Consumer Journals and Hedonics: A Puzzle

Derek Blades[1]

Abstract: This note describes an attempt to use the product information contained in a British consumer journal to estimate the values that consumers attach to particular characteristics of four popular durable goods. It is argued that information in such journals should be particularly suitable for hedonic regressions because they measure actual transaction prices and because the product information refers to the most commonly purchased models. For two of the goods - fridge-freezers and multi-media home computers - the results raise doubts about the basic premise underlying hedonic regression; no meaningful relationships can be found between price and operating characteristics.

1. Introduction

This note examines the question of whether the product information contained in consumer journals can be used in hedonic regressions to ascertain the values that consumers attach to particular characteristics of consumer durable goods. These are the values needed to distinguish between price and quantity when a manufacturer changes the characteristics of a model. This distinction is essential in order to make quality adjustments for consumer price indices.

By "consumer journals" I mean publications which are funded by associations of consumers. This note uses material from recent editions of **Which?**, published by the U.K. Consumer Association. Similar journals are published by consumer associations in most OECD countries. A common feature of these journals is that they publish reports on tests carried out on consumer goods in the course of which they collect and publish information on the prices, characteristics and performance of the goods concerned.

In considering whether this information could be exploited in an "hedonic" context, two prior questions need to be answered. First, when tests are carried on, say, vacuum cleaners or paint strippers how are the different models selected? And second, what kinds of prices are reported? The editor of **Which?** has supplied information on these two points. She has explained that the models tested are those most widely available from the largest sellers. The prices quoted in the reports are the lowest prices found by their investigators; statisticians may feel more comfortable with an average rather than a single price quotation, but the important point is that they are genuine transaction prices. On both these points, **Which?** staff have done something which is difficult for academic researchers and even national statistical offices to do. They have investigated the market to identify which models are most widely available from the most popular outlets and they have recorded a transaction price by actually acquiring one of the goods at that price.

The literature on hedonic price measures shows that researchers have frequently had to make use of list prices even though they recognise that these may bear an unknown relationship with transaction prices[2].

---

[2] For example, "Another deficiency [of the study] relates to the use of list rather than transaction prices. Ideally, a price index requires transaction prices". (Cole et al. 1986, p. 49.) "Unfortunately, data on transactions prices are not available to us." (Berndt and Griliches, 1992 p. 64.)

In addition, the selection of models appears to be usually made from inspection of trade catalogues with the risk that some rarely sold or obsolete models may be included in the studies. Using information only on the most widely available models, as in this study, can be seen as a simple method of weighting, using weights of 1 or 0 depending on whether the good is, or is not, "widely available". Ideally, the weights should refer to consumers' preferences as measured by actual expenditures on the different models. The simple weighting system used here is, however, preferable to equal weighting for all models which is the usual practice when trade catalogues are used.

2. Data base

Which? reports follow a standard format. The models are listed in columns and the test information, given in rows, is divided into three blocks - specifications, features, performance. This note looks at recent test reports on four consumer durable goods - jig saws, fridge freezers, steam irons and multimedia personal computers

Specifications always include price and country of manufacture and characteristics such as size, weight, power input and annual running costs. **Features** describe particular things that the models can or cannot do such as automatic de-frost for freezers, self cleaning system for steam irons, variable speed for jig saws, etc. **Performance** gives an assessment by the *Which?* testers of how well each model did the things expected of it: how stable was the freezer temperature, how sharp was the PC screen, how fast did the jig saw cut? *Which?* uses five symbols to grade performance going from very bad, to very good.

As noted above, the purpose of this note is to see whether data bases of this kind could be used in regression analyses in order to ascertain the values that consumers attach to particular characteristics. My emphasis on the **consumers'** perception of the utility of a particular characteristic has implications for the selection of variables for use in the regression analyses. In particular, it excludes those variables which could not be perceived by consumers when they evaluate different models prior to making a purchase. Most of the performance variables fall in this category since prospective purchasers are not usually able to use the goods before buying them.[3] They must base their assessment on the things that they can see and read by looking at the good or its package or that they can learn from a shop assistant. Most of these things are included under **specifications** and **features** in *Which?* test reports.

One exception is the performance of personal computers. These are generally displayed in such a way as to to invite customers to tinker with them. Performance variables such as "screen quality" and "computing speed" can, therefore, be compared between competing models and these two performance variables are used in the regressions below for multimedia personal computers.

One final point about the selection of variables: in the extensive literature on hedonic indices for computer equipment in the United States, there is a strong emphasis on the importance of technical knowledge in identifying relevant characteristics.[4] This may (or may not) be legitimate for the indices calculated by the U.S Bureau of Economic Analysis (BEA) which are used for deflation of capital investment, but it would be inappropriate to ask product engineers to identify characteristics that bear on

---

"Discounting is common in the computer industry, and the use of list, rather than transaction, prices in the sample may bias the measures of price change if discounts change over time" (Cartwright, 1986, p.9.)

[3] "Performance" will of course have an impact on purchasing decisions for people who read *Which?* before deciding which model to buy. I assume that very few consumers base their purchasing decisions on *Which?* test reports.

[4] "Determining the characteristics of a particular product requires a great deal of technical information." (Triplett, 1986, p. 38.) "The authors (IBM staff) had strong views with respect to the variables to be included in the hedonic regressions ..." (Cole et al, 1986, p. 44.)

the evaluation of consumer utility. And it is consumer utility alone that is relevant for a consumer price index. The advantage of the hedonic approach is that it enables the statistician to identify, in an objective fashion, the characteristics that consumers really do value in the products they buy. But to reap this advantage the statistician must allow the regression to select, from the full range of characteristics, those which are significantly correlated with transaction prices. The hedonic principal is perverted if product engineers or other technical experts are invited to nominate the characteristics to be included in the regression equation.

Associations of consumers, such as the one that produces *Which?* are much better placed than product engineers or other technical experts to identify the various characteristics that are likely to affect consumer utility. There is, however, the danger that they may be too perfect as consumers. They may be so rational in their selection of characteristics that they omit characteristics that real consumers may, irrationally, value highly.

3. Regression results

Sample sizes are small for all four goods: PCs, 12; steam irons, 15; jig saws, 17; fridge freezers, 21. This should not be interpreted as a fault with the data base. If *Which?* testers have done their job well in identifying the models that consumers usually buy, the addition of rarely purchased models would add noise rather than information to the regression results. These small sample sizes presumably reflect the fact that the U.K. market, and perhaps the European market, cannot support more than a limited number of competing models. The small size of the samples makes it difficult to obtain reliable regression estimates and this may mean that hedonic methods are impractical in the real world.

The independent variables are of two kinds - **continuous variables** such as input power, hard disk size, freezer space and the "performance" variables used for computers and **indicator variables** which are assigned values of 1 or 0 depending on whether the item does or does not possess a particular feature or quality. Simple, arithmetic linear regressions were first calculated between prices and each of the continuous variables in order to turn to determine whether they were both positively and significantly correlated with price. Of the continuous variables which passed this dual test, the one that had the highest R^2 coefficient was used in a multiple linear regression with each indicator variable in turn. This is a rather simplistic analysis which tries only to answer the question of whether data bases in consumer journals could be used for hedonic regression analyses.

Summary results are given in Table 1. Below are some comments on the main findings:

a. Jig saws. The four continuous variables are weight, length of cable, input power and maximum cutting speed; indicator variables are whether or not the model had an anti-splinter device, a variable speed control and a "pendulum action" which is a device to maintain speed when cutting thick wood. Only weight and input power were both positively and significantly related to price. Weight is commonly regarded as a proxy variable in hedonic analyses[5] but in the case of a power tool, consumers may regard weight as a desirable quality in itself; a heavy tool may be seen as solid and durable while a light one is seen as flimsy and fragile. Power input has a marginally higher R^2 than

---

[5]   "... early hedonic studies on automobiles employed weight as a variable, even though weight has little to do directly with the usefulness of an automobile ... weight stood as a proxy for the true characteristics" (Triplett, 1986, p. 38.)

weight (0.39 against 0.36) and was used in the multiple regressions with each indicator variable in turn. All three indicator variables have the expected positive relation with price.

b. Fridge freezers. These are dual purpose appliances consisting of a normal refrigerator with a large and separate freezer compartment. Continuous variables are height, external volume, fridge storage space, freezer storage space, total storage space, annual running costs and number of shelves; no indicator variables were used. All variables except fridge storage space were positively related to price but none of the correlations are remotely significant. What do consumers look for when they buy a fridge freezer? None, apparently, of the characteristics that seemed important to the *Which?* testers. The absence of positive correlation between price and fridge storage space is particularly puzzling. Perhaps this is because the choice of model is mainly determined by the space available to house it. Purchasers first decide where it is to be installed and then buy the largest model available to fit that space without considering the price.

c. Steam irons. These are electrically heated smoothing irons that eject bursts of steam to facilitate the smoothing process. Only two continuous variables were available - weight and length of flex; indicator variables were "vertical steaming" and self cleaning capabilities. ("Vertical steaming" means that the iron can be used to smooth vertically suspended fabrics such as hanging curtains or a suit on a coat-hanger). Weight was positively and significantly correlated with price; both indicator variables were also strongly correlated with price.

d. Multimedia personal computers. These are PCs with a built in CD ROM drive. According to *Which?* "they include a sound card and a pair of stereo speakers. They can display colourful graphics and have enough computing power to be able to run multimedia software." Continuous variables were screen size (measured diagonally), processor speed, memory supplied, maximum memory that could be added, hard disk size, computing speed and screen quality. The last two were *Which?* performance variables using a scale of 1 to 5 for "very bad" to "very good". One indicator variable was used: whether the price includes office or entertainment software. Surprisingly, none of the continuous variables were significantly correlated with price and two apparently important technical characteristics - processor speed and maximum memory - were negatively correlated with price. Both performance variables - screen quality and computing speed were positively correlated with price but neither correlations were significant. The indicator variable - whether software was included in the price - was positively correlated with price. How can these results be interpreted? Perhaps purchasers do not care about processor and computing speed or about memory size because even models with the lowest speeds and the least memory are regarded as powerful enough for the uses they expect to make of them. Additional speed and memory are luxuries that consumers do not need and will not pay for. If this is indeed the correct way of interpreting these regression results, BEA type hedonic indices that measure quality exclusively in terms of memory and processing speed appear to be inappropriate for consumer price indices. British consumers at least pay no attention to either variable. Unfortunately, the regression analysis provides little evidence about what characteristics do catch their attention.

4. Conclusions

Which? and similar magazines in other OECD countries are free and attractive sources of information on the characteristics of consumer durables. They record genuine transaction prices and their staff investigate markets to identify the commonest brands and models on sale.

Sample sizes tend to be small. This presumably reflects the fact that European markets cannot support more than 20 or so competing models of a given type of consumer durable good. Small sample size limits the possibilities of using hedonic regression methods to estimate the values that consumers attach to particular features.

For two of the four consumer durable goods examined in this note - jig saws and steam irons - the *Which?* data base provided enough information to show what characteristics and what features are valued by consumers. A more sophisticated econometric analysis could probably assign values to these characteristics.

For the other two items covered in this note - fridge freezers and multimedia PCs - the regression results were frankly astonishing. Consumer willingness to pay, as measured by *Which?* transaction prices, cannot be explained by any of the characteristics that *Which?* testers believe to be important. What is going on here?

Table 1. Summary ANOVA regression results

Variables Continuous (C)	Indicators (I)	Intercept	Coefficients (C)	(I)	R2
Jig saws (sample size 17), Which? October 1996					
Weight	-	-34.2	52.9	-	0.36
Cable length	-	58.2	6.1	-	0.01
Input power	-	-20.5	0.2	-	0.39
Max. speed	-	183.9	-34.3	-	0.14
Input power	Anti-splinter	20.0	0.1	34.8	0.56
Input power	Variable speed	-21.2	0.2	33.5	0.54
Input power	Pendulum	17.5	0.1	33.1	0.57
Fridge-freezers (sample size 21), Which? June 1996					
Height	-	190.6	1.0	-	0.03
External volume	-	229.7	0.0	-	0.02
Fridge storage vol.	-	371.7	-0.2	-	0.01
Freezer storage vol.	-	304.3	0.5	-	0.02
Total storage vol.	-	302.6	0.2	-	0.00
Running cost	-	318.8	0.5	-	0.00
Number of shelves	-	238.8	16.4	-	0.05
Steam irons (sample size 15), Which? April 1996					
Weight	-	-13.5	40.0	-	0.56
Flex length	-	26.5	1.8	-	0.00
Weight	Vertical steaming	20.2	3.9	16.6	0.71
Weight	Self cleaning	-10.0	31.6	8.4	0.70
Multimedia computers (sample size 12), Which? October 1995					
Screen size	-	1044.5	16.5	-	0.03
Processor speed	-	1861.4	-3.8	-	0.07
Memory supplied	-	1373.3	27.5	-	0.07
Max. memory	-	1793.2	-1.4	-	0.23
Disk size	-	1531.5	0.1	-	0.01
Comp. Speed	-	1845.3	-61.7	-	0.06
Screen quality	-	1534.8	14.9	-	0.00
Screen size	Soft included	677.4	22.4	227.7	0.37

References

Berndt, Ernst R. and Zvi Griliches. *Price Indexes for Microcomputers*: *An Exploratory Study* in Price Measurements and Their Uses, edited by Murray F. Foss et al., The University of Chicago Press, Chicago and London, 1993.

Cartwright, David W. *Improved Deflation of Purchases of Computers* in Survey of Current Business, March 1986, Bureau of Economic Analysis, Washington, D.C.

Cole, Rosanne, Y.C. Chun, Joan A. Barguin-Stolleman, Ellen Dulberger, Nurhan Helvacian and James H. Hodge. *Quality Adjusted Price Indexes for Computer Processors and Selected Peripheral Equipment,* in Survey of Current Business, January 1986, Bureau of Economic Analysis, Washington, D.C.

Triplett, Jack E. *The Economic Interpretation of Hedonic Methods*, in Survey of Current Business, January 1986, Bureau of Economic Analysis, Washington, D.C.