# CHANGES IN CIGARETTE PRICE AND CONSUMPTION BY MEN IN BRITAIN, 1946-71 : A PRELIMINARY ANALYSIS

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The campaign to curb cigarette smoking in Britain is gaining momentum. So far the main emphasis has been on alerting the public to the health hazards. There has also been pressure for restrictions on smoking in public places and for greater control over tobacco sales promotion. Despite the fact that the expense of smoking is a major disincentive, especially for the teenager (McKennell and Thomas, 1967), the possibility of changing smoking behaviour by price manipulation has received relatively little attention.

Since 1946, in addition to seven manufacturers' price increases, there have been nine increases in tobacco duty, some of them large. No systematic analysis has yet been published of the effect of these price changes on smoking behaviour and tobacco consumption. This paper presents a preliminary analysis of the effect of price on cigarette consumption.

#### Methods

The study was confined to analysing the relationship between price and consumption of manufactured cigarettes.

### THE CONSUMPTION VARIABLE

Cigarette tobacco sales by weight is an unsatisfactory measure of the amount smoked. Less tobacco is used in filter-tipped cigarettes. Thus the trend towards filter-tipped cigarettes does of itself account for much of the decline in tobacco sales by weight, independent of any change in the amount smoked. The number of cigarettes sold is a more accurate measure of consumption in terms of the amount smoked.

During the period covered by this analysis the prevalence of smoking among women was rising. This was due to social forces that were probably largely independent of price. To obtain a purer measure of the influence of price, the analysis was confined to consumption by men. Per capita figures were used to correct for population changes over the years. The final consumption variable selected was the 'consumption of manufactured cigarettes by men (aged 15 and over) in numbers of cigarettes per head per year'. The figures were obtained from the Tobacco Research Council (1972).

## THE BASIC PRICE VARIABLE

Figures for changes over the years in retail price of 20 standard plain (non-tipped) cigarettes were obtained from Her Majesty's Customs and Excise (H.M. Customs and Excise Annual Reports, 1968-70) together with details of increases in tobacco duty and manufacturers' price (see Table I). Similar figures have been published by the Tobacco Trade (Tobacco Trade Year Book and Diary, 1972).

The two sources tally except for the manufacturers' price increase in 1951 which is not included in the Tobacco Trade figures. Personal enquiry revealed that this was not included because some but not all manufacturers increased their prices at that time. It was not possible to obtain the proportion of the market held at the time by those manufacturers who did increase their prices. The Tobacco Trade source unfortunately refused to pursue the point so that it was not possible to set right the discrepancy. This 1951 price rise is also the only one for which the precise date is not known. It is known only that it occurred some time after June. For this analysis it was taken as 15 September.

With knowledge of the date and the amount of individual price rises it is possible to calculate the mean price of 20 standard plain cigarettes for each year. This price unit has been kept in old pence partly because the years analysed precede decimalization but also because conversion to new decimal pence requires approximations which would have introduced needless loss of variance. For example, both two and three old pence each equal one new penny.

Instead of the mean price for each year of 20 standard plain cigarettes it would have been preferable to have used the mean price for each year of 20 cigarettes taking the mean from all types of

|                              |   |                              | asic Pric                     | æ Variables                             |   |                     | Price Ad   | justme     | nt Variat   | les  |   | Adjusted P  | rice Variat  | les   | ľ                              | Consump  | tion Variable  |
|------------------------------|---|------------------------------|-------------------------------|---|---|---------------------|--|------------|---|--|---|---|--|---|--------------------------------|--|--|
|                              |   |                              |                               |   | Basic Pric  | 8                   |  |            |   |  | Correc  | ted Price   | Price Ir   | ncome R   | tatio                          |  |  |
| Year                         | Retail<br>Price of 20<br>Standard<br>Plain<br>Cigarettes<br>s. d.                           | og                           | f Price II                    | Amount                                  | Mean Price<br>Year (old pe<br>with % ann<br>parenthesi<br>%   | for linal           | Internal<br>Purchasin<br>Power of £1<br>Power of £1<br>annual fall<br>parenthesi   | 80 n.% n.% | Annus<br>capita P<br>Dispor<br>Incon<br>Current<br>in £ (%<br>parentl | ul per<br>ersonal<br>sable<br>ne at<br>Prices<br>annual<br>in<br>'hesis)                         | Mean Pr<br>(old pen<br>to 1963<br>with 5<br>cha                                 | ice for Year<br>ce adjusted<br>value of £1<br>nge in<br>nthesis)  | Mean F<br>(old pe<br>to a %<br>disposit<br>with<br>par | rice for<br>nce adju<br>of annua<br>a person<br>able incc<br>% annu<br>ange in<br>enthesis)         | Year<br>Year<br>all per<br>all | Consur<br>Manu<br>Cigarett<br>(no. of<br>head/ye<br>annual<br>parei                | mption of<br>factured<br>es by Men<br>cigarettes/<br>ciarettes/<br>change in<br>nthesis) |
| 1946<br>1947<br>1948         | 00000<br>44000  | D+12d (<br>D+2d              | 42 · 86%<br>(5 · 00%          | ) 16 April<br>) 7 April                 | 28 0<br>36 5 (30<br>42 0 (13<br>5 (30<br>13<br>5 (30<br>13<br>5 (30<br>13<br>5 (30<br>5 (30)<br>5 ( | କୃହିନ୍ଥି            | 121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:83<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>121:85<br>12 | କ୍ର୍ନ୍     | 221<br>221<br>222<br>222<br>222<br>222<br>222<br>222<br>222<br>222    | 4 · 24)<br>4 · 55)   | 25<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>55<br>5 | (+ 22.05)<br>(+ 5.55)<br>(- 1.13)   | 0.0022   | 22<br>(++<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>) | Ĵ.                             | 3320<br>3320<br>3320   |  |
| 1951                         | 00000   | M + 1d                       | (2 · 38 %                     | ) After June*                           | \$750<br>500<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>10<br>1   | (1)<br>(5)          | 285128<br>0 0 - 0 0<br>2 8 5 5 8 5   | فخفخة      | 533858  | 4.5.8.9<br>4.5.88<br>4.1.88  | 88.58<br>88.58<br>88.58   |   | 0.086.0  |   | រិននទ                          | 2000<br>0000<br>0000   |  |
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| 0961<br>1961                 | - 44  | D+24<br>M+14<br>M+14         | 2.64%                         | 5 April<br>12 June<br>26 Iuly           | 4/ 0<br>48 5<br>51 3<br>51 3<br>5   | <u>6</u> [          | 108.8  |            | 342   | (2,27)<br>(9,34)<br>(9,34)   | 57.53<br>57.53<br>57.53   | 3 <u>2</u><br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7<br>7   | 0.0582   |   | 52)<br>52)                     | 4030<br>4030<br>4030   | 2000<br>- + + + +  |
| 1962<br>1963<br>1964         | 4447<br>  | D+44                         | Report                        | 7 March)<br>15 April                    | 54-0 (5-3<br>54-0<br>57-2 (5-5  | 26)                 | 101-8<br>96-8<br>30-0<br>30-0<br>30-0<br>30-0<br>30-0<br>30-0<br>30-0<br>30  | فغغ        | 383<br>405<br>432   | 3 · 79)<br>5 · 74)<br>6 · 67)  | 54-97<br>54-00<br>55-37   | (+ 1.36)<br>(+ 1.76)<br>(+ 2.54)  | 0-0581   | 227<br>11+<br>027   | 1388                           | 3750<br>3800<br>3740   | [ - 6.48]<br>(+ 1·33)<br>[ - 1·58]   |
| 1965<br>1967<br>1968<br>1968 | ,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>,<br>, | D+64 (1<br>D+24 (1<br>M+14   | 0.17%)<br>3.08%)              | 7 April<br>20 March                     | 63-4 (10-5<br>65-0 (2-5<br>67-6 (4-6  | <b>3</b> 2 <b>1</b> | 8310<br>870<br>870<br>870<br>870<br>870<br>870<br>870<br>870<br>870<br>87  | ଢ଼ଢ଼ୠଢ଼    | 459<br>484<br>502<br>533<br>533                                       | 6 · 25)<br>5 · 45)<br>6 · 18)<br>6 · 18)   | 58 · 71<br>57 · 98<br>56 · 55<br>56 · 31  | $\begin{array}{c} (+ & 6 \cdot 03) \\ (- & 1 \cdot 24) \\ (- & 2 \cdot 47) \\ (- & 0 \cdot 42) \end{array}$ | 0.057(<br>0.056(<br>0.054(<br>0.0528                   |   | 523 <b>33</b>                  | 3580<br>3640<br>3740<br>3850   | +++<br>+ 28)<br>+++2<br>24)  |
| 1969<br>1970<br>1971         | 044<br>00000  | D+5d (<br>M+1d (<br>(2nd RCP | 7.35%<br>1.37%                | 23 November<br>26 October<br>5 January) | 73-0 (7-5<br>73-2 (0-5<br>74-0 (1-6   | \$1.8               | 79-1<br>75-0<br>69-6<br>77-0   | ອຸລຸລຸ     | 561<br>609<br>674 (1  | 5 · 25)<br>8 · 56)<br>0 · 67)  | 57 · 74<br>54 · 90<br>51 · 50   | (+ 2·54)<br>(- 4·92)<br>(- 6·19)  | 0.0542<br>0.0501<br>0.0457                             | 8 4 5<br>5 - 1 - 5<br>6 - 1 - 5   | 365                            | 3790<br>3910<br>3710   |  |
|                              |   | * Calcul                     | lated as                      | 15 Sentember                            |   | -                   |  | -          |   |  |   |   |  |   | -                              |  |  |

Table I cigarette price and consumption changes for men in britain 1946-71

2

# M. A. H. RUSSELL

*Note:* For technical reasons associated with the structure of tobacco taxation, it is not possible to express the duty element on a packet of cigarettes in absolute terms. The figures of duty element shown in the Table are therefore approximate. The % annual changes in bold type for three of the price variables represent those years in which consumption fell. M = manufacturers' increase; D = increase in tobacco duty (see Note).

manufactured cigarettes consumed during the year. This would have obviated loss of variance due to the shift towards smoking cheaper filter-tipped and small-sized cigarettes. For example, instead of smoking fewer cigarettes after a price rise, there is also a tendency to respond by switching to cheaper cigarettes without cutting down on the number smoked. Figures for this ideal basic price variable are unfortunately not yet available so that for this analysis the basic price variable used was the 'mean price for each year of 20 standard plain cigarettes in old pence'. This variable is referred to simply as the 'basic' price.

#### Adjusted Price Variables

In an analysis involving price changes over time it is obviously essential to correct for the declining value of money. This was done by adjusting the 'basic' price to 1963 values, using the Index for Annual Internal Purchasing Power of £1 at 1963 value (Central Statistical Office, 1971a). This adjusted price variable is referred to as the 'corrected' price.

Another approach used was to examine the effect of price relative to income by expressing the 'basic' price for each year as a percentage of annual per capita personal disposable income at current prices (Central Statistical Office, 1971b). This adjusted price variable is referred to as the 'price-income ratio'.

#### THE TIME SPAN

The analysis covered the years 1946-71. The war years were excluded because the situation was so unusual and figures for the essential price adjustments are not available for the war period.

#### RESULTS

Inspection of Table I shows that of the 25 years covered by the study annual cigarette consumption fell in 10 and increased in 15. There were eight occasions when 'basic' price increased by 5% or more. In all eight of these years consumption fell. This association is unlikely to be fortuitous (P < 0.001, Fisher's exact test). Furthermore, for the two exceptional years in which consumption fell in the absence of a notable price rise there is an adequate explanation. In 1949 the effects were no doubt still being felt of the massive price increases of the two preceding years. The fall in consumption in 1971 was almost certainly due to the second report of the Royal College of Physicians.

The association is no less strong in the case of 'price-income ratio'. In each of the eight years that



FIG. 1. Changes in 'corrected' price of cigarettes and consumption by men in Britain, 1946-71: cigarettes/adult man per year; o-o mean price for year in old pence of 20 standard plain cigarettes corrected to 1963 values.

show a rise in the ratio or a fall of less than 2%, there is a drop in consumption. Again 1949 and 1971 are the exceptions. For 'corrected' price the association with consumption is also strong on simple inspection, but 1960 appears here as a glaring exception that is not immediately explicable.

Figure 1 shows graphically the clear inverse relationship between consumption and 'corrected' price. The year of the second Royal College of Physicians' report, 1971, is the only one in which this mirror-image relationship is substantially disturbed. The relationship is quantified in Table II in the form of product-moment correlation coefficients and regression coefficients. It can be seen that a large amount of variance is accounted for by the enormous price and consumption change that occurred in 1947. Excluding 1962 and 1971, the two years which witnessed the additional influence of the Royal College of Physicians' reports, changes in price account for some 80% of the variation in consumption over the period studied.

The regression coefficients (Table II) indicate that for each one old penny change in the 'corrected' price of 20 cigarettes the consumption by men showed an opposite change of about 40 cigarettes per head per year; and that for every 1% change in 'corrected' price, consumption changed inversely by about 0.6%. TABLE II

CORRELATION AND REGRESSION COEFFICIENTS BETWEEN CIGARETTE CONSUMPTION AND PRICE VARIABLES, 1946-71

|   | Consumption<br>(no. of cigarettes/<br>head/year)<br>'Corrected'<br>Pricet<br>(old pence) | % Change in<br>Consumption<br>% Change in<br>'Corrected'<br>Price | % Change in<br>Consumption<br>% Change in<br>'Price-Income<br>Ratio' |
|---|--|---|--|
| Correlation Coefficients<br>All years<br>Excluding 1947<br>Excluding 1962 and 1971<br>Excluding 1962 and 1971 | -0·77**<br>-0·80**   | -0.78**<br>-0.52*<br>-0.92**<br>-0.78**                           | -0.79**<br>-0.56*<br>-0.91**<br>-0.77**                              |
| Regression Coefficients<br>All years  | -35·59<br>-38·23   | -0.59<br>-0.50<br>-0.66<br>-0.65                                  | $ \begin{array}{r} -0.53 \\ -0.44 \\ -0.58 \\ -0.52 \end{array} $    |

† For 20 standard plain cigarettes. \* P<0.01; \*\* P<0.001.

The data comparing 'corrected' price with consumption and percent change in 'corrected' price with percent change in consumption for each year were plotted, together with the least squares regression lines, for the two sets of data (Figs. 2 and 3). The years which are out of alignment with the general trend are clearly evident. It seems that for 1949, 1962, 1971, and, to a lesser extent, 1956 some influence other than price was operating more strongly to depress consumption. It has already been suggested that the Royal College of Physicians' reports account for 1962 and 1971 and that 1949



FIG. 2. Comparison of 'corrected' price and consumption of cigarettes by men, 1946-71.

Note: Each point on the graph represents one year. The bold line is the least squares regression line for consumption on price, excluding the years 1962 and 1971 (r = -0.80, P < 0.001). Fine solid lines indicate the slope between consecutive years which approximately parallel the regression line. Arrowed broken lines show the years which aberrate from the general trend.

could have been affected by the unduly large price increases of the preceding two years, but there is no obvious explanation for 1956. Likewise it is not clear why consumption was so high relative to price in 1960 and 1968.

#### DISCUSSION

To have found an inverse relationship between the price of cigarettes and their consumption is not surprising. The interest of the analysis rests more in ascertaining the strength and nature of the relationship. The high negative correlation of 0.9indicates that changes in price account for as much as 80% of the variation in consumption by men over the 25 years between 1946 and 1971. The relationship appears to be linear rather than curvilinear, at least within the range of price change



FIG. 3. Comparison of annual change in 'corrected' price and annual change in consumption by men, 1946-71.

*Note:* Each point on the graph represents one year. The line is the least squares regression line for annual consumption change on price change, excluding the years 1962 and 1971 (r = -0.91, P < 0.001). The unlabelled points bunched in the upper left quadrant represent the years 1953, 1954, 1957, 1958, 1959, 1963, and 1966.

(-8% to +22% annual change in 'corrected' price) that occurred during the period studied. This is rather unexpected and means that a price increase of 20% does not depress consumption relatively more than an increase of 1%. Moreover, the relationship seems to be the same whether the price change is upwards or downwards.

A persistent decline in the purchasing power of money and a rise in personal income over the years ensure that cigarettes become progressively cheaper in real terms unless the 'basic' price is increased in step with these economic trends. To exceed these trends requires a substantial increase in 'basic' price of 5% or more. For the period studied, in all eight of the years that witnessed annual price rises of this order consumption was depressed (see Table I). All eight of these large price increases were instigated by the Government. Manufacturers' increases, always less than 3%, have been too small to depress consumption noticeably. On the four occasions that they were not contaminated by the effect of tobacco duty increases (1951, 1955, 1957, 1970) there was no evident fall in consumption.

Data on changes in smoking prevalence over the years are awaited before it is possible to assess how much the fall in consumption resulting from a price rise is due to established smokers reducing or stopping smoking and how much to a lowered recruitment to smoking.

#### PRICE AND ELASTICITY

As an index of the responsiveness of the consumption of a product to price changes, economists have developed the concept of 'elasticity' (Samuelson, 1967). The elasticity of the demand for a product is the percent change in consumption that results from a 1% change in price. A product has unit elasticity when a 1% change in price causes a 1% change in consumption. Products for which the elasticity exceeds one have 'elastic' demands. For such products a rise in price depresses sales so much that total expenditure on the product is less than it was at the lower price, while a drop in price increases total expenditure. On the other hand, products with an elasticity less than unity have 'inelastic' demands. For these products a rise in price reduces consumption proportionately less than the price increase so that total expenditure is increased. This is the case with cigarettes. The regression coefficients for consumption change on price change (-0.50 to -0.66, Table II) are an index of elasticity. They indicate that for every 1% rise in 'corrected' price, consumption fell by about 0.6%. This analysis shows, therefore, that the demand for cigarettes is 'inelastic'. Economic studies have shown that food and necessities that have no adequate substitute tend to have 'inelastic' demands while luxuries and items that are easily substituted have 'elastic' demands (Dorfman, 1964). The low elasticity of the demand for cigarettes is a measure of dependence on them.

In their analysis of consumer behaviour in the United Kingdom between 1920 and 1938 the Department of Applied Economics at Cambridge (Stone, 1954) found the elasticity for tobacco products as a whole to be about -0.5. This finding of an 'inelastic' demand for cigarettes is in accordance with the present analysis. The slightly lower figure of the Cambridge study may be due to a number of facts. First, it refers to all tobacco products rather than to cigarettes alone. Secondly, their analysis was not confined to consumption by men. Also, compared with the pre-war period were very small.

#### **OTHER ANTI-SMOKING INFLUENCES**

It is just possible that the major change after 1949 of the intercept of the curve for consumption on 'corrected' price (Fig. 2) was an early influence of the evidence linking smoking with lung cancer. This is very tentative because the first solid report of the association with cancer was a year later, in 1950 (Doll and Hill, 1950).

The data of this study suggest that the two Royal College of Physicians' reports greatly depressed consumption. Both 1962 and 1971 produced marked atypical changes in slope between years in Figure 2. In 1962 the rise in 'corrected' price of 0.74 old pence per 20 cigarettes (Table I) would, according to the regression coefficient of  $38 \cdot 23$  (Table II), be expected to have reduced consumption by 28.29  $(38 \cdot 23 \times 0.74)$  to 3,982 per head per year instead of the actual figure of 3,750 for that year. The excess drop in consumption (equivalent to what would be expected to result from a 'corrected' price rise of 6.07 old pence for 20 cigarettes) is almost certainly attributable to the Royal College of Physicians' report. In the same way the 1971 report was associated with an excess drop over expected change in consumption equivalent to a 'corrected' price rise of 8.63 old pence per 20 cigarettes. Furthermore, contrary to what is usually said, the figures suggest that the change in intercept associated with the 1962 report was preserved until 1967 (Fig. 2), indicating more than a transient effect. It remains to be seen whether the effect of the 1971 report is more or less durable. As is the case with price increases, it is not possible to say from the present data whether the effect has been to make established smokers reduce or stop smoking or to lower recruitment to smoking.

There is no evidence from these data that the ban on cigarette advertising on television in August 1965 had any effect whatsoever. It could be, however, that there was an effect but that it was masked by the vigorous intensification of coupon promotion and other schemes with which manufacturers countered this move by the Government.

#### IMPLICATIONS FOR SMOKING CONTROL

Recommendations that changes in tobacco tax be used as a means to control smoking are not new (Royal College of Physicians, 1971; Russell, 1971; Peston, 1972). This analysis provides some indication of the potency of this measure as well as guides to its use. There is no doubt that successive annual price rises exceeding 5% would be highly effective in depressing consumption.

The first essential in the planning of any programme is to settle on the objectives. It is suggested here that to seek the eventual elimination of all forms of smoking is too extreme. Rather than anti-smoking, the aim should be towards achieving acceptably safe controlled smoking. This would still require the virtual exclusion of cigarette smoking. Most smokers are simply unable to smoke cigarettes in a controlled non-dependent manner. There are two reasons for this. First, the rapid absorption through the lungs of nicotine from inhaled cigarette smoke mimics the effect of a series of small intravenous injections. Secondly, the ease of smoking cigarettes in many situations allows a frequency of use that almost invites dependence. These dangers are minimized in the case of pipe or large cigar smoking, provided the smoke is alkaline so as to allow slower absorption of nicotine through the buccal and nasal mucosa in a manner that is less likely to produce dependence.

Current interest in the development of a safe cigarette is to some extent misguided. To be completely safe, cigarette smoke would have to be not only carcinogen-free but free of nicotine and carbon monoxide as well. A nicotine-free cigarette would be unacceptable to most smokers, and carbon monoxide absorption can be reduced only by not inhaling. Cigarettes with a low tar content are no doubt safer but the position with low nicotine cigarettes is questionable. It is possible that they may even be more dangerous for established smokers who will tend to puff at them harder and more frequently to obtain their usual dose of nicotine.

The goal of acceptably safe controlled smoking would therefore require the virtual elimination of cigarette smoking in favour of pipes and cigars above a certain weight and at a price that would place them in the class of small luxuries. This could be achieved by selectively applying the price disincentive to cigarettes while adopting a more lenient approach to pipe and large cigar smoking. By leaving pipes and cigars as available substitutes the chances would be reduced of troublesome cigarette black-marketeering.

A feasible programme would be to increase tobacco tax selectively so as to raise the 'basic' price of cigarettes by about 10% a year. At this rate it would take 12 years for the cost of 20 cigarettes to reach £1. This rate of increase might need to be accelerated if the gearing to inflation or disposable income became substantially altered. This is not as harsh as it appears. There are certainly precedents for price rises of this order. In terms of proportion of disposable income, people in 1948 were paying for 20 standard plain cigarettes the 1971 equivalent of 13s. 7d. (68p) as opposed to what people in 1971 were actually paying, namely 6s. 2d. (31p). With regular price increases of this order it is likely that the elasticity of the demand for cigarettes would gradually climb above unity as cigarettes assumed the characteristics of luxury products. At this stage further price rises would become even more potent depressors of consumption. During such a programme the revenue obtained from tobacco tax would increase despite the drop in consumption, at least for as long as the elasticity of the demand for cigarettes remained below one.

With selective taxation along the lines suggested coupled to health education and other measures geared more towards achieving acceptably safe, controlled, non-dependent, non-inhaled puffing of alkaline smoke from pipes or large cigars, it is likely that dangerous cigarette smoking could be virtually eliminated within a decade.

#### SUMMARY

Analysis of changes in the price of manufactured cigarettes and consumption by men in Britain over the 25-year period 1946-71 revealed a strong inverse linear relationship. An annual increase in 'basic' price of 5% or more invariably depressed consumption. After correcting the price to 1963 values or by expressing it as a proportion of personal disposable income, negative correlations as high as 0.9 were found (P < 0.001). Regression coefficients showed that for every old penny change in the 'corrected' price of 20 cigarettes, consumption changed inversely by about 40 cigarettes per head per year; and that for every 1 % change in 'corrected' price consumption changed inversely by about 0.6%, indicating that the demand for cigarettes is 'inelastic'. Both the 1962 and 1971 Royal College of Physicians' reports depressed cigarette consumption, the effects being respectively equivalent in potency to increases in 'corrected' price of  $6 \cdot 1$  and  $8 \cdot 6$  old pence for 20 cigarettes. Selective taxation to increase the price of cigarettes by about 10% a year is suggested as an essential ingredient for success in the control of cigarette smoking.

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