TRADITION AND FASHION IN CONSUMER CHOICE: BAGGING THE SCOTTISH MUNROS

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ABSTRACT

Standard consumer choice theory, even its modern guise incorporating costs of information gathering, imperfect information and such like, assumes atomised individuals exercise choice in an attempt to maximise utility subject to a budget constraint. Given an individual's tastes and preferences, decisions are taken on the basis of the attributes of the various products, such as price and quality.

Economists have paid relatively little attention to markets in which fashion is important i.e. markets in which the decisions of others can affect directly the choices made by an individual. Evidence is growing rapidly, however, that such markets constitute an important part of real world behaviour. Consumers select not simply on the basis of the perceived attributes of products, but their preferences are modified by the behaviour of others.

We consider in this paper evidence from the activity of hill-walking. The Munros are a list of Scottish hills over 3,000 feet in height. Both the number of peaks on the list and the nature of the Scottish climate make the ascent of all the peaks a demanding activity. The aim of completing all the peaks on the list is one, however, which grew in popularity throughout the 20th century. We consider completions of both the Munros themselves, and the Munro Tops, a difficult and time-consuming extension of the Munros.

Despite the impressions in the media that Munro completing is becoming more and more popular, the annual number of Munro completions levelled out in the late 1990s. In contrast, the (much smaller) number of those completing the Tops as well as the Munros peaked in 1991 and has since fallen away markedly.

The classic Bass diffusion model, which incorporates the imitation of others as a part of the behavioural rules used by consumers in making choice, explains the data on Top completions well. The model is dominated by the 'fashion' component, suggesting there was a cohort amongst which Tops completions became fashionable, but which has not been sustained.

In contrast, the standard Bass model is unable to account for the fact that Munro completions have remained close to their peak level for a decade now. We extend the Bass model to allow for growth over time in those choosing to try to complete the Munros. Fashion remains an important part of the explanation, but the Munros require the tradition of completion to be passed from one generation of active hill walkers to the next in order to be able to explain the movements in the data.

Keywords: consumer choice theory; imitation; fashion; tradition; Bass diffusion

JEL classifications: C32, D11, D12

I INTRODUCTION

Standard consumer choice theory assumes atomised individuals exercise choice in an attempt to maximise utility subject to a budget constraint. In this approach, given an individual's tastes and preferences, decisions are taken on the basis of the attributes of the various products, such as price and quality.

In recent decades, the conventional theory has been extended to allow for factors such as the cost of gathering information (Stigler 1961), imperfections in the perception of information and limitations to consumers' cognitive powers in gathering and processing information (Simon 1955). So decisions are not necessarily made in a fully rational way, but are nevertheless based on the (perceived) attributes of the products, without direct reference to the choices of others (Of course, the latter can affect choice indirectly by their effect on relative prices).

Almost 50 years ago, Tintner (1960) extended classical consumer choice theory by assuming that individual utility depended not merely on an individual's consumption, but on the consumption patterns of other people. This extension introduced far greater indeterminacy into the signs of income and price elasticities than standard theory.

In general, however, economists have paid little attention to markets in which fashion is important (*e.g.,* Chai *et al.* 2007); i.e., markets in which the decisions of others can affect directly the choices made by an individual. Social influences are generally only invoked for cases considered exceptional, such as 'irrational' stock market bubbles or real estate crises. Analysis of fashionable markets is not entirely absent from the economics literature, however. For example, published nearly 20 years ago Arthur (1989) demonstrated that it is theoretically possible in markets where fashion is important for superior versions of new technologies to be eliminated by inferior rivals. The 1980s video recorder battle between VHS and Betamax is often cited as a practical example.

Interest in such markets has, however, been much greater outside of economics. For example, two recent papers by non-economists (Salganik *et al.*, 2006; Colbaugh and Glass, 2007) provide strong empirical evidence that in markets where the decisions by others strongly influence individual choice, products which are superior in terms of their attributes may do no better than ones which are worse. It was also shown recently that charitable donations are highly subject to fashion (Schweitzer and Mach, 2008). Such markets are characterised by randomness and inherent unpredictability (Salganik *et al.*, 2006).**Error! Bookmark not defined.**

If we consider the case where consumers do not select products (or behaviours) solely on the basis of inherent attributes, but instead make their descisions upon the decisions of what other people are doing[1], then we may usefully posit two potential extremes of a spectrum. At one end, we have what we might label a "tradition," which is carried on by new generations, and at the other, a "fashion", which has most of its impact on one particular generation.

We illustrate the approach using data maintained by the Scottish Mountaineering Council (SMC), who keep a list of people who have completed the 'Munros', a specific list of 284 hills in Scotland with a height of at least 3,000 feet.

II THE DATA

Despite the relatively low height of the summits, the Munros are nevertheless a demanding group of hills, as the summits are fully exposed to high winds, rain and mist, and on the highest hills snow can fall on any day of the year[2]. But they are an attractive challenge within the capability of fit walkers willing to dedicate time and effort. Substantial numbers of walkers aspire to complete this list,[3] whereupon they can register a claim with the SMC.

[1] Subject of course to a budget constraint in each case

[2] One of the present authors has experienced snow in 11 of the 12 months. In August, the rain merely fell as sleet rather than snow.

[3] British hill walkers have a predilection for compiling lists of hills to complete. In addition to the Munros there is, for example, the list of: Corbetts (Scottish hills between 2500 and 3000 feet), the Donalds (over 2000 feet in a particular part of Scotland), the English and Welsh 2000 foot peaks, the highest point in every county, both on pre and post-1974 boundaries, and the Marilyns (any hill in

The SMC does not pretend that this is a complete record of all those who have ascended all the Munros, but the existence of the list of completers is well known amongst hill walkers, publicised on SMC website and numerous popular guide books. In the early part of the 20th century, when hillgoers were few and far between, an ethos of modesty prevailed in these circles, and some early completers probably did not register their claims. Comments posted on a website dedicated to Scottish peakbagging (http://www.scottishhills.com/html/index.php) suggest that more recently, in a few Scottish-based walking clubs around 10 per cent of those who complete the Munros fail to register a claim, and there appear to be a few individuals in these clubs who deliberately stop when they have climbed 283 out of the 284 hills on the list. However, many completers are English, and it is unlikely that such individuals would fail to register, given the effort of travelling simply to get to the Scottish hills. The SMC list can therefore be regarded as providing a reasonably accurate picture of the patterns of completion over time.

Here we examine the popularity of this activity, known as 'Munro bagging.' It has increased dramatically during the 20th century, particularly in its final decades, leading to the view in the UK media and in the SMC's own publications that Munro bagging is becoming ever more popular.

The actual number of Munros completions registered each year, however, tell a slightly different story (Figure 1), in that it peaked in 1999 at 247, and appears to have levelled off, averaging[4] 203 between 2000 and 2007.

England Wales or Scotland, but not Northern Ireland, which is separated from any other hill by an ascent of at least 150 metres on all its sides). This latter might be thought easy, but it is the one list which no-one has yet completed. It involves not just over 1500 hills in total, but two 200 metre Very Severe rock climbs (USA grade 5.7 -5.8) of sea stacks in the remote Atlantic archipelago of St Kilda, where even getting a boat close to the stack is impossible most days of the year.

[4] The data were taken from the SMC website in early March 2008

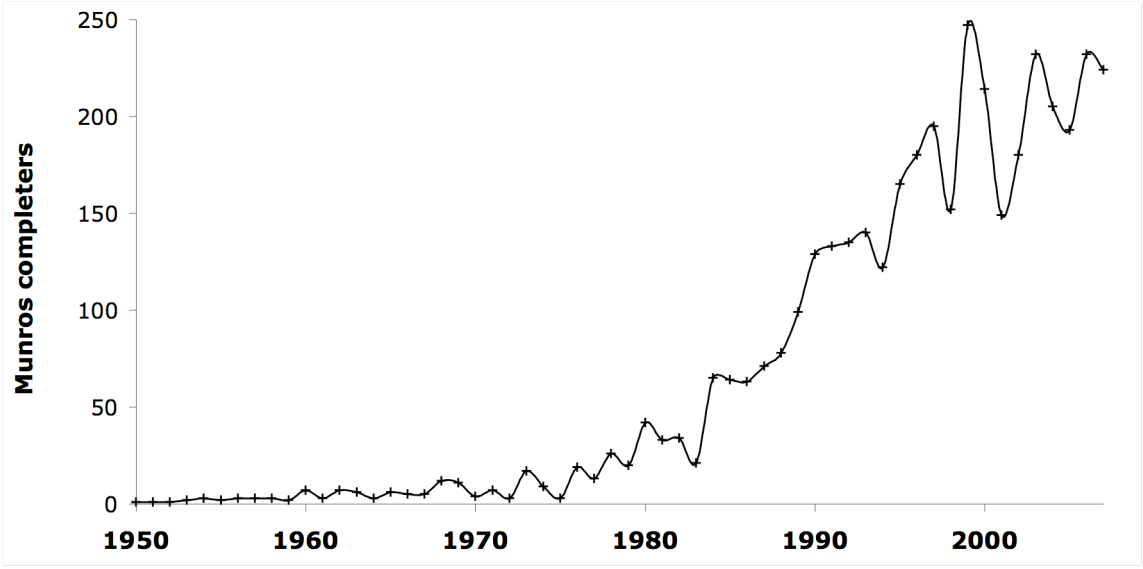

Figure 1: Number completing the list of Scottish Munros each year, by year of completion. Source: Scottish Mountaineering Council, www.smc.org.uk

The Munros are not without their own variant lists. The principal one is the Munro Tops, which are hills in Scotland which are also above 3000 feet but which for some reason are not regarded as separate mountains. There are no set criteria for determining which is a full Munro and which is merely a Top, and every decade or so the SMC moves a few hills back and forth between the two lists. But the fact that they are not 'separate mountains' does not mean they are trivial. Several of them involve exposed climbing where an unroped slip would be fatal, many others are orthogonal to the main ridge containing the Munro and their ascent involves much ascent and re-ascent during an already long day, whilst others are simply remote being 10 miles or so from the nearest road. The total number of Munro completers is 4019, but the number of Top completers is only 446[5].

The annual completions of the Tops rose sharply during the 1980s, but in contrast to the Munros, its popularity has declined sharply of late, as the annual number of completions shows (Figure 2a). Figure 2b shows this decline is of gradual exponential form when the Top completions are expressed as a fraction of those completing the Munros (there were only 17 Top completions in total before 1965, so Figure 2 plots the data from 1965 onwards).

[5] There is in addition what the Scottish Mountaineering Council calls ' the Furth of Scotland', which is the 3,000 foot peaks of England, Wales and Ireland. Only 193 people have completed the Munros, Tops and Furth since records began in 1901.

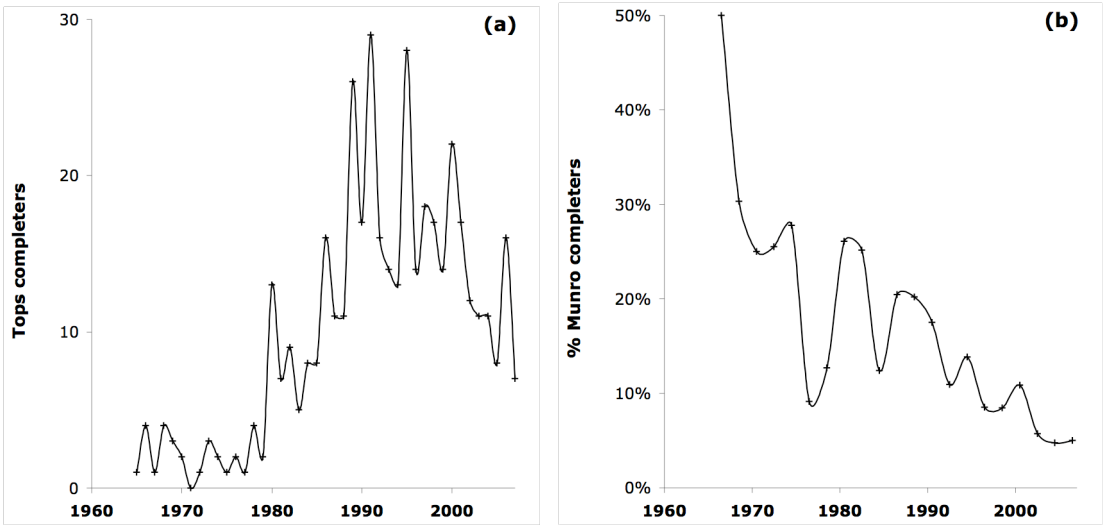

Figure 2. (a) Tops completers each year, 1965-2007. **(b)**Tops completers as a percentage of Munros completers, 1965-2007, in two-year averaged intervals.

III THEORETICAL MODELS: FASHIONS VERSUS TRADITIONS

To model a 'fashion', we consider a model of selective copying among binary options, after the Bass (1969) diffusion model. The Bass model assumes that the spread of a behaviour depends on random encounters between 'potential' and 'actual' adopters, with a fixed probability that any such encounter causes the 'potential' to adopt. The model implies that people adopt a particular behaviour mainly from imitating others, with the probability of adoption at time t is modelled as:

$$p(t) = (\mu + qF(\mathrm{t}))(1\text{-}F(t)), \qquad (1)$$

where the parameters μ and q represent the degree of innovation and imitation, respectively. This well-known model assumes a binary decision, between whether or not to adopt a single behaviour. The first half of $p(t)$ in eq. (1) models the imitation rate as proportional to the fraction $F(t)$ who have already adopted the behaviour, governed by the constant q, and the relative rate of independent discovery, governed

by μ. The second half of $p(t)$ forces the levelling off of the spread of behaviour as it approaches the full number of eventual adopters. This is a standard aspect of logistic growth or 'S' curve models, in which the rate of adoption decreases exponentially as the cumulative number of adopters asymptotically approaches its pre-determined maximum.

Empirical studies on durable consumer goods suggest that the innovation and imitation rates typically differ by an order of magnitude rate, with innovation μ about 1% or less and imitation q from 10% to more than 50% (Srinivasan and Mason, 1986). This means that most people adopt the behaviour upon witnessing it, whereas only a minority independently decides to adopt it. In both aspects, the adoption is made based on the perceived benefits of the behaviour over the previous alternative.

If N is the total number of eventual adopters, the cumulative number of adopters in (1), X_t, is given by (Schmittlein and Mahajan 1982):

$$X(t) = NF(t) = N\frac{1-e^{-(\mu+q)t}}{1+\frac{q}{\mu}e^{-(\mu+q)t}}, \qquad (2)$$

The number of new converts in period t is $X_t - X_{t-1}$ or:

$$X_t - X_{t-1} = \mu N + (q-\mu)X_{t-1} - \frac{q}{N}X_{t-1}^2 \qquad (3)$$

After an initial growth period, the Bass model yields an exponential decay in the number of new converts, as the cumulative behaviour asymptotically approaches its maximum frequency, or saturation point.

Following this pattern, the Tops demonstrate a marked decrease in the number of completers per year over the last decade (Figure 2).

Over the whole data period, 1901-2007, the fit of the simple Bass model for the Tops is characterised by estimates of μ and q which are robust with respect to the choice of

sample period. The estimates are carried out imposing the implied constraints on the coefficients in (3), using non-linear least squares regression. (with the command 'nls' in the statistical package S-Plus). Table 1 sets out some illustrative results.

Table 1. Estimations of simple Bass model for the Tops.

Period	μ	q	N
1901-2007	-0.0011	0.152	503.2
1951-2007	-0.0036	0.165	493.3
1951-1995	-0.0036	0.167	517.7
1961-1995	-0.0066	0.188	462.0
1961-2007	-0.0049	0.171	489.6

The coefficient on μ is not significantly different from zero in any individual equation, while q and N are highly significant.

In contrast, the fashion model does not account for the Munros very well, mainly because the number of Munros completers per year is persistent after its decline in growth, rather than decaying (Figure 1).

At first sight, the results obtained using the full Bass model (equation (3)) for the Munros appear very similar to those obtained with the Tops. The results are set out in Table 2.

Table 2. Estimations of simple Bass model for the Munros.

Period	μ	q	N
1901-2007	-0.0001	0.143	6023
1951-2007	-0.0003	0.144	5994
1951-1995	-0.0014	0.173	3956
1961-2007	-0.0003	0.145	5979
1961-1995	-0.0002	0.186	3536

Again, the estimates of μ are not statistically significant from zero (except for 1961-1995 which is just significance at $p = 0.05$). And the value of q are similar to those obtained for the Tops.

This similarity extends to the fact that, over the entire sample period, the null hypothesis that the Tops and Munros follow the same statistical distribution[6] is only rejected on a Kolmogorov-Smirnov test at the p-value = 0.0531, and for the 1951-2007 at 0.0639. In other words, on the conventional criterion of significance (0.05) the null hypothesis cannot be rejected, although the calculated values are of course close to the rejection level.

As noted above, however, there is an important difference between the Tops and Munros in that the latter have remained close to their peak level in recent years, whereas the former have fallen away sharply. A reflection of this is that the saturation level N is much more sensitive to the sample period in the Munros case (Table 2).

Given that empirical estimates show that μ is in general not significantly different from zero, we can simplify (3) to give:

$$X_t - X_{t-1} = qX_{t-1} - \frac{q}{N}X_{t-1}^2 \qquad (4)$$

Recognising this parameter N as the deciding difference, the reason eq. (4) does fit the Munros would appear to be population flux. In other words, the potential number of Munro completers is not time-invariant.

We modify the simplified model in eq. (4) to incorporate population flux into the number of new adopters per time interval.

If the population is growing, then the maximum number of adopters N_t increases accordingly. Letting a denote fractional rate of the growth in N_t per year, such that $N_t = (1+a)N_{t-1}$, eq. (4) becomes:

$$X_t - X_{t-1} = qX_{t-1} - \frac{q}{(1+a)N_{t-1}}X_{t-1}^2. \qquad (5)$$

[6] normalised by the respective sums, so that the annual rates are the percentage of the total 1901-2007 in each year.

The first term on the right hand side is the same as in eq. (4), whereas the modified term reflects how a growing population introduces an additional number of potential adopters per time interval.

This persistence is why we consider this a model of 'traditions', as the activity is carried on through time and indeed passed on between generations (population renewing through time).

In terms of estimating (5), we initially create a new variable, $(1 + a)N_{t-1}$, setting N equal to approximately 6000 in 2007, and estimating (5) for a =0.01, 0.02, 0.03, 0.04 and 0.05. We consider the period 1960-2007, since even with the Munros there were only 36 completions prior to that date. By the end of 2007, the actual number of completers was 4019, so implicitly there were then around 2000 people consciously engaged in the process of bagging the Munros but who had not yet done so. This, of course, is a fairly arbitrary but not unreasonable figure to use.

The residual standard error of the equation for the various values of a are, respectively, 18.16, 17.80, 17.63, 17.93 and 18.38. We then refined the gird search, as it were, and used values of a between 0.022, 0.024,…, 0.038. The standard error of the equations is rather flat for values between 0.026 and 0.036. The actual minimum is at a = 0.028, and we report results with this value.

The constraint in (5) that the coefficients on X_{t-1} and $X^2_{t-1}/(1 + a)N_{t-1}$ are the same in absolute value was tested and is not rejected by the data, the standard errors of the equation being, respectively, 17.43 and 17.59 without and with the constraint.

$$X_t - X_{t-1} = 0.164*(X_{t-1} - X^2_{t-1}/(1 + a)N_{t-1})$$
$$(0.0037)$$

Adj r^2 = 0.977, skewness (1) = 0.78, kurtosis (1) = 2.55, LM(3) = 5.52

where a = 0.028, the figure in parentheses is the standard error on the estimated coefficient (there is no constant term), skewness and kurtosis are chi-square variables each with 1 degree of freedom of the null hypothesis that the residuals exhibit no

skewness and no kurtosis, and LM(3) is the Breusch-Godfrey test of the null hypothesis that the residuals exhibit no auto-correlation at lags 1 through 3, and is distributed as a chi-square variable with 3 degrees freedom. The regression was carried out in STATA, which does not allow the Ramsey test for omitted variables to be carried out in regressions without a constant. However, estimating the equation with a constant gives a calculated value for the Ramsey test, an F-distribution with (3,42) degrees of freedom of 1.15.

The estimated equation therefore appears to be well specified. Over the 2000-2007 period, the annual average of actual completions was 203 compared to the predictions of the model of 213, but this is accounted for by the unusually low number of completions in 2001, just 149.

In contrast, the simplifies Bass model in equation (4), omitting μ, gives a good explanation for the Tops, again using data 1960-2007. Imposing the value of N from Table 1, we get

$$X_t - X_{t-1} = \underset{(0.008)}{0.154}*(X_{t-1} - X^2_{t-1}/(498.6))$$

Adj r^2 = 0.880, skewness (1) = 13.4, kurtosis (1) = 1.49, LM(3) = 1.78

The overall level of fit is less than with the preferred equation for the Munros, because the small numbers of the Tops completers exhibits more year-by-year random fluctuation, but it is still good. In particular, the equation captures the reduction in Top completers towards the end of the sample period, the fitted values averaging 11.4 for 2000-2007 compared to the actual average of 13. The 1990-1999 average is 18, peaking at 29 in 1991.

The residuals exhibit skewness, but the simple model is otherwise well-specified. Again including a constant term, the Ramsey test statistic for omitted variables (F(3,42)) is calculated as 0.93.

IV CONCLUSION

We consider in this paper a market in which consumers select not simply on the basis of the perceived attributes of products, but in which their preferences are modified by the behaviour of others.

The specific 'market' is the consumption experience of ascending all the Munros, a list of 3000 foot peaks in the Scottish Highlands. We examine also the completion of the list of Munro Tops, a difficult and time consuming extension of the Munros themselves.

Despite impressions in the media that Munro completing is becoming more and more popular, in fact the annual number of Munro completions levelled out in the late 1990s, the highest number being in 2000 itself. In contrast, the (much smaller) number of those completing the Tops as well as the Munros peaked in 1991 and has since fallen away markedly

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In contrast, the standard Bass model is unable to account for the fact that Munro completions have remained close to their peak level for a decade now. We extend the Bass model to allow for growth over time in those choosing to try to complete the Munros. Fashion remains an important part of the explanation, but the Munros require the tradition of completion to be passed from one generation of active hill walkers to the next in order to be able to explain the movements in the data

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