A Statistical Analysis of the Prices of Personalised Number Plates in Britain

Mr Matthew Corder and Professor Andrew Oswald

Warwick University

Department of Economics.

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This study was done principally by Matthew Corder, who is the main author, and was supervised during the summer of 2002 by Andrew Oswald.

Summary

This paper provides what we believe to be the first statistical analysis of the market for personalised car number plates. Using data on nearly 3000 number plates -- all sold at British DVLA auctions -- we derive a formula to explain the prices paid. Our formula shows which attributes are valuable, and puts monetary figures on each attribute. Shortness of number plate and having it spell out a person's name are what buy status. Spelling out a word is, in itself, of little value. Our statistical formula can be used to value any number plate. For economists, this market is an unusually interesting one to study, because a number plate is an unusually pure 'status good'. Our main findings are the following:

- Having a person's surname in a number plate is the single most valuable characteristic. It raises the plate's value by an average of £1300.
- Having a person's first name in a number plate is worth £1100.

- Having a number 1 at the start of a number plate makes it worth an extra £1000.
- Intriguingly, people severely ‘over-pay’ (by a remarkable £2500) for registrations sold in DVLA Classic Collection auctions rather than DVLA Custom Marks auctions. This may because richer people attend, or because they get carried away or misled by the term ‘Classic’ in the title of the auction.
- A word (other than a person’s name) in a number plate has only marginal benefit – perhaps 200 pounds at most. We found this surprising.
- As expected, shortness of number plates adds value. Extra letters reduce a number plate’s value by more than extra numbers do.
- An S at the start of a number plates raises its value by £1000. An F lowers it. We are not sure why these letters are so special.
- It pays to buy late in an auction. A number plate sold at the end of a 1000-lot auction goes on average for £350 less than an equivalent one sold at the start.
- The full best-fitting statistical equation for the price of personalised number plates is:

Price = 4619 – (0.352×Lot Number) + (2596×being a Classic Collection) + (1122×First Name) + (1256×Surname) – (1149×having 2 Letters) – (2125×3 Letters) – (2714×4 Letters) – (3015×5 Letters) – (780×2 Numbers) – (829×3 Numbers) – (3105×4 Numbers) – (565×First Digit F) + (1072×First Digit S) – (1042×First Digit is a 2) – (717×First Digit 3) – (832×First Digit 4) – (700×First Digit 5) – (686×First Digit 6) – (796×First Digit 7) – (553×First Digit 9)

Status matters a lot to human beings. Yet, perhaps because of its complexity and subtlety, economists have found this a difficult topic to study empirically. Most economics textbooks ignore concerns about status altogether or assign it to footnotes.

This short paper describes an empirical study of status. It uses data on personalised number plates in Great Britain. This is an unusually 'pure' market for status goods. The description below draws on Matthew Corder's work.

Personalised Number Plate Pricing Equation Regression

Data

To construct a pricing equation for personalised car number plates I collected data from the DVLA website (www.dvla-som.co.uk). The DVLA conducts auctions of selected personalised number plates throughout the year and their website had information on the last two Classic Collection auctions at Newport and Linton, and the last Custom Marks auction at Pontefract. A total of 2748 number plates were up for sale, although, as Table 1 shows, 199 of the registrations were left unsold.

Table 1 – Number of Number Plates in Sample

	Custom	Classic	Total
Unsold	73	126	199
Sold	1075	1474	2549
Total	1148	1600	2748

The average price of the 2549 registrations sold was over £3100, raising a total of £8,057,775. Table 2 shows the most expensive registrations sold in the three auctions used in this dataset.

Table 2 – Highest Value Registrations in the Three Auctions used in Regression

Reg. No.	Price
MAR 71N	£35,000
1 PGP	£33,000
80 SS	£31,000
W4 TER	£25,500
E111 OTT	£21,000
3 OO	£20,200
BOB 8Y	£19,000
A11 MED	£17,600
54 RAH	£17,500
1 JTL	£17,100

Using the data taken from the DVLA website, a dataset was created with information on the lot number and hammer price of each number plate. Information on the first digit of the plate and the number of letters and numbers that it contained, and whether the plate contained two- or three-letter initials, were also included. First name, surname, and word dummies were created by asking a small group of individuals to review the number plates and to indicate whether they thought the plates contained a first name, surname and/or word. These responses were collated and a dummy variable was included if one or more individuals thought that the number plate contained a word, surname or first name.

Results

To estimate the price equation I used a simple OLS regression. As previously stated, some of the number plates in the three auctions were not sold, and these plates were not included in the regression -- reducing the final sample to 2549 number plates. To allow for the fact that the effect of increasing the number of letters and numbers in the number plate may not be linear, dummies for the number of letters and numbers in each plate were included in the regression, rather than using a single variable. Initially all the variables were included; in the regressions later, variables that were not statistically significant at the 10 per cent level were excluded from the regression. Some of the results are shown in Table 3 below. The figures in square brackets are the heteroscedasticity-consistent standard errors.

Table 3 – Personalised Number Plate Pricing Equation Regressions: cross-section data from three auctions in 2002

	Equation 1		Equation 2		Equation 3	
Constant	4863.56	***	4673.46	***	4619.17	***
	[421.03]		[417.35]		[411.98]	
Lot Number	-0.33723	**	-0.336249	**	-0.352046	**
	[0.168]		[0.168]		[0.170]	
Classic Collection Auction	2515.28	***	2535.1	***	2595.97	***
	[179.62]		[180.68]		[174.87]	
Contains First Name	1174.78	***	1168.57	***	1122.28	***
	[187.75]		[188.00]		[192.22]	
Contains Surname	1289.57	***	1272.25	***	1256	***
	[269.29]		[268.44]		[268.94]	
Contains Word	244.912	*	225.902			
	[136.07]		[140.12]			
2 Letters	-1187.07	***	-1160.28	***	-1149.05	***
	[288.35]		[288.98]		[289.81]	
3 Letters	-2219.92	***	-2167.57	***	-2125.08	***
	[280.92]		[286.13]		[284.65]	
4 Letters	-3022.55	***	-2832.51	***	-2714.14	***
	[361.76]		[363.30]		[353.72]	
5 Letters	-3261.48	***	-3095.96	**	-3015.19	**
	[1258.10]		[1263.20]		[1314.10]	
2 Numbers	-799.024	***	-786.034	***	-779.924	***
	[143.17]		[141.76]		[141.64]	
3 Numbers	-834.117	***	-841.067	***	-828.545	***
	[150.64]		[151.20]		[150.93]	
4 Numbers	-3190.65	***	-3107.37	***	-3104.88	***
	[689.65]		[655.83]		[655.63]	
First Digit is: F	-571.502	*	-577.119	*	-564.904	*
	[321.88]		[322.18]		[323.73]	
First Digit is: S	1049.82	***	1053.99	***	1071.88	***
	[393.87]		[394.06]		[396.34]	
First Digit is: 2	-1165.65	***	-1037.09	***	-1042.44	***
	[187.54]		[189.55]		[190.23]	
First Digit is: 3	-839.904	***	-708.874	***	-716.833	***
	[202.98]		[205.76]		[206.74]	
First Digit is: 4	-966.434	***	-835.531	***	-832.474	***
	[198.22]		[200.39]		[199.67]	
First Digit is: 5	-839.018	***	-709.712	***	-700.305	***
	[197.47]		[196.60]		[195.46]	
First Digit is: 6	-832.719	***	-699.506	***	-685.937	***
	[202.85]		[200.89]		[199.20]	
First Digit is: 7	-965.73	***	-829.688	***	-795.67	***
	[219.11]		[215.92]		[211.28]	
First Digit is: 8	-623.498					
	[419.07]					
First Digit is: 9	-705.301	***	-561.916	**	-552.594	**
	[241.74]		[236.42]		[236.73]	

Note:

*** Coefficient significant at 1 per cent level

** Coefficient significant at 5 per cent level

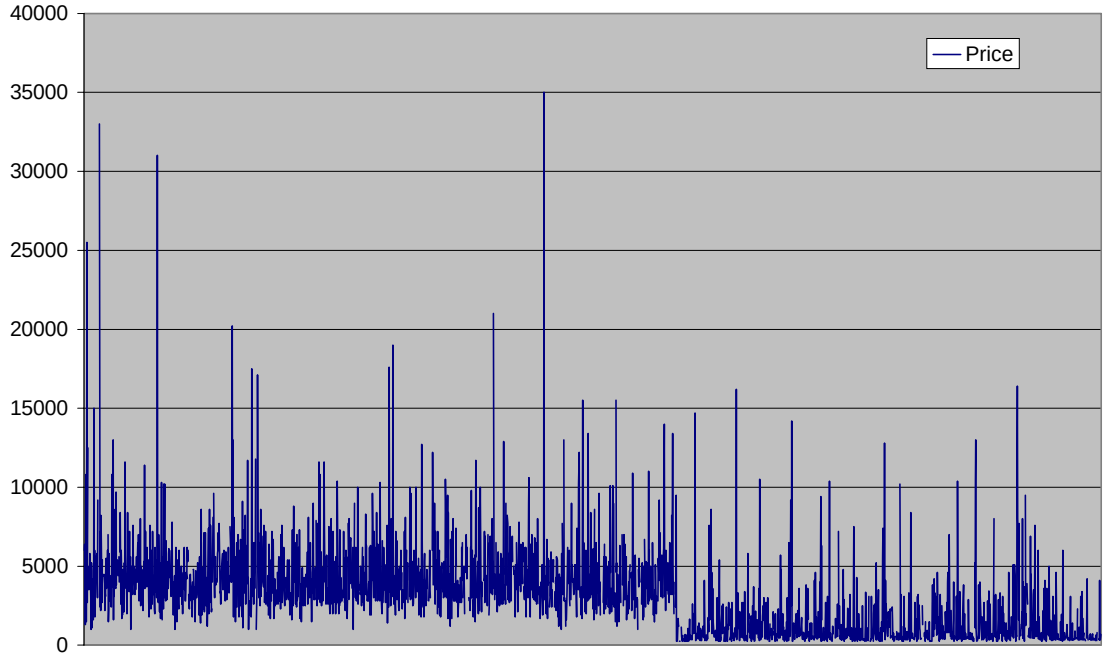
* Coefficient significant at 10 per cent level

Table 4 – Further Selected Statistics from the Number Plate Pricing Equations

	Equation 1	Equation 2	Equation 3
Number of Observations	2549	2549	2549
Number of Parameters	23	22	21
Sigma	2279.32	2280.81	2281.9
RSS	1.312E+10	1.315E+10	1.316E+10
R^2	0.3599	0.3588	0.3579
Adjusted R^2	0.3543	0.3535	0.3529
Log Likelihood	-23313.3	-23315.4	-23317.1
Normality	4656	4609.3	4648.9
	(0.000)	(0.000)	(0.000)
Heteroscedasticity	2.2774	2.3522	2.4263
	0.0005	0.0004	(0.0003)
RESET	2.2202	2.0737	2.1986
	(0.1363)	(0.1500)	(0.1383)

The equations here fail the test for heteroscedasticity. It is unclear whether this is due to the presence of several large outliers or the fact that there is some difference in the variance of the different auctions. Figure 1 shows a graph of the prices achieved in the three auctions. It shows that there is a definite break in the average price level between the number plates sold in the Classic Collection auctions and those sold in the Custom Marks auction. There also appears to be a difference in the spread of the price of the number plates in the different auctions -- with most of the number plates in the Classic Collection auctions selling for between 0 and £10,000 while registrations in the Custom Marks auction sold in a range between 0 and £5000. The graph also shows that there are problems with several outliers. While most registrations sold in the Classic Collection auctions sold for below £10,000 and most registrations in the Custom Marks auction sold for less than £5000 there are a limited number of plates that sold for more than this; four registrations sold for over £25,000. This may be the cause of the heteroscedasticity. Heteroscedasticity means that the standard errors are not accurate and that is why I have used White's heteroscedasticity-consistent standard errors (HCSEs) to take account of this problem.

Figure 1 – Plot of Number Plate Prices in the Dataset



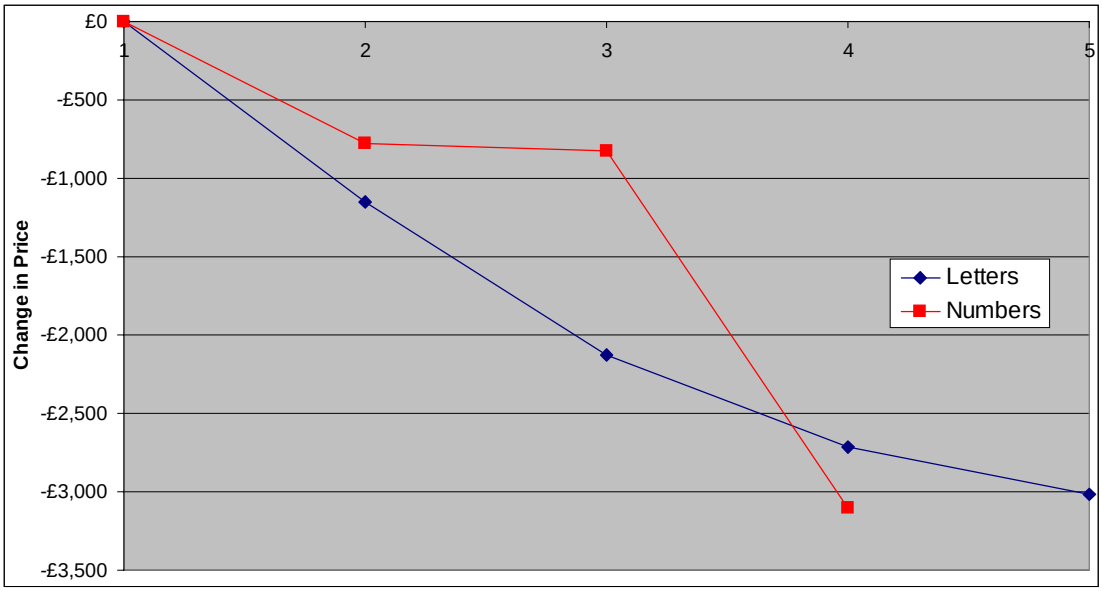
The regression does not pass the test for normality. This is at least partly due to the fact that there are several large outliers as mentioned previously, but I have not found any variable that adequately deal with these outliers. However, even though the residuals are not normal, the estimates of the coefficients are unbiased.

The coefficient on the Lot Number variable implies that moving a number plate one place later in the auction (raising the lot number by one) reduces the price of the number plate by 35 pence. In the case of the Classic Collection auctions, where 800 number plates are sold, this implies that the last number plate will sell for approximately £280 less than the first one, ceteris paribus. The results also imply that number plates in the Classic Collection auction have a premium of over £2500 above that of Custom Marks auction. Number plates which contain a first name or surname carry a premium of over £1100 and £1250 respectively. Number plates containing words also appear to have a small premium of around £200 but this coefficient is not statistically significant at the 10 per cent level.

There was a high degree of correlation between the two- and three- letter initial dummy variables and the dummy variables for number plates with two or three letters which caused problems with the regressions; they were therefore excluded from the regressions. The dummies for the number of letters and numbers in the each number plate were all significant and a plot of these coefficients is shown in figure 2 below. The results imply that increasing the number of letters in a number plate reduces its value but the effect diminishes as the number of letter increases. For example, while increasing the number of letters in a plate from one to two reduces its price by just under £1150, adding another letter reduces the price by only another £975 (a total fall of over £2100) and adding yet another letter reduces the price by less than £600. A number plate with five letters is worth over £3000 less than a plate with only one letter.

Adding a letter to a number plate also appears to have a greater effect on its price than adding a number does, at least initially. A number plate with two or three numbers in it is worth approximately £800 less than one with a single number in it; while increasing the number of letters in a number plate by a similar amount reduces its value by between £1150 and £2100. One reason why letters have a larger effect on prices than number may be the fact that adding a letter to a plate increase the number of possible permutations available more than adding another number does. For example, there are 23 possible number plates with one letter in them (the letters I, Q and Z aren't used), but there are only 10 number plates possible using only one number. This means that adding a letter to a number plate reduces the rarity of a plate more than adding a number does, and as the value of a number plate is dependent on the status its rarity confers anything that reduces its rarity will therefore presumably reduce its value. Despite the fact that the effects of increasing numbers on the price of the number plates appears less than increasing the number of letters, adding four numbers to a registration reduces its price by £3100 (four letters only reduce the price by £2700). Why adding four numbers has such a large affect on the price is unclear given that adding two or three numbers has a relatively small effect.

Figure 2 – Plot of Price versus Number of Letters and Numbers in a Number Plate



The regressions of the effects of the first digit in the number plate on its price show that only two letters – F and S – are statistically significant at the 10 per cent level. A number plate starting with an F will get a price over £500 less than a number plate starting with any other letter, but having an S at the start of a number plate raises its value by over £1000. Number plates starting with the number one were used as the base case for all the first-digit dummies and apart from the number eight, which is not statistically significant, all of the numbers appear to have significant effects at the one per cent level. Relative to number plates starting with the number one, all other number plates starting with other numbers are worth less; for example, plates starting with the number two earn over £1000 less at auction.

Conclusions

- People pay over £2500 extra for registrations sold in Classic Collection auctions rather than Custom Marks auctions.
- A surname in a number plate is worth nearly £1300.
- A first name in a number plate is worth over £1100.
- A word in a number plate has only marginal benefit.
- Short number plates are worth the most.
- Extra letters reduce a number plate's value more than extra numbers do.
- An S at the start of a number plates raises its value by over £1000.
- A number 1 at the start of a number plate is worth nearly £1000 more than other numbers.
- A number plate sold at the end of a 1000 lot auction is worth £350 less than one sold at the start.
- The final equation for the price for personalised number plates is:

Price = 4619 – (0.352×Lot Number) + (2596×Classic Collection) + (1122×First Name) + (1256×Surname) – (1149×having 2 Letters) – (2125×3 Letters) – (2714×4 Letters) – (3015×5 Letters) – (780×2 Numbers) – (829×3 Numbers) – (3105×4 Numbers) – (565×First Digit F) + (1072×First Digit S) – (1042×First Digit is a 2) – (717×First Digit 3) – (832×First Digit 4) – (700×First Digit 5) – (686×First Digit 6) – (796×First Digit 7) – (553×First Digit 9)