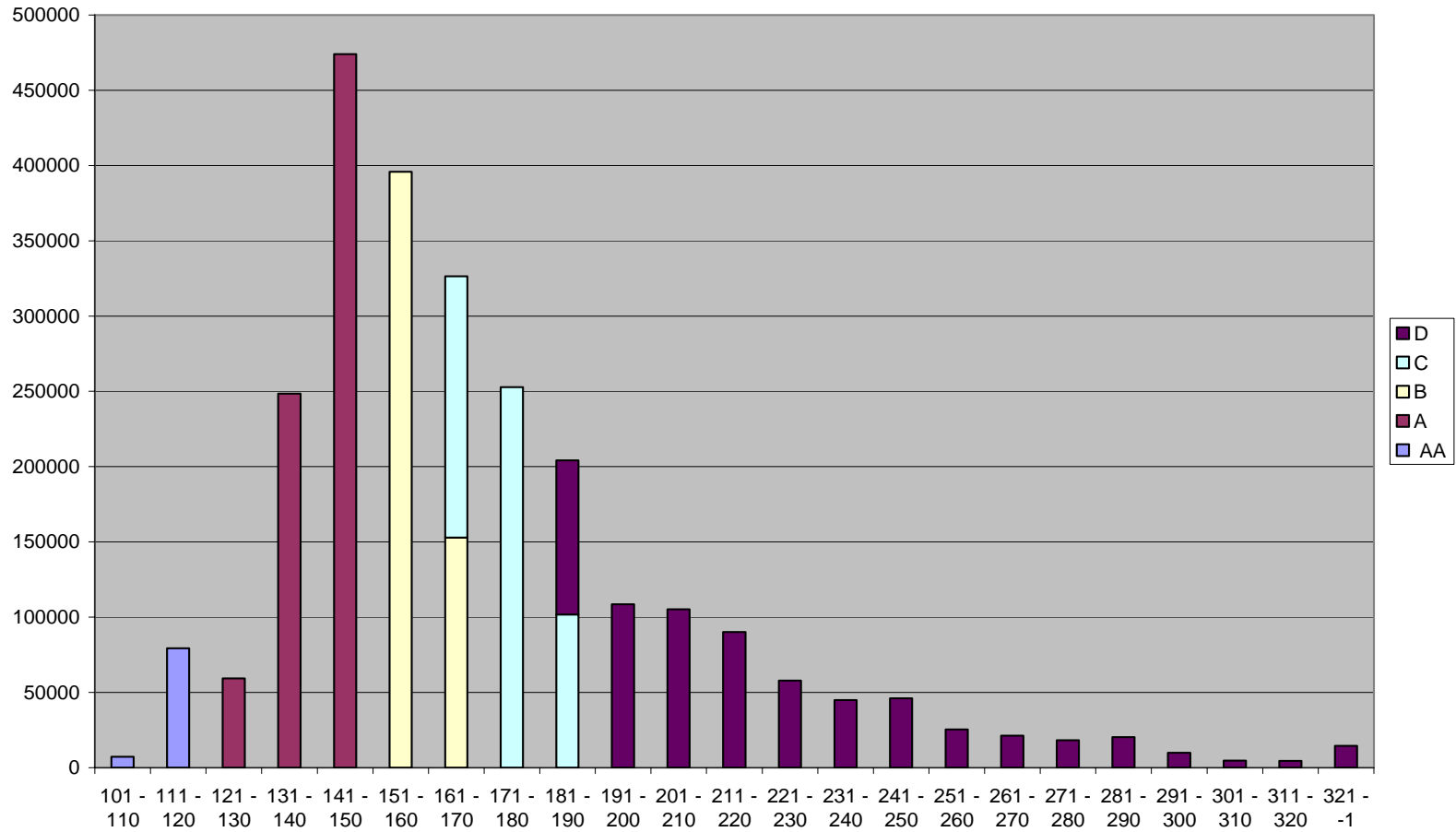


Figure 3: Distribution of CO₂ Emissions for Business and Private Purchases, 2003/4

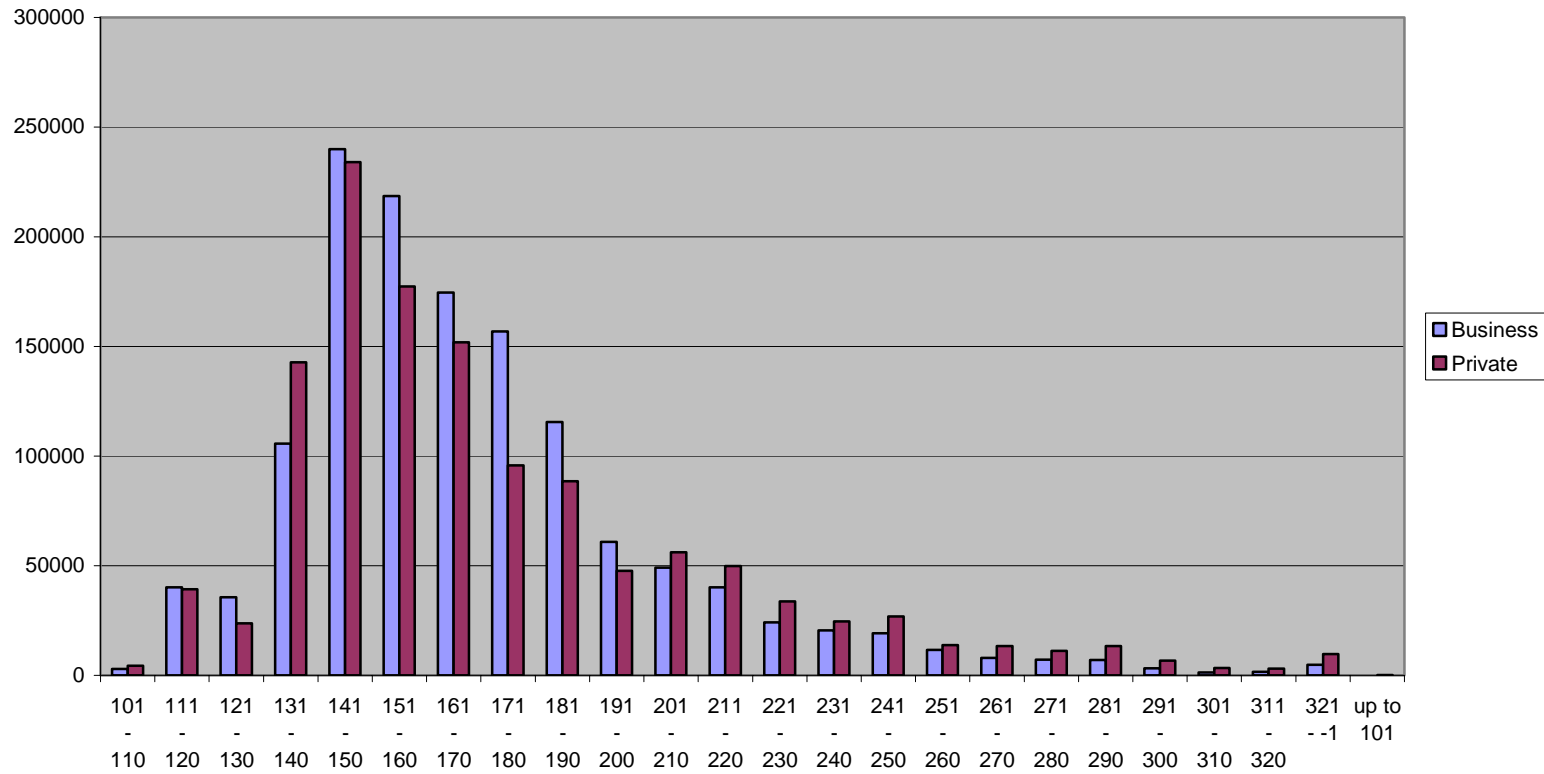


Figure 4: Development of the Distribution of CO₂ Emissions 1997/8 - 2003/4

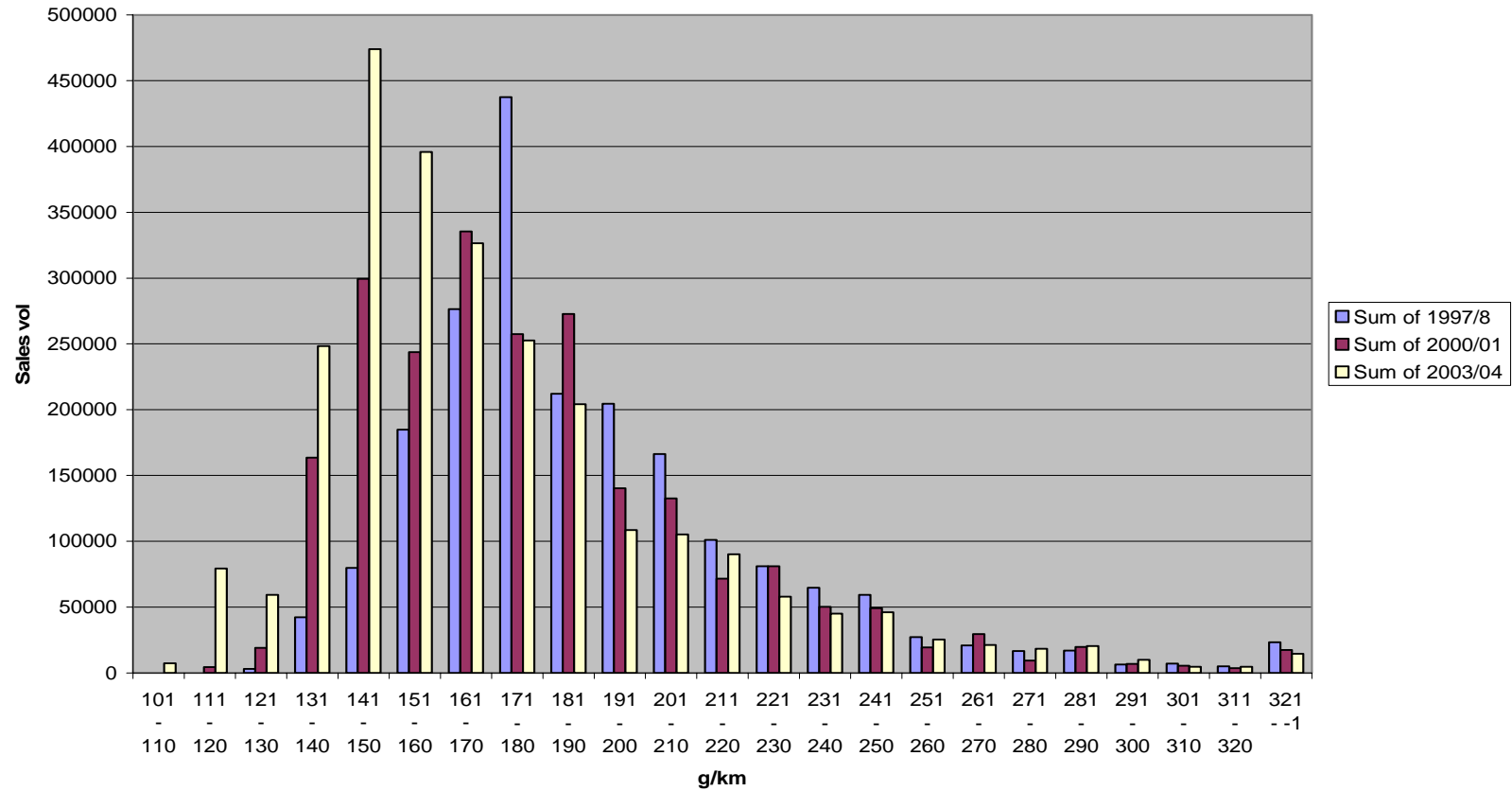


Figure 5: Average CO₂ by Market Segment

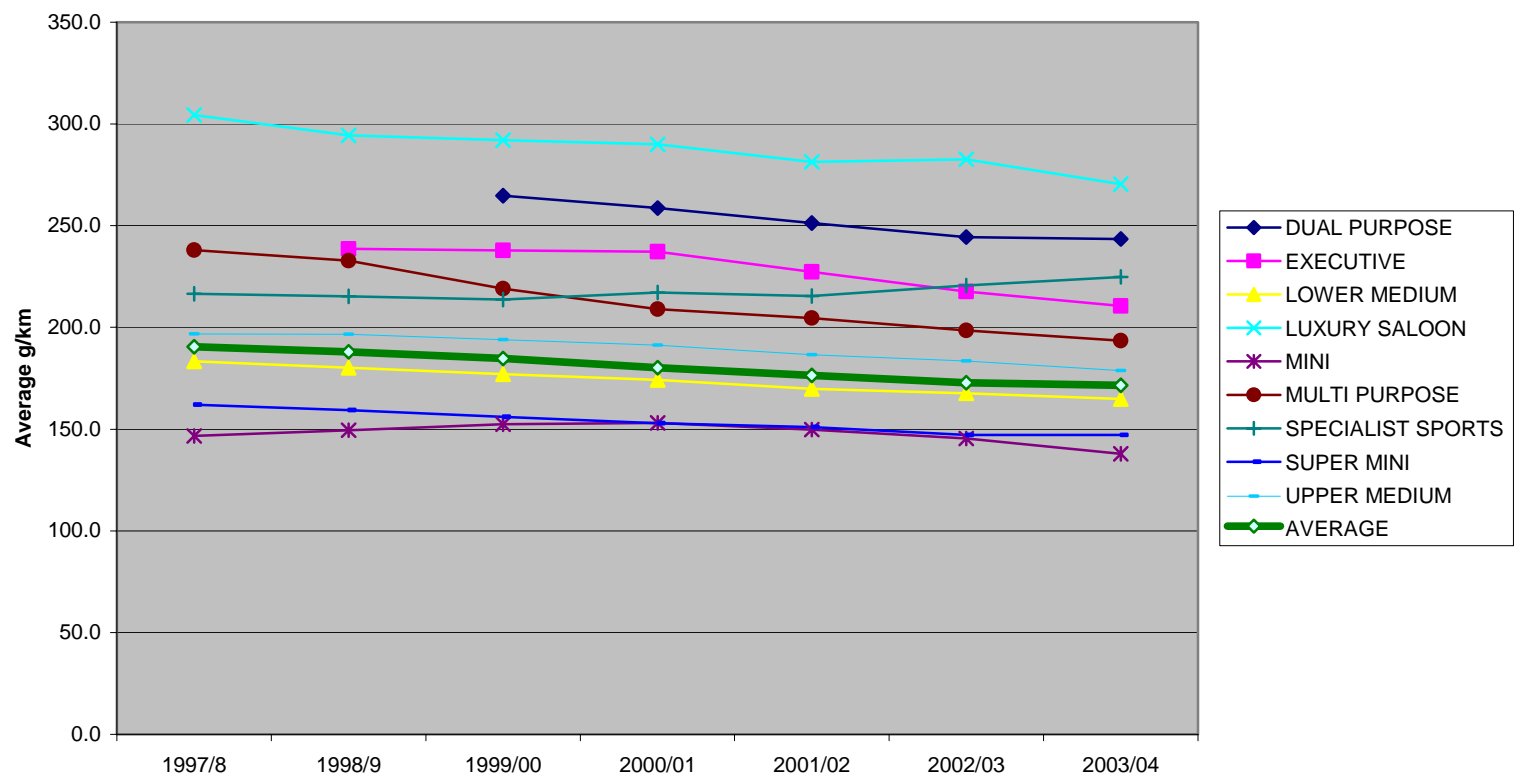


Figure 6: Annual Sales by Vehicle Class

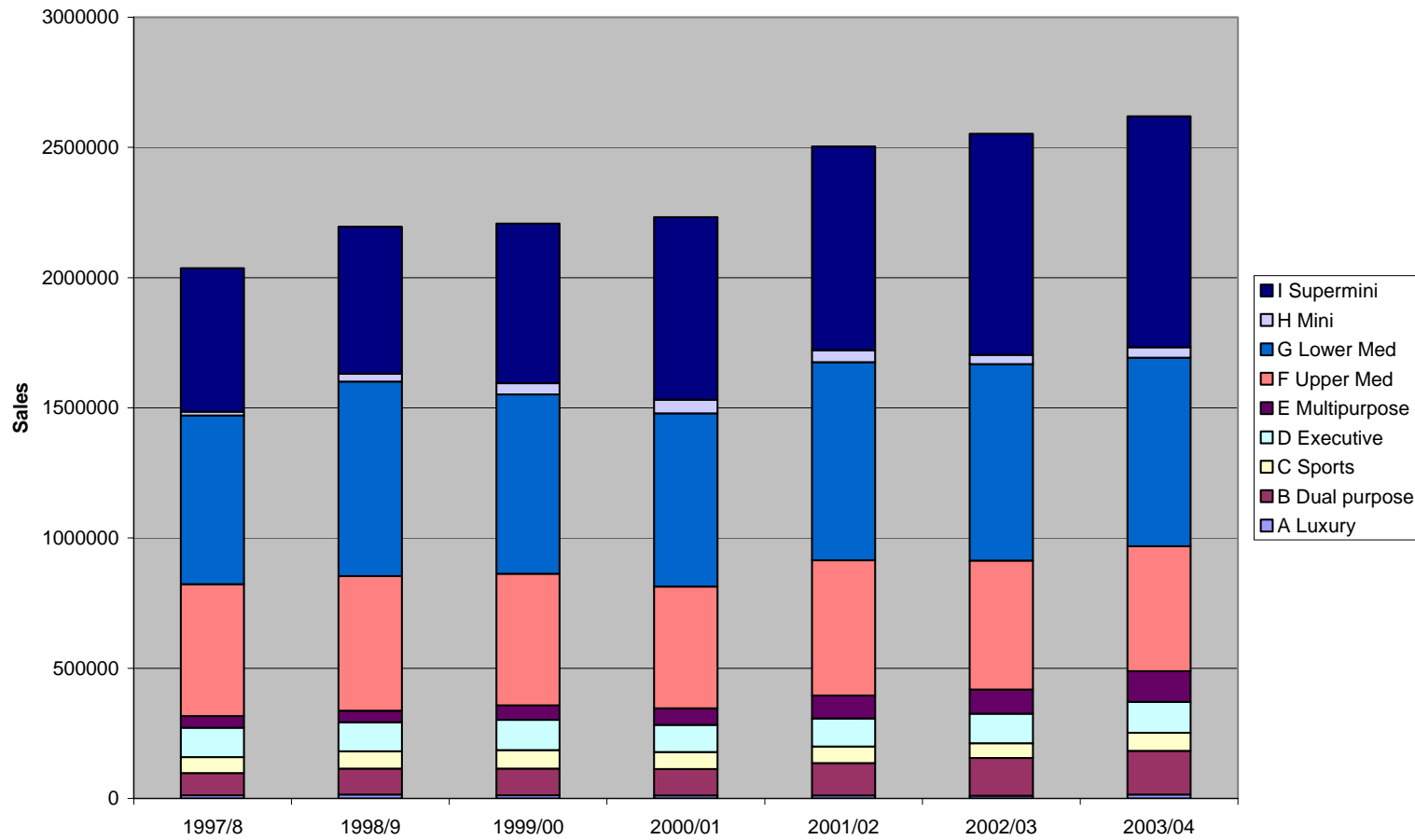


Figure 7: Product of Annual Sales and CO₂ by Class

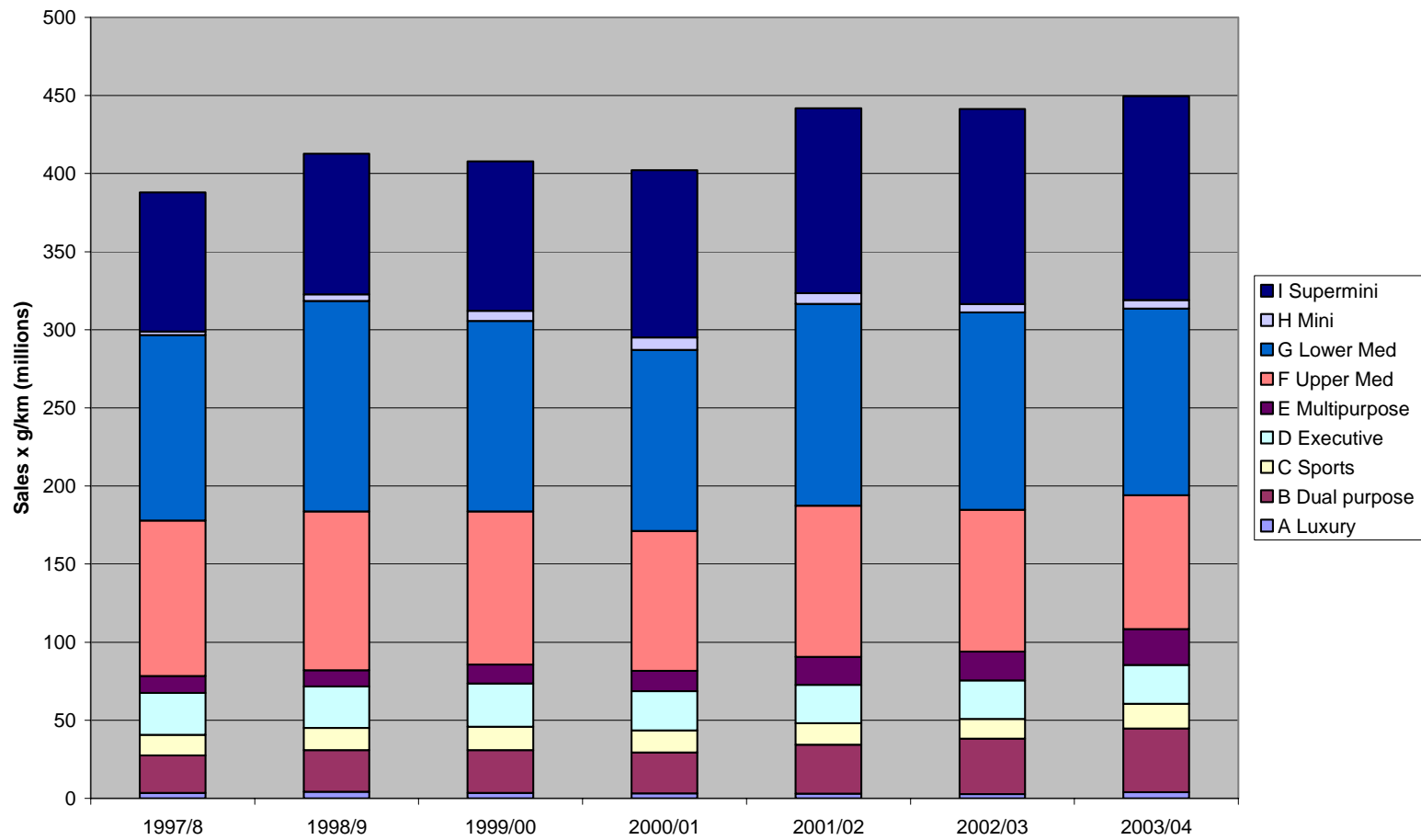


Figure 8: Product of Annual Sales and CO₂ by Class - Business

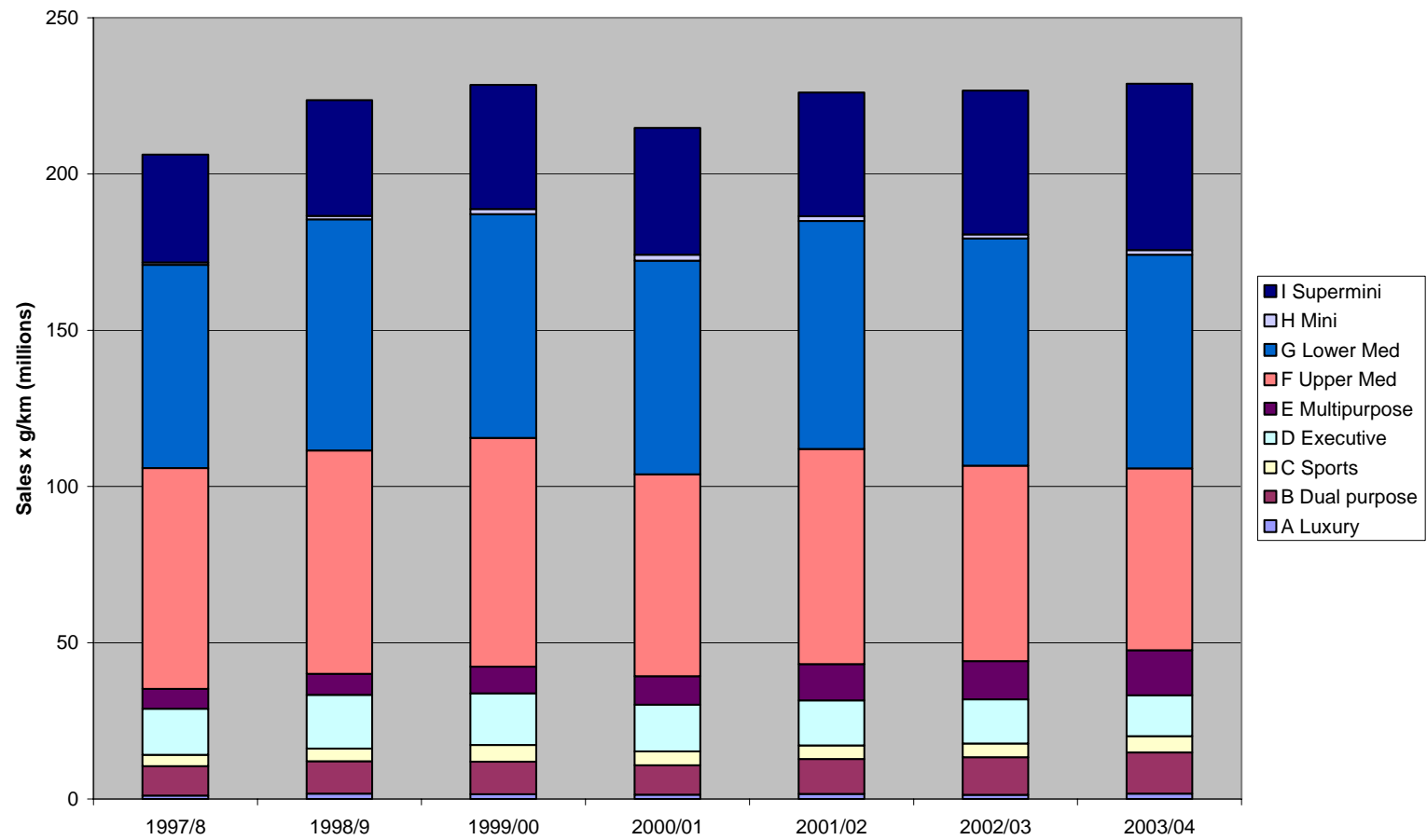


Figure 9: Product of Annual Sales and CO₂ by Class - Private

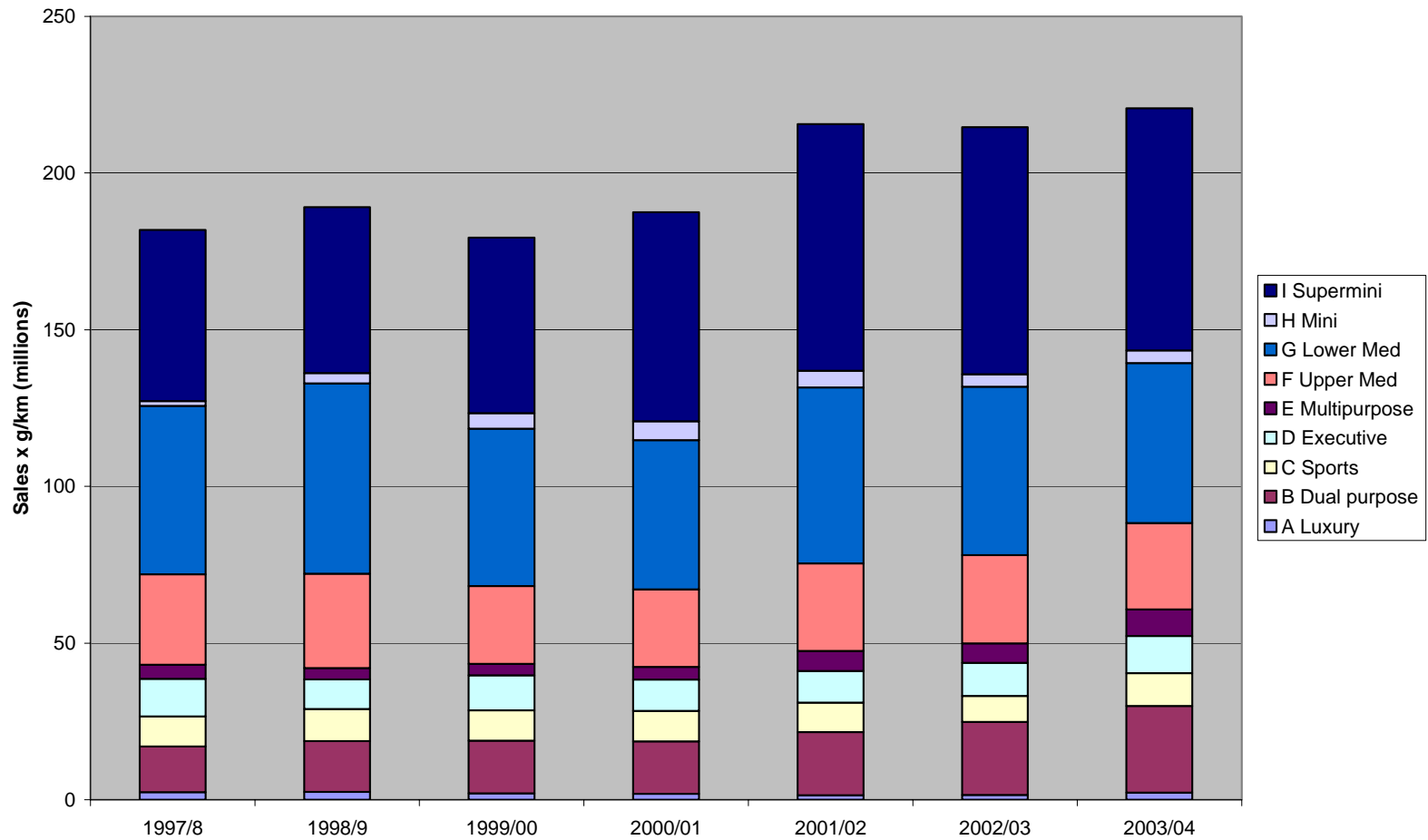


Figure 10: VED Band D – Private Purchases 1997/8 – 2003/4

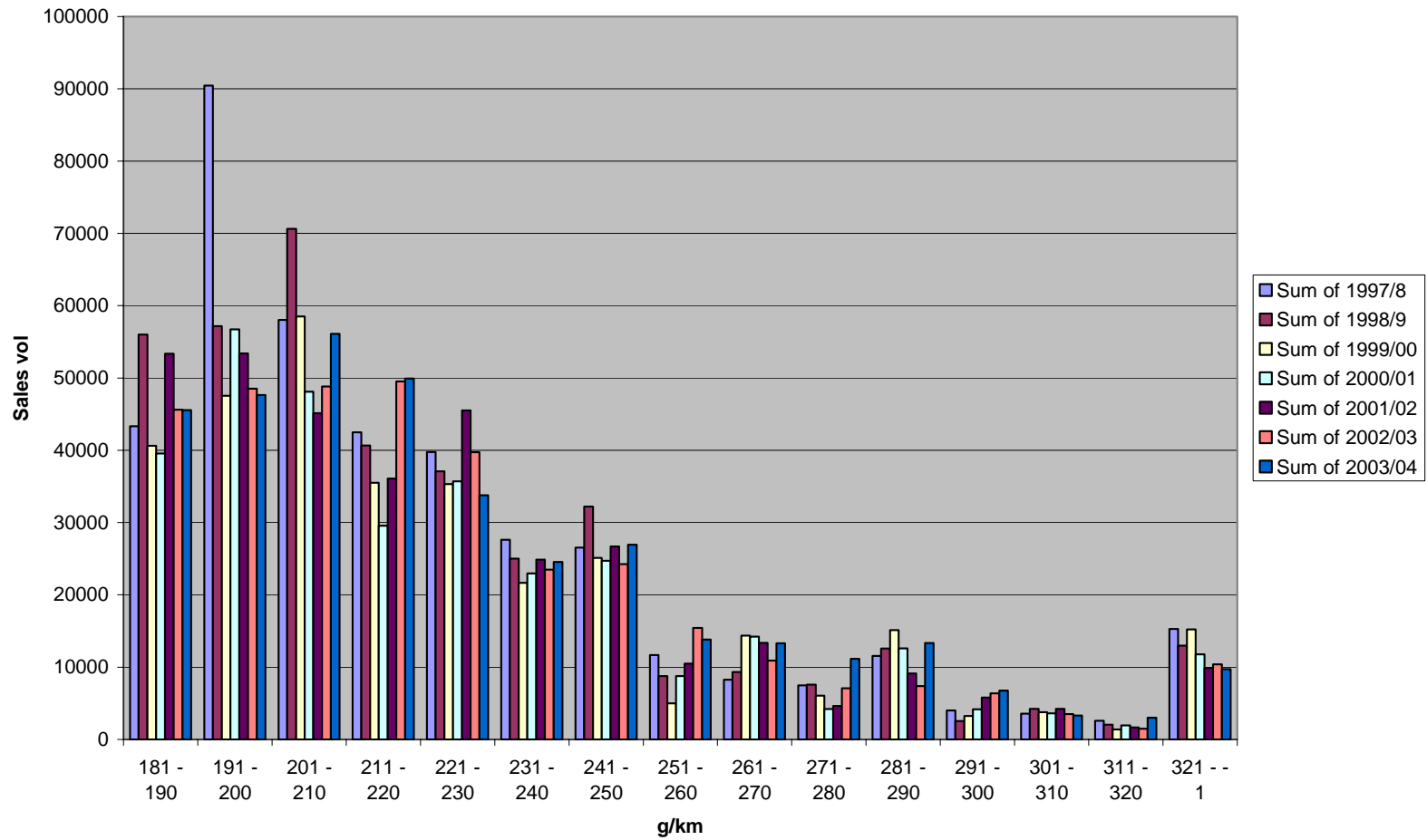


Figure 11: VED Band D – Business Purchases 1997/8 – 2003/4

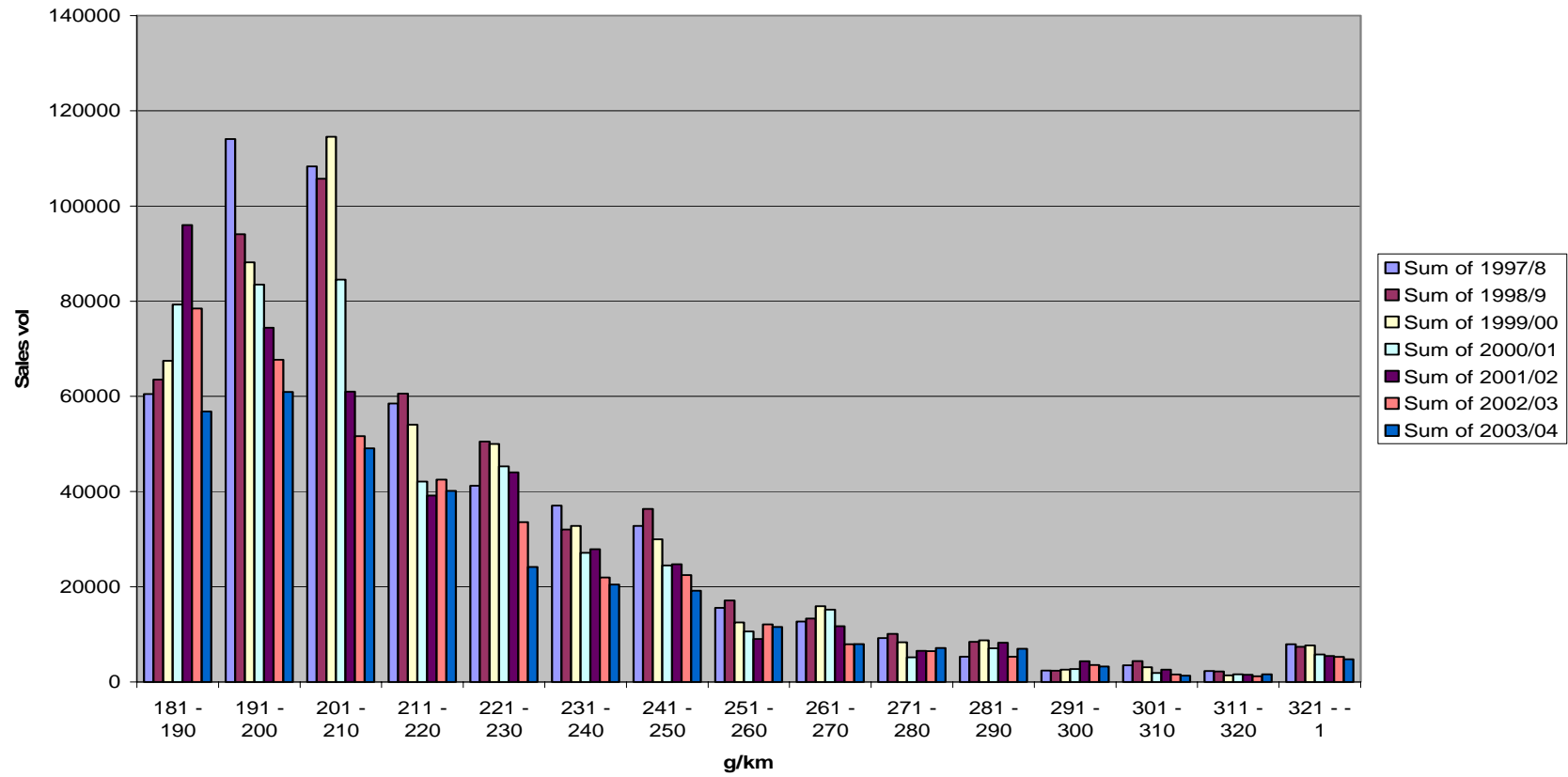
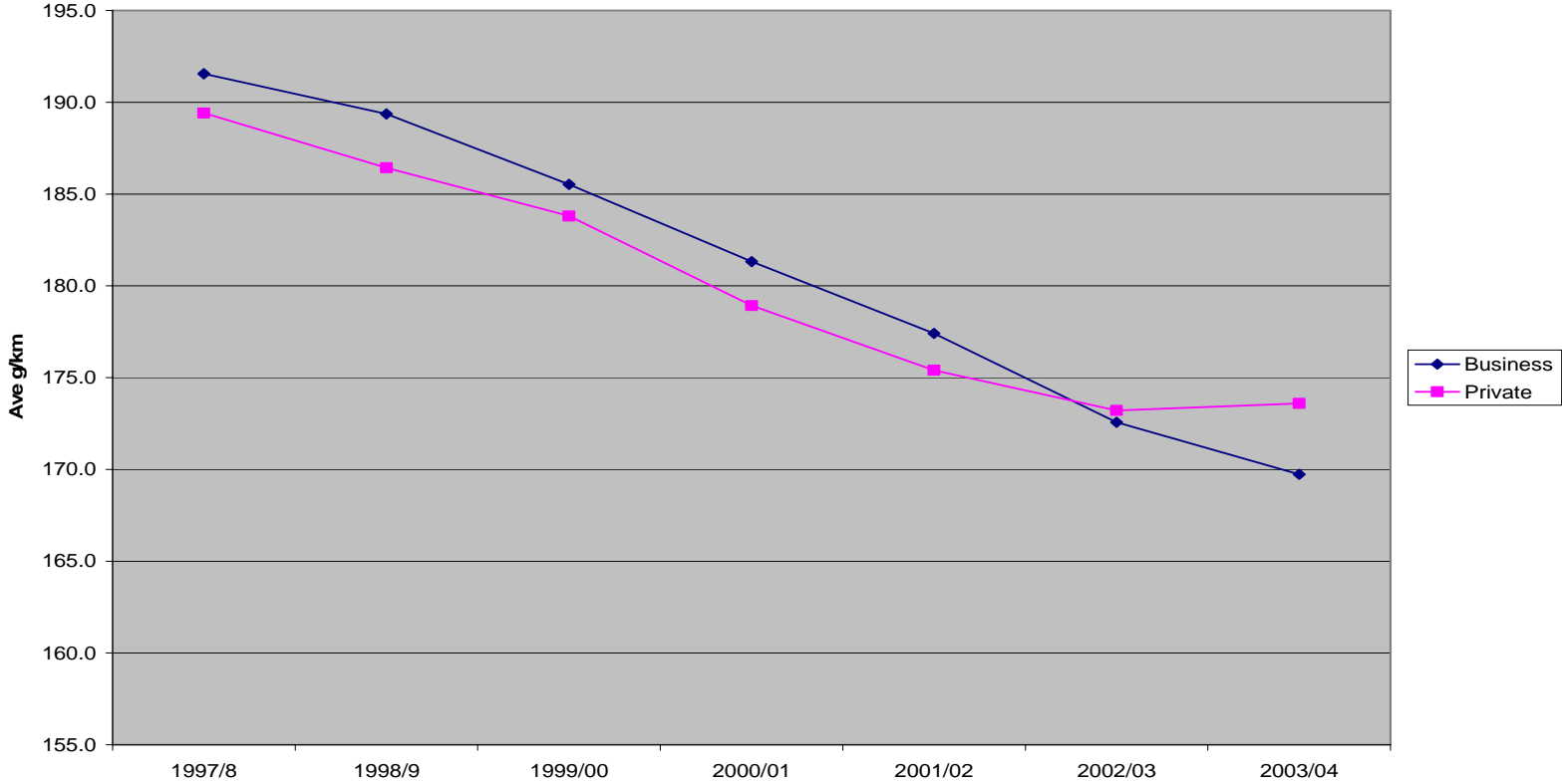


Figure 12: Development of Average CO₂ Emissions for Private and Business Purchases 1997/8 – 2003/4



VED Bands: Passenger Cars (Source: DVLA)							
		Diesel Car		Petrol Car		Alternative Fuel Car	
		TC 49		TC 48		TC 59	
Bands	CO₂ Emission	12 months	6 months	12 months	6 months	12 months	6 months
	Figure (g/km) *	rate £	rate £	rate £	rate £	rate £	rate £
Band AAA	Up to 100	75	41.25	65	35.75	55	30.25
Band AA	101 to 120	85	46.75	75	41.25	65	35.75
Band A	121 - 150	115	63.25	105	57.75	95	52.25
Band B	151 - 165	135	74.25	125	68.75	115	63.25
Band C	166 - 185	155	85.25	145	79.75	135	74.25
Band D	Over 185	165	90.75	160	88	155	85.25