
Advertising Investment in the UK Brewing Industry: An Empirical Analysis

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Abstract

This article analyses the significance of long-run advertising investment in the UK brewing industry. The Johansen multivariate cointegration procedure is utilised to estimate a model of the demand for beer to compare the effectiveness of 'main-media' and 'below the line' advertising. An error correction model is estimated to depict the short - run movements to equilibrium. The empirical analysis shows that both forms of advertising have no significant impact on the total barrelage sales in the UK. One reason for this may be that advertising influences the distribution of barrelage sales between brewers rather than the total quantity of beer sold.

1. Introduction

Over recent years the UK brewing industry has experienced a period of momentous change, which has inevitably led to market restructuring. For example, in August 1995 Scottish and Newcastle breweries became the UK market leader following the £425m acquisition of Courage from the Australian Fosters Group. This industry concentration occurred despite a Monopolies and Mergers Commission (MMC) investigation. In February, 1995, the Office of Fair Trading (OFT) launched a three month investigation into the differences in wholesale prices

charged by brewers for their tied-premises compared with independent chains. More industry concentration is expected in the next few years, with further rivalry such as price discounting, increased product differentiation² and heavy continuous promotional advertising likely to occur.

Within the structure-conduct-performance (S-C-P) paradigm the long-run advertising strategy of the firm can prevent competition through entry barriers³, since advertising may strengthen consumer preferences. Within the Arrow-Nerlove model (Nerlove and Arrow, 1962), the impact of advertising may create increases in perceived product differentiation by conferring goodwill on established players. This may create additional problems for potential entrants. Brewers may therefore seek to enhance their stock of 'goodwill' by using different advertising campaigns over time.

In this paper we test this hypothesis with respect to two main forms of advertising available to brewers - 'main-media'⁴ and 'below the line'⁵ advertising. The incumbent firms' long-run advertising policy can influence the strategic behaviour of potential entrants. Following the Arrow-Nerlove approach we adopt the view that market structure is, to a significant degree, endogenous in all but the short-run. Strategic conduct by incumbents is critical in affecting future profitability. It is shown from the evidence that given a choice of advertising

techniques, brewers will normally aim to undertake continuous 'main-media' advertising investment to improve potential market share. This is a long-run strategic decision. The static S-C-P approach typically ignores this key phenomenon, whereas in our approach continuous advertising investment is the central theme of the analysis⁶.

Section 2 begins with a discussion of the functional characteristics of advertising in UK brewing. Section 3 considers model specifications and the concepts of advertising investment are discussed. In the fourth section, empirical findings derived from two cointegration models are considered, together with findings from a short-run error correction model. Finally, section 5 provides some concluding comments and links with the extant literature.

2. Background

The demand for beer in the UK reached a peak in the late 1980s. Since then demand has declined significantly and UK brewers have been producing at below potential capacity. Price discounting for the large brewers is likely to be ineffective in the long-run since the price elasticity of the demand for beer is low (see Lynk, 1985; Muelbauer, 1977; Penm, 1988 and Abbott, Lawler and Ling, 1995), thus making non-price competition a dominant feature in brewers' long-run marketing strategies. One type of non-price competition which is likely to be pursued is vertical product differentiation (Schmalensee, 1982), taking the form of quality improvements and new product innovations. However, more importantly, non-price competition will take the form of long term advertising strategies.

Advertising has well known informative functions (Nelson, 1974; Ozga, 1960; Stigler, 1961; and Telser, 1964) which focus on the distributive characteristics of beer. Advertising can also be persuasive in target

markets (Schmalensee, 1972; Lambin, 1976; and Comanor and Wilson, 1967, 1974). Persuasive advertising is not untrue or misleading, but aims to pair buyers with sellers in a systematic way. Moreover, advertising campaigns usually try to create majestic illusions which aim to link potential buyers with life styles associated with unique attributes for hedonistic pursuits.

In 1993 UK national brewers spent more than £70 million on advertising (Table 1). The advertising/turnover ratio for national brewers varies from 0.3 per cent (Carlsberg and Tetley) to 1.5 per cent (Courage). Table 2 illustrates the effectiveness of using advertising to stimulate lager sales. Despite the fact that sales performance by leading brewers solely attributed to advertising investment, the data presented suggests that the efficient market leader is Bass PLC since it has the lowest advertising to sales ratio (1.11), followed by Carlsberg-Tetley (1.96). Whitbread however appears to be less efficient in utilising advertising investment. Both tables 1 and 2 indicate that the beer market is very competitive. These ratios suggest that advertising has a powerful intrinsic commercial value, otherwise brewers would not be willing to put such a large proportion of their sales revenue into long-run advertising investments.

Theory suggests advertising expenditure has distinctive features, since it can be seen as a durable good with positive long-term effects on brands and individual firms, through building up stocks of goodwill (Nerlove and Arrow, 1962; Schmalensee, 1972; Shapiro, 1983 and Kioulafas, 1985). Moreover, advertising produces scale economies and sunk costs⁷ generating entry barriers which discourage potential entrants (Needham, 1976; Williamson, 1963 and Schmalensee, 1983).

Table 1: Advertising/turnover ratio, 1993

<i>Brewer</i>	<i>Turnover (£m)</i>	<i>Advertising (£000)</i>	<i>Advertising/turnover ratio (%)</i>
Bass	4,451	14,654	0.3292
Carlsberg & Tetley	5,266	16,209	0.3078
Courage	1,326	20,129	1.5180
Scottish & Newcastle	1,514	7,880	0.5205
Whitbread	2,346	18,282	0.7793

Source: Register-Meal

Table 2: Advertising/sales ratio for lager products, 1993

<i>Brewer</i>	<i>Lager Sales (£m)</i>	<i>Lager Volume Share in the UK (%)</i>	<i>Advertising On Lager Products (£000)</i>	<i>Advertising/ Sales(%)</i>
Bass	755	25	8,403	1.1130
Carlsberg & Tetley	635	21	12,456	1.9616
Courage	745	25	17,114	2.2972
Scottish & Newcastle	220	7	4,889	2.2223
Whitbread	390	13	10,155	2.6039

Source: Register-MEAL

Brand building is currently a key strategy in UK brewing. In this paper, investment used for long term brand promotion is treated as an asset instead of a pure sunk cost with no salvage value. Tables 3 and 4 indicate that brewers are willing to allocate far larger budgets to 'main-media' advertising than 'below the line' advertising investment. Accordingly, this paper seeks to isolate the rationale for this long-run advertising strategy.

3. The model and data

Our analysis assumes that a typical large brewer maintains a continuous flow of real advertising investment resources over time.

This means that such investments are not concentrated on given periods of the year, but are distributed equally in each quarter of a year. Consequently, systematic advertising investment implies the stock 'goodwill' for any given firm takes time to accumulate. Hence, continuous advertising investment can be conveniently considered as:

$$A = \frac{\text{(Ann. real advertising Investment/RPI)}}{4} \quad (1)$$

Moreover, we utilise a standard linear model of the demand for beer (see Lynk, 1985 and Penn, 1988).

Table 3: Main-media advertising budgets

Year	Advertising (Ale & Stout) £m	Advertising (Lager) £m	Total Advertising £m
1987	29.2	68.9	98.1
1988	31.4	70.4	101.8
1989	29.7	72.7	102.4
1990	28.6	73.7	102.3
1991	33.4	73.0	106.4
1992	41.8	85.0	126.8
1993	45.1	68.8	113.9
1994	44.7	60.0	104.7

Source: Register-MEAL

Table 4: Below the line advertising in the UK (1987 prices)

Year	Advertising Rate Card Prices (£m)	Index
1983	2.0	133.85
1984	2.4	160
1985	1.4	93.85
1986	1.5	100
1987	1.5	100
1988	1.5	92
1989	1.1	68
1990	1.5	92
1991	2.9	181

Source: Register Meal

This may be written as:

$$Q_D = f(Y, P_B, P_S, A) \quad (2)$$

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where Q_D is a proxy of the UK demand for beer in real terms (total barrelage); Y is real UK personal disposable income; P_B is the

ratio of an index of beer prices to the retail price index; P_S is the ratio of a price index of substitute alcohol products to the retail price index; A is real advertising investment, in particular 'main-media' advertising (A_M) and 'below the line' advertising (A_B). Economic theory would predict that the income elasticity of demand for beer should be positive over

time. Moreover, whereas the advertising elasticity could be expected to be positive, the own price elasticity of demand should be negative and the cross-price elasticity should be positive. However, short-run price discounting, 'tit for tat' marketing strategies and intensive advertising strategies in the short-run could produce perverse effects. This would not be unusual in any given short-run analysis of oligopoly. Moreover, given the long-run decline in the demand for beer, competitive long-run advertising investment expenditure by leading brewers could counteract short-run advantages attained by 'first movers' in such games. Indeed, over the long term, the overall impact of both types of advertising strategy by leading brewers may not have any significant impact on the aggregate demand for beer, or its long term decline, but have serious consequences for any individual brewer which does not implement a continuous advertising investment approach.

4. Empirical analysis

In order to test for the long-run impact of 'main-media' and 'below the line' advertising on aggregate UK beer sales, the Johansen multivariate cointegration procedure was used (Johansen, 1988)⁸. To implement this method, it is necessary to (i) test for the order of integration of each variable in the model and (ii) use likelihood ratio hypothesis testing to identify the number of distinct cointegrating vectors. Given the problems of data availability, specifically for the advertising variables, it was only possible to estimate equation 1 with 'main-media' advertising (A_M) over the period 1987 Q4 to 1994 Q1 and 'below the line' advertising (A_B) over the period 1983 Q4 to 1990 Q4. This lack of observations may slightly impair our empirical analysis since all the tests are only

asymptotically valid.

Table A1 shows the Augmented Dickey-Fuller tests, which indicate that the levels of each variable are integrated of order one, and the first differences are stationary. Given these results, each variable satisfies the requirements to be included in the long-run cointegration model.

To implement the Johansen Procedure it was necessary to specify the lag length of the VAR at one time period, which in each case ensured that the error term was white noise. Given the seasonal fluctuations in the barrelage sales over each year, seasonal dummy variables were also included in the VAR, but not in the long-run cointegration equation. The Johansen procedure produces trace and maximum eigenvalue tests, from which the number of cointegrating vectors can be identified. The results of the hypothesis testing are shown in tables A2 and A3.

The results from table A2 clearly reject the null hypothesis of zero cointegrating vectors against the alternative, at both the 5 per cent and 10 per cent significance levels. Each test indicates the presence of at most one cointegrating vector in respect to the variables specified in the model. The results from table A3 indicate that when the below-the-line advertising variable is included, the model does not cointegrate at both the 5 per cent and 10 per cent significance levels. This is an important finding, since the Johansen procedure indicates which particular form of advertising is more important in influencing aggregate beer sales.

The Johansen procedure also produces the normalised coefficients associated with the unique cointegrating vector, obtained from the results of table A2, which are given as follows:

$$Q_D = 10.0311 + 0.030203 Y - 0.36169 P_B + 0.39551 P_S - 0.13809 A_M \quad (3)$$

The income elasticity is positive in this case, although the magnitude of the coefficient is far smaller than one would normally expect. Both the coefficients of the P_B and P_S variables have appropriate signs and magnitudes. The demand for beer is own price inelastic and the cross elasticity is positive, indicating that beer is a substitute for other alcoholic products, over the period examined. Surprisingly, the coefficient of the A_M variable is negative and has a smaller magnitude than expected. A likelihood ratio test, which imposed a zero restriction on this particular coefficient, yielded a test statistic of 0.95156, which for a $\chi^2(1)$ of 3.84146 at the 5 per cent significance level, indicates that 'main-media' advertising had no significant influence on aggregate beer sales over the period examined. A plot of the residuals from the cointegrating vector in equation 3 indicates an absence of serial correlation (see figure 1). This conclusion is supported from the plot of the estimated residuals autocorrelation function, shown in figure 2. An ADF test for the residuals was estimated to be -5.3641, which given the 95 per cent critical value of -4.5449 (Mackinnon, 1991) indicates that the estimated residuals are $I(0)$ and thus the cointegration regression specified is a valid long-run equilibrium relationship, since the variables have a tendency to move together over time.

The residuals from the cointegration equation were then incorporated into a short-run error correction model, with a view to investigating the short-run movements in aggregate beer sales:

$$\Delta Q_D = \alpha + \sum_{i=0}^5 \beta_i \Delta Y_{t+i} + \sum_{i=0}^5 \delta_i \Delta P_{B,t+i} + \sum_{i=0}^5 \gamma_i \Delta P_{S,t+i} + \sum_{i=0}^5 \phi_i \Delta A_{M,t+i} + \sum_{i=0}^5 \lambda_i \Delta Q_{D,t+i-1} + \sum_{i=1}^3 \mu_i DUM_t + \pi ECM_{t-1} \quad (4)$$

Given the quarterly frequency of the data, up to 5 lags were included in the ECM.

Hypothesis testing was then used to derive a parsimonious equation, using the general to specific procedure, the results of which are given as follows:

$$\begin{aligned} \Delta Q_{D,t} = & 0.023714 + 1.7886\Delta Y_t \\ & (2.1465) \quad (2.5834) \\ & + 13.98047\Delta P_{B,t} + 2.4114\Delta P_{S,t} \\ & (2.2718) \quad (1.6705) \\ & - 0.45114\Delta A_{M,t} - 1.1716ECM_{t-1} \quad (5) \\ & (-1.2991) \quad (-6.1450) \end{aligned}$$

$$\begin{aligned} R^2 = & 0.82110 \quad DW = 1.9806 \\ \text{Serial Correlation, } \chi^2(4) = & 8.6018 \\ \text{Normality, } \chi^2(2) = & 1.1167 \\ \text{Heteroscedasticity, } \chi^2(1) = & 0.00084 \end{aligned}$$

The diagnostic tests⁹ indicate that the residuals approximate a white noise process. The plot of the actual and fitted values in figure 3 suggest that the short-run model tracks the data well. Moreover a CUSUM test of parameter stability (figure 4) indicates that the estimated parameters of the model are stable over the sample period examined. All of the short-run elasticities have magnitudes which are far larger than anticipated. Strangely, the own price elasticity is positive, the coefficient of the A_M variable is also incorrectly signed and insignificant. In support of the conclusions from the cointegration equation, the results indicate 'main-media' advertising has no significant influence on short-run movements in beer sales, as well as having no long-run impact.

5. Conclusions

The econometric analysis shows that in the case of 'main-media' advertising, this variable should be included in the cointegrating vector of beer demand, despite the fact that its impact was shown to be insignificant. Our

evidence implies that both forms of advertising had no significant impact on beer sales in the long-run. These are startling findings given that advertising investment by brewers has increased dramatically in the 1990s compared with similar expenditure in the 1980s. Ironically though, total beer sales in the UK have steadily declined. However, it cannot be concluded that between the 1980s and 1990s advertising produced a zero or negative impact on the demand for beer, since advertising investment may have arrested the rate of decline in beer sales. There are also other exogenous factors such as demographic changes, the recent deep recession and changing leisure interests which have led to the decline in beer demand (see Abbott, Lawler and Ling, 1995).

The coefficients of the long-run model parameters may represent the aggregate responses in the UK beer market. They cannot though reflect the true picture for each brewer in the UK with respect to analysis of advertising investments. Instead, they provide guidelines for evaluating strategic conduct by individual brewers. The continuous advertising investment approach and the model specifications are useful for focusing the analysis at the level of the individual firm. Data for any single brewer could be estimated in the same way to evaluate the effectiveness of advertising over time. These are important findings which link theories on advertising proposed by Arrow and Nerlove with the actual practice in a key industry.

The strategic conduct adopted by leading brewers will not necessarily prevent long-run entry but should cause potential entrants to focus their promotional strategies in such a way as to mimic the behaviour of incumbents. This is a dynamic competitive process and follows the spirit of the neo-Austrian thinking. Entry will not be blocked by main media

advertising in brewing but it will become more costly not to advertise in this way. Moreover, short-run strategic advertising investment is crucial for long-run survival of brewers, since it should help intensify local brand preferences and generate a greater individual stock of goodwill through time.

Endnotes

1. Economics Division, Sunderland Business School, University of Sunderland.
2. For example, leading brewers have recently biased their production towards high gravity brewing. Recent technical innovations have included for example, widgets in cans and new microbological taste enhancers.
3. However, from an Austrian perspective, advertising can only act as an entry barrier in the short term. Product differentiation enables potential entrants to enter the market.
4. For example, advertising on television, radio, national newspapers and posters in eye-catching areas etc.
5. For example, advertising on posters and leaflets used for promotion in supermarkets, off-licences, public houses etc.
6. This approach accommodates the effect of a cumulative build-up in goodwill derived from past, present and future advertising campaign. Empirical findings from Clark (1976), Kioulafas (1983), Griliches (1967)

and Zellner and Hall Geisel (1970) indicate that the impact of advertising lasts longer than the advertising period and the advertising impact fades away in time. The fundamental strategic aim of advertising investment is to strengthen the influence of the advertising message on sales over time.

7. In reality, no one is willing to pay a higher price for buying a brand from another business which has experienced unsuccessful advertising campaigns.
8. All calculations were undertaken using Microfit V3.21 (Pesaran and Pesaran, 1991).
9. The diagnostic tests include the Durbin-Watson test for first order residual serial correlation; the lagrange-multiplier test for up to 4th order residual serial correlation; the Jarque-Bera test for normality of errors and the Koenker test for heteroscedasticity.

Appendix

Q_D is the quarterly expenditure on beer in the UK, obtained from *National Income and Expenditure*, National Statistics Office, HMSO.

Y is the quarterly real personal disposable income in the UK, obtained from *National Income and Expenditure*, National Statistics Office, HMSO.

P_S is the ratio of a price index of substitute alcoholic products to the general price index. Both indices sources are obtained from *Employment Gazette*, Journal of the Department of Employment (HMSO).

P_B is the ratio of beer price index to the UK general price index, both indices are obtained from *Employment Gazette*, Journal of the Department of Employment (HMSO).

A represents the annual 'main-media' (A_M) and 'below-the-line' (A_B) advertising expenditure obtained from Register-MEAL (through the Information Department at Advertising Association in London).

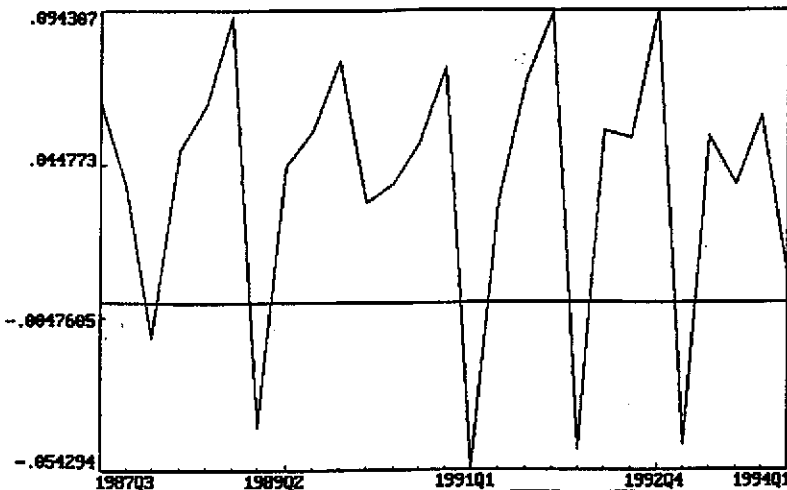


Figure 1: Plot of Estimated Residuals from Cointegration Regression

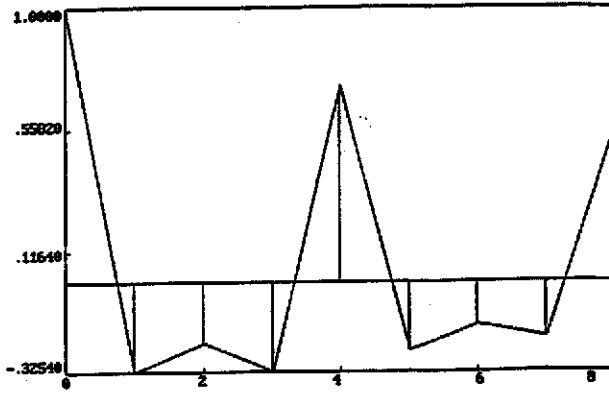


Figure 2: Autocorrelation Function of Estimated Residuals from Cointegration Regression

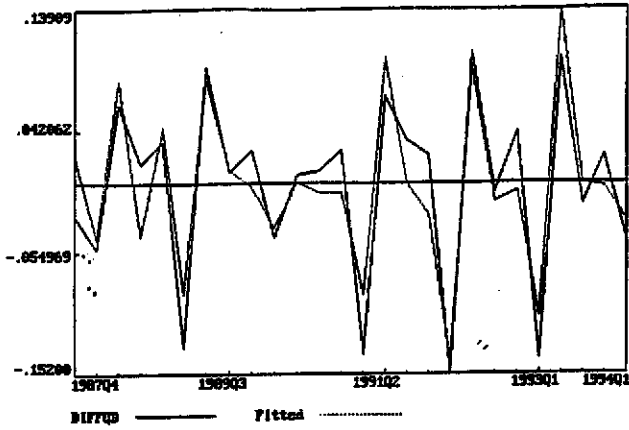
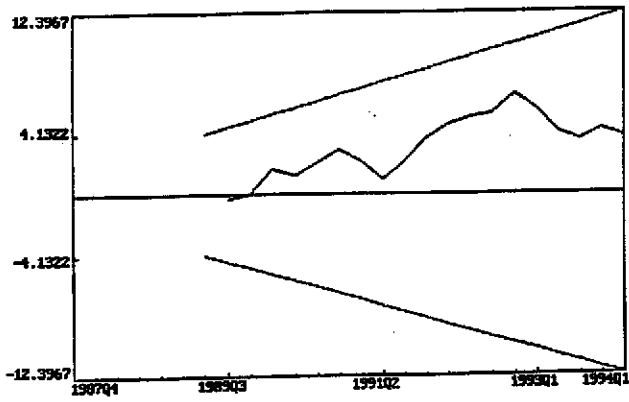


Figure 3: Plot of Actual and Fitted Values from Short Run Error Correction Model



The straight lines represent critical bounds at 5% significance level

Figure 4: Plot of Cumulative Sum of Recursive Residuals

Table A1: Augmented Dickey-Fuller tests

Variable	1987(4)-1994(1) (Main media advertising)		1983(4)-1990(4) (Below the line advertising)	
	ADF Test (Levels)	ADF Test (First Differences)	ADF Test (Levels)	ADF Test (First Differences)
Q _D	-2.6784* [1]	-8.9377 [0]	-3.4134* [2]	-6.9335 [0]
Y	-1.7602 [1]	-10.4326 [0]	-2.7793* [1]	-13.2213 [1]
P _B	-1.7898* [0]	-4.0242 [0]	-2.1142 [1]	-7.8139 [0]
P _S	-2.9023* [0]	-6.9391 [0]	-2.6054* [0]	-6.3145 [0]
A _M	-1.1163 [0]	-4.9169 [0]	-	-
A _B	-	-	-2.2363* [0]	-5.2902 [0]

Note: the alternative hypothesis in each case is that the variable in question is I(0); the 95% critical values are -2.9850 and -3.6027 for the ADF regression with and without a time trend respectively over the period 1987 Q4 - 1994 Q1. Over the period 1983 Q4 - 1990 Q4 the ADF critical values are -2.9706 and -3.5796 for the ADF regression with and without trend respectively. The critical values are derived from Fuller (1976). * denotes a significant time trend. The lag length of the ADF regression is specified in parentheses.

Table A2: Maximum eigenvalue and trace tests - 1987(4)-1994(1), main-media advertising

Number of Cointegrating Vectors	Likelihood Ratio Statistic LR(n)	95% Critical Value	90% Critical Value
Maximum eigenvalue test			
r=0	70.1365	34.4000	31.6640
r=1	15.4378	28.1380	25.5590
r=2	8.1760	22.0020	19.7660
Trace test			
r≤0	101.1010	76.0690	71.8620
r≤1	30.9645	53.1160	49.6480
r≤2	15.5267	34.9100	32.0030

Table A3: Maximum eigenvalue and trace tests - 1983(4)-1990(4), below-the-line advertising

Number of Cointegrating Vectors	Likelihood Ratio Statistic LR(n)	95% Critical Value	90% Critical Value
Maximum eigenvalue test			
r=0	28.9126	34.4000	31.6640
r=1	19.2930	28.1380	25.5590
r=2	13.8464	22.0020	19.7660
Trace test			
r≤0	69.4845	76.0690	71.8620
r≤1	40.5719	53.1160	49.6480
r≤2	21.2789	34.9100	32.0030

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