

Control of smoking and price of cigarettes — a comment*

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SUMMARY

A recent paper by Russell concluded that sharp annual increases in the price of cigarettes should be an essential part of any programme aiming to reduce cigarette smoking by men in the United Kingdom. The present paper reports results of research indicating, however, that men in this country respond very little to changes in price of cigarettes but have been more influenced, albeit temporarily, by antismoking propaganda.

INTRODUCTION

In a recent paper Russell (1973) examined the effect of price on cigarette consumption and argued that there is 'a strong inverse linear relationship'. This conclusion has important implications for policy, and Russell suggested as a feasible method of smoking control an annual increase in the tax so as to raise the price of cigarettes by 10% a year. This conclusion is, however, quite different from that reached in work which is being carried out at the University of Essex and has been reported by Atkinson and Skegg (1973). The results of this paper indicate that price does not have a significant effect on the consumption of cigarettes by men, which means that tax increases would be unlikely to provide an effective means of smoking control. The aim of this comment is to identify the differences between the two sets of results and to suggest that Russell may be taking an overoptimistic view of the effectiveness of tax increases.

The main differences between the analyses are:

- (1) the time span
- (2) specification of the demand relationship
- (3) treatment of other antismoking influences
- (4) data.

These differences are discussed in turn below.

TIME SPAN

Russell's analysis covered the years 1946 to 1971. This includes, however, the period of postwar

adjustment from the wartime boom in smoking, and of serious restrictions on other types of consumer spending. The immediate postwar years are likely, therefore, to be somewhat atypical, and Russell himself comments on the enormous price and consumption change that occurred in 1947. In view of this we consider here the period from 1951 to 1970† (1971 is excluded on the grounds of the Royal College second report published that year—see below).

SPECIFICATION OF THE DEMAND RELATIONSHIP

Russell's central concern is with a relationship between consumption per head (q) and the price of cigarettes (p) relative to the general purchasing power index (π), where the relationship is assumed to be of the form

$$(1) q = \gamma - \delta(p/\pi) \quad (\text{as in his Fig. 2})$$

$$(2) q = \varepsilon(p/\pi)^\beta \quad (\text{which is the form underlying his Fig. 3})$$

where β , γ , δ and ε denote constants. Although the linear relationship (1) may be a reasonable approximation for a small range of variation in (p/π) , it is not likely to be an adequate global representation of consumer behaviour, and for this reason we focus here on equations of type (2). More importantly, Russell takes no account of the independent effect of income on the demand for cigarettes. If we extend equation (2) to include real disposable income per head (y),

$$(3) q = \varepsilon y^\alpha (p/\pi)^\beta$$

then Russell assumes that either $\alpha = 0$ (middle column of Table II) or $\alpha = -\beta$ (third column in Table II). There is, however, no reason to impose such restrictions, and the effect of rising incomes needs to be taken explicitly into account.

* The research reported in this paper is part of a joint project on the economic consequences of smoking between the MRC/DHSS Epidemiology and Medical Care Unit, Northwick Park Hospital and the Department of Economics, University of Essex.

† We are also engaged in a longer term study covering the prewar period, in which the adjustments of the immediate postwar years may be seen in perspective.

TABLE
CIGARETTE CONSUMPTION (NUMBERS PER MAN) 1951-70

Equation	Dependent Variable	Independent Variables	\bar{R}^2	DW
<i>Alternative Specifications</i>				
(a)	q ..	$-36.6 (p/\pi)$ (3.7)	0.41	0.75**
(b)	$\log q$..	$-0.54 \log (p/\pi)$ (3.8)	0.41	0.73**
(c)	$\log q$..	$-0.62 \log (p/\pi) + 0.09 \log y$ (5.1) (2.9)	0.58	1.00**
<i>Alternative Treatment of Other Antismoking Influences</i>				
(d)	$\log q$..	$-0.36 \log (p/\pi) + 0.24 \log y - 0.06 D1$ (2.8) (4.7) (3.3)	0.74	0.86**
(e)	$\log q$..	$-0.15 \log (p/\pi) + 0.29 \log y - 0.07 D1$ (1.1) (5.6) (4.8) $-0.07 D2 + 0.01 R$ (4.7) (3.2)	0.84	1.61
(f)	$\log q$..	$+0.33 \log y - 0.08 D1$ (8.5) (7.0) $-0.08 D2 + 0.01 R$ (9.5) (3.4)	0.84	1.92
<i>Alternative Data</i>				
(g)	$\log q^*$..	$-0.06 \log (p/\pi) + 0.35 \log y^* - 0.07 D1$ (0.4) (6.9) (4.2) $-0.08 D2 + 0.01 R$ (4.7) (2.2)	0.86	1.57
(h)	$\log q^*$..	$-0.01 \log (p/\pi)^* + 0.36 \log y^* - 0.08 D1$ (0.1) (8.1) (4.8) $-0.08 D2 + 0.01 R$ (5.5) (2.3)	0.86	1.74

NOTE: DW denotes Durbin-Watson statistic
** indicates significant serial correlations at 1% level
The figures in parentheses are the t values

The results obtained for different specifications are shown in the first three lines of the Table*. The first line (a) gives the linear equation comparable with the results in the first column of Russell's Table II. The estimates of the price effect are very similar. The second line gives the logarithmic specification corresponding to (2) and the third line that corresponding to (3). Two important conclusions emerge. First, the coefficient of the income term is significantly different from that of the price term, and its introduction improves the fit of the equation. Secondly, even with the income term, the overall level of explanation is not very impressive. The coefficient of determination corrected for degrees of freedom (\bar{R}^2) is only 0.41 in the case of Russell's equation and 0.58 with the addition of the income term. In view of this it does not seem wise to rest content with the equation shown in line (c) of the Table†.

* Unless otherwise stated, the data employed are taken from Table I of Russell's article—see the definitions given at the end of the paper.

† Equations (a) to (d) indicate serious serial correlation. This may be eliminated by the transformation to first differences, but a more careful examination of possible lagged relationships seems called for.

TREATMENT OF OTHER ANTISMOKING INFLUENCES

Russell refers to the effect of the Royal College of Physicians' reports of 1962 and 1971, and he allows for this by omitting these years from the regression. A comparison of the predicted values with the actual values for 1962 indicates that the report caused a reduction in consumption of 5.8%; Russell suggests that this effect was preserved until 1967, although he does not test this explicitly. On the other hand, he claims that 'there is no evidence from these data that the ban on cigarette advertising on television in August 1965 had any effect whatsoever'.

In view of the importance of these conclusions, a more systematic treatment seems very desirable. It is possible that the correlation between the movements in the price series and the variables reflecting other antismoking influences leads to a biased estimate of the price elasticity from equations such as those shown in lines (a), (b), and (c). Line (d) shows the effect of incorporating a dummy variable for the post-1962 period as a crude indicator of the effect of the report on reducing demand once and for all. The coefficient is significant at the 1% level

and the overall level of explanation is considerably improved. A more attractive hypothesis on *a priori* grounds is that there have been a number of 'scares' which caused consumption to drop but that it gradually returned to its previous level. Relevant dates for such a 'pulse' were clearly 1962, 1965 (when television advertising was banned), and 1971 (not included in our estimation period). Denoting the dummy variables for the first two events by D1 and D2, and writing R for the return trend gives the equation shown in line (e). From this it appears that both the 1962 report and the 1965 advertising ban reduced consumption by 7% (both coefficients being significant at the 0.1% level). These effects died away at the rate of 1% per annum*.

The effect of introducing antismoking measures explicitly into these equations is to reduce the price elasticity. The simple post-1962 dummy in line (d) reduces the elasticity from 0.62 to 0.36; and in equation (e) it is further reduced to 0.15. Indeed, if we estimate the equation without the price variable, the goodness of fit is scarcely affected while serial correlation is reduced (see line (f)).

DATA

The data employed by Atkinson and Skegg (1973) differ from those of Russell in two respects. The first and less important difference concerns the method of deflation for population. Russell took consumption per head of cigarettes by men aged 15 and over, but during the period in question this leads to a jump in the series in 1962, 15 years after the postwar 'baby boom'. In view of the importance of this year in determining the impact of the Royal College report, it was considered preferable to weight each age group according to its cigarette consumption (in 1958). The results of making this change are shown in line (g) of the Table.

The second difference concerns the price variable. Russell used the price of 20 standard plain cigarettes, but he recognized that it would have been preferable to use an index which took account of the shift towards filter and small-sized cigarettes (see pp. 1 and 3 of the article). In our paper we followed Sumner (1971) in using the implicit price deflator from expenditure data, which should in theory

allow for the effect of this shift. As can be seen from line (h) of the Table, it reduces still further the coefficient of the price variable, which is again insignificantly different from zero†.

CONCLUSIONS

In this note we have suggested that an alternative view of the problem may lead to very different conclusions about the price elasticity of demand and the effectiveness of antismoking measures. In general, our results indicate that tax increases are less effective, and other antismoking measures more effective (albeit temporarily), than Russell believed‡. They suggest that he overestimated the price elasticity by attributing to price changes the immediate postwar readjustment of demand and the reaction during the 1960s to publicity concerning the effects of smoking on health. The difference between the results is highly important from the point of view of policy decisions. Russell's linear equation relating price and consumption suggests that an increase in the current price of 20 cigarettes to 68p (new pence) would totally eliminate smoking. However, the alternative equations presented here would predict the following results:

Equation	Reduction in Consumption %
(c)	39
(d)	25
(e)	11
(h)	Not significantly different from zero

Our aim is not to argue that Russell's results are necessarily wrong but rather to suggest that they are far from conclusive. In view of the importance of the subject it is to be hoped that further work will be carried out in this area. This work should consider, among other aspects, the dynamic specification, habit effects, and lagged adjustments to price and other changes, the role of advertising, and the relationship between time-series and cross-section data.

† A further factor taken into account in this equation is the misspecification involved in the use of a general price index π which includes the price of cigarettes. As is shown by Sumner (1971), this leads to the estimate of the price elasticity being biased upwards in equations such as those presented by Russell.

‡ It should be emphasized at this point that we are concerned only with men; the results obtained by Atkinson and Skegg (1973) for women are rather different.

* Using the estimated equation to predict the level of consumption in 1971 suggests that the report reduced consumption in that year by 9%.

DEFINITION OF VARIABLES

Variable	Definition	Source
q	Annual number of cigarettes per adult male	Russell
q^*	As q but deflated by population variable weighted by age group cigarette consumption in 1958	Russell and TRC
(p/π)	Price index for 20 standard plain cigarettes divided by cost of living index.	Russell
$(p/\pi)^*$	Implicit price deflator for cigarettes divided by implicit price deflator for non-tobacco expenditure.	see Atkinson and Skegg
y	Disposable income per head deflated by retail price index.	Russell
y^*	Disposable income per head of adjusted population deflated by implicit price deflator for consumers' expenditure.	see Atkinson and Skegg
D1	Zero until 1961; 1 from 1962	—
D2	Zero until 1964; 1 thereafter	—
R	1, 2, 3, 8 for 1963, 1964, 1965, 1970	—

TRC = Tobacco Research Council

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