Economics of Brewing, Theory and Practice: Concentration and Technological Change in the USA, UK, and West Germany since 1945

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The modern brewing industry would seem at first sight to be an exemplar *par excellence* of a number of theoretical or economic postulates commonly used in business history. With its appeal to a mass consumer market and its relatively simple production technology, there were clearly opportunities to achieve scale economies. The emergence of large brewing companies in the UK and USA from the nineteenth century provides case-study support for Alfred Chandler's notion of the "three-pronged investment" in production facilities, distribution and retailing networks, and managerial organization [3]; locational concentration of brewing in centers such as Milwaukee, Munich and Burton on Trent is consonant with Michael Porter's views on the importance of industrial clusters in competitive advantage [14, pp.148-52]; brewing provides ample opportunity to test the contributions of Scherer, Pratten, Weiss and others on the minimum efficient scale of production [15; 16; 22]; and finally, the investment "sunk" in large-scale brewing and its endogenous expression in the aggressive promotion of major brands through advertising are central elements in John Sutton's theoretical contribution on sunk costs and market structure [18]. With brewing technology diffused fairly broadly the exploitation of scale economies depended upon the justification of large-scale investment by the effective marketing of brands sold in large volumes. Successful companies such as Bass, Guinness, Pabst and Anheuser-Busch certainly did this. The process naturally led onto the search for both horizontal and vertical integration by the major corporate players and to the higher concentration levels characteristic of an oligopoly [8; 12; 18]. However, comparative analysis reveals that there are three elements which complicate the simplified theoretical exposition of the development of brewing production and retailing: 1) the impact of government regulation, and in particular the approach to mergers, vertical integration and taxation; 2) the behavior of firms, including the extent to which smaller and medium-sized

[1]I should like to thank Dr Fiona Wood, Records Manager of the Brewers and Licensed Retailers Association, London, for her help with brewing industry data, and the British Academy for awarding me a travel grant to attend the Conference at Williamsburg.

BUSINESS AND ECONOMIC HISTORY, Volume Twenty-three, no. 1, Fall 1994.
 ISSN 0849-6825.

brewers were determined to retain independent status and able to maintain profitability; and 3) consumer preference, both in relation to the packaging of beer (draught, bottles, cans) and the variety of beer types and brands. Most of these constraints upon the attainment of scale economies and high concentration have already been recognized. Thus, Chandler conceded the third point, noting that when the large American breweries began to emerge in the later 19th century the "craft" skills needed to produce the taste requirements of consumers acted as a constraint on high-volume production [4, p.257]. More recently, Sutton has referred to the importance of "institutional regimes" for regulating mergers and vertical integration in influencing the level of concentration in different countries [18, p.286].

Superficially, there would seem to be several common elements in the record of post-war brewing world-wide. These include sluggish growth in national production and consumption from 1945 to the mid-late 1950s; a rapid rise in production and consumption and in consumption per capita from the mid-late 1950s to the late 1970s; and more uncertainty in the market during the 1980s. Data for the USA, UK and West Germany support this contention (Table 1). There were some variations, of course. UK production and consumption fell well below 1945 levels in the austerity conditions of the late 1940s and early 1950s, while West German production and consumption, which all but collapsed in the immediate post-war period, increased steadily from a very modest base in 1950 to a peak in 1976. Furthermore, there was no check to the *absolute* levels of production and consumption in the USA in the 1980s, as there was in the other two countries. The *per capita* consumption data show, as one would expect, a strong upward trend in West Germany in the 1950s. Nevertheless, the broad hypothesis, of two decades of increasing per capita beer consumption to c.1980, with a check in the 1980s, is confirmed.

A further point of similarity is the trend towards increasing concentration (see Table 2). In all three countries the number of breweries and companies, which had been falling *before* 1945 [8; 12], continued to fall, and output per plant and per company increased correspondingly. By 1980 the major corporate players had clearly emerged: Anheuser-Busch, Miller, Pabst, Schlitz [acquired by Stroh in 1982], Heileman and Coors, in the United States; Bass, Allied, Whitbread, Watneys [Grand Met], Guinness, Scottish & Newcastle and Courage [Imperial] in the UK; Bayerische Hypo-Bank, Reemtsma, Oetker and Holsten in West Germany. Thus, a more revealing measure, the market-share of the top five/ten brewing companies (which had been growing *before* 1945 [7; 8; 12]), intensified in the 1960s and 1970s (Table 3). In the USA, the process was clearly more a case of internal growth than merger and acquisition, the latter being actively discouraged by antitrust regulation until a belated relaxation in the late 1970s. The only exceptions were Stroh and Heileman, which grew largely through acquisition [7, pp.224-28; 18, p.291; 20, pp.23-25; 21]. In the UK, by contrast, mergers were the major element in the move to higher concentration levels between 1959 and 1973. Here, the only exception was Guinness, which retained its market-share by successful product development [8].

Table 1. Production and Consumption Trends in Brewing, 1945-90 : USA, UK and W. Germany

Year	Production (m.hl.)			Consumption (m.hl.)			Consumption Per Capita (litres)		
	US	UK	GER	US	UK	GER	US	UK	GER
1945	101.6	53.4	—	93.4	55.0	—	70.4	111.9	82.0*
1950	104.2	40.7	18.2	98.0	42.1	—	65.1	83.3	35.6
1955	105.4	40.2	36.1	99.1	41.4	—	60.2	81.1	67.0
1958	104.5	38.9	47.8	98.5	40.2	—	56.8	77.9	86.0
1960	111.0	44.3	53.7	104.4	45.0	52.6	58.3	85.9	94.7
1970	158.0	56.2	87.1	143.8	57.2	85.6	70.8	102.6	141.1
1976	188.5	66.1	95.7	174.6	66.8	92.9	79.5	119.5	151.0
1980	222.1	68.2	92.3	198.1	65.5	89.8	87.4	118.3	145.9
1983	229.6	60.5	95.0	208.9	62.5	91.3	89.3	111.2	148.7
1990	236.7	59.3	104.3	213.0	62.9	90.3	85.6	109.5	142.7

Source: Gourvish and Wilson, *British Brewing Industry*, pp.618-19, 630; BS, *Statistical Handbook 1993*, p.32; *Modern Brewery Age Blue Book 1985-90*; Deutscher Brauer-Bund E.V., *Statistischer Bericht*, nos. 6, 15, 18, 20 (1963, 1981, 1988, 1992).
* 1938

Mergers were also a major route to higher concentration in West Germany between 1965 and 1971 [18, p.523]. There was a further disparity in the 1980s. In the US concentration increased further while in the UK stabilization was evident. In both countries concentration remained high in comparison with West Germany, despite the market entry of a number of small "micro-breweries". The similarity in trend towards higher concentration in the three countries is scarcely surprising, given the common search for scale economies, as economists and technologists in the 1970s isolated the "minimum efficient scale" of production at levels varying from 1.6 to 5.3 million hectoliters per plant [5; 7; 15; 16; 18; 19; 22]. The technological thrust of research and development in brewing from the 1960s lay in capturing these economies and translating them into more effective beer distribution. Thus, we see more effective and automated control of the malting, brewing, fermenting and conditioning processes, enabling consistent beers to be brewed in larger volumes; the development of "continuous brewing" techniques, particularly in fermentation; accelerated batch production; improved packaging [aluminum/steel casks, non-returnable bottles, ring-pull cans]; and automated canning and bottling techniques, facilitating much faster

throughputs [up to 2,000 cans per minute]. More effective distribution was also achieved by high capacity trucks and improved road networks [8, pp.534-57; 12, p.69].

However, the more interesting elements of modern brewing are the differences in the experience of each country, which reveal the importance of the "constraints" isolated earlier. The *degree* of concentration was clearly very different in the three countries, ranging from high (USA, also evident in France, Netherlands, Belgium etc) to medium (UK) to low (Germany [though the position is complicated by interlocking shareholdings among the major firms, and by the fact that most of the small breweries were located in Bavaria: in 1980 931 or 68% of the total]). Why was this? This is a complex issue which is hard to analyse effectively in a short article. Nevertheless, the following factors deserve attention. First, the response to scale varied widely. In the USA there was a substantial shift to higher-capacity plants. In 1973 Scherer reported that while the largest 50% of US brewing plants had attained 80% of optimal output (here defined as 5.3 million hectoliters p.a.), the figure was only 24 % for the UK and 10% for West Germany [16, p.138]. Sutton also observed this disparity: in 1980 59% of US breweries had a capacity in excess of 1.2 million hectoliters, while in Europe only 4.5% had a capacity of over 1.0 million [18, p.511]. In the UK it is quite clear that the actual output per plant of many of the major companies fell well below both plant capacity and theoretically recommended levels. The average output per brewery in 1980 was only 0.4 million hectoliters, while that of the largest seven companies five years later, 1.1 million, was some way short of Cockerill's suggested minimum of 2.0 million [3.0 million less the effects of a high excise tax]. Only Guinness, Courage and Scottish & Newcastle matched the recommended level [5, pp.289-91; 8, pp.504-07]. Indeed, there appeared to be a trade-off between production and distribution economies, such that the m.e.s. for both functions combined was much lower, at about 1.0 million hectoliters per annum [5, pp.291-3]. This is demonstrated by experience in the United States, where there was an acceptance by some of the leading companies that it was more economical to operate with 3-4 plants than with a single mega-brewery. In the UK multi-plant operations facilitated the brewing of different beer types for regional markets, and the move to mega-scale production was halted by the emergence of serious industrial relations problems at some of the new plants (i.e. Luton and Runcorn) and their subsequent closure [8, pp.507-08, 518; 17, pp.334-36].

Production decisions, of course, rest on corporate responses to the nature of the market. There were considerable differences in the three countries (see Table 4). In the USA there was (and is) a considerable take-home trade (about 80% of total sales) and beer was popularly sold in cans and bottles. By 1960 draught beer made up under 20% of the market, and by 1980 only 12%; canned beer, on the other hand, amounted to 30% of sales in 1960, and just under 50% twenty years later. In the UK the reverse was true. Beer was drunk primarily in pubs and other on-licensed premises (88% of the market in 1980) and thus in draught form (64% of sales in 1960, when *returnable* bottles made up a third of the market). The popularity of draught beer not only survived the post-1960 move from bitter to lager but actually increased its market-share, reaching 79%

Table 2. Brewing Plants and Companies and average output, 1950-90: USA, UK and W. Germany

Year	Brewing Plants (no.)			Brewing Companies (no.)			Output per plant (m. hl)			Output per company (m. hl)		
	US	UK	Ger	US	UK	Ger	US	UK	Ger	US	UK	Ger
1950	407	539	2300e	370e	362	2100e	0.26	0.08	0.01	0.28	0.11	0.01
1960	229	336	2218	171	247	1950e	0.48	0.13	0.02	0.65	0.18	0.03
1970	154	177	1815	92	96	1750e	1.03	0.32	0.05	1.72	0.58	0.05
1980	88#	142#	1364	43#	81#	1270e	2.51	0.48	0.07	5.14	0.84	0.07
1990	63#	99#	1184	30#	65#	1150e	3.76	0.60	0.09	7.89	0.91	0.09

Source: CBMC/EBIC, *Combined Statistics 1970, 1980, 1990*; *Brewers' Almanack 1958, 1971*; BS, *International Statistical Handbook* (1983), p.79; BS, *Statistical Handbook 1993*, p.78; Deutscher Bauer-Bund E.V., *Statistischer Bericht*, No.7, 20 (1966, 1992); US Brewing Association, *Brewers Almanac 1984, 1993*; *Modern Brewery Age Blue Book, 1986, 1991*.

e estimate

excludes "micro-breweries" and home-brew pubs. In the UK there were c.40-50 micros in 1980 and c.100 in 1990; in the USA there were 4 in 1980 and c.190 in 1990 [defined as producing under 10,000 US barrels or 11,700 hl. p.a.].

Table 3. Estimated market-share of top five and top ten breweries, 1939-90(%)

Year	Market-share (sales/output†): Top 5 companies (%)			Top 10 companies (%)		
	US	UK	Ger*	US	UK	Ger**
1939	16	/	/	24	40	/
1954	25	18	/	38	/	/
1964	39	42♦	13♦♦	58	/	21
1974	64	69#	38	81	84+	45
1980	75	/	34##	94	/	44
1990	92	70•	28	98	/	/

Source: Douglas F. Greer, "Product Differentiation and Concentration in the Brewing Industry", *Journal of Industrial Economics*, 18 (1970), 202; Kenneth G. Elzinga, "The Beer Industry", in Walter Adams (ed.), *The Structure of American Industry* (6th edn., New York, 1982), p.224; John Sutton, *Sunk Costs and Market Structure* (Cambridge, Mass., 1991), p.523; *Modern Brewery Age Blue Book 1991*.

* 4-co. ratio ** 8-co. ratio

† sales for US, output for UK

♦1963 ♦♦1965 + 1973 # 1975 ## 1979 • 1986 production

Table 4. Beer Market Characteristics, US, UK and W Germany c. 1980

Item	US	UK	W. Ger
Significance of beer in alcohol mkt	high (51%)	high (58%)	high (54%)
No. of brands	small	large	large
Size of take-home market	large (80%)	small (12%)	large (60%)
% sold on draught	low (12%)	high (79%)	medium (28%)
% sold in cans	high (49%)	low (10%)	very low (3%)
Retail integration	prohibited	allowed	allowed
Taxation	medium/stable	high/rising	low/stable differential favors small producers

of sales in 1980. Canned beer represented only 2% of sales in 1960 and 10% in 1980 (currently c.22 %) [1; 2]. In West Germany consumers' loyalty to local beer brands - about 4,000 in all - inhibited the emergence of a national market. Furthermore, the import of leading brands such as Heineken and Carlsberg was effectively blocked by Germany's *Reinheitsgebot*, the brewing purity law which until ruled against by the European Court in 1987 imposed a very strict intepretation of the way in which beer could be brewed.

Thus, technological change and greater scale in production had to take account of the type of packaging, the point of sale, and also the demands of consumers. Brewers had to provide a *flexibility* of production response, an awareness of quality, but above all an appreciation of changing markets and the volatility of beer-drinkers' tastes, all of which made product life-cycles shorter [11]. The point should also be made that some technical developments also worked to the brewers' advantage at less than previously recommended plant-sizes. For example, the advent in the mid-1970s of high-gravity brewing, in which beer is brewed at a high original gravity and then diluted, not only economized on energy costs but also enabled companies to increase production, particularly at seasonal peaks, without investing heavily in greater scale. Nor should the regulatory environment for vertical integration, and discouragement of the ownership or "tie" of retail outlets be neglected. In the US the tie was expressly prohibited, while in the UK and West Germany retail integration was condoned (in the former country at least until the Monopolies and Mergers

Commission report of 1989 and the government's ensuing Beer Orders) [8, pp.596-8]. On the other hand, the level of taxation was very different in the three countries. In the US federal taxes remained stationary from 1951 to 1990 at $7.67 a hectoliter. Even allowing for state taxes, which rose from an average of $3.04 in 1965 to $4.35 in 1980 (and $5.76 in 1990), the overall level was much lower than in the UK, where the excise duty per hectoliter for beer of average strength (1037° gravity) rose steadily from £6.16 in 1950 to £16.10 in 1980 (£35.89 in 1990). Comparative rates of tax in 1980 in dollars for beer of average American strength (4.5% abv) were: $12 in the US, $46.60 in the UK. In West Germany the excise duty remained unchanged from 1952 to 1993, and the level was even lower than in the US. For producers of over 120,000 hectoliters a year, it amounted in 1980 to only $7.66 a hectoliter for beer of 4.5% abv. Smaller brewers paid even less.

Finally, there is an entrepreneurial/managerial dimension which needs emphasizing. The ability of family-owned enterprises to survive, particularly in the UK, was boosted by the two decades of demand growth, 1958-79, and by a growing skepticism in the 1970s about the short- and medium-term returns to mergers [6; 13]. In the UK several smaller producers capitalised on the "niche" demand for "real ale" stimulated by the consumer pressure group CAMRA from the 1970s. The same trend assisted the retention of independent status by some of the regional companies, such as Greene King and Wolverhampton & Dudley. The maintenance of family control, together with the skewing of equity voting rights, in some of the smaller companies, was another element. Moves taken by companies such as Fuller Smith & Turner of London and Samuel Smith of Tadcaster ensured that there was no chance of a predator bid, though this did not of course *guarantee* survival. However, some companies not only survived, but actually out-performed their larger rivals in terms of profitability precisely because they did not follow Chandler's "three-pronged investment". Here the emphasis was upon low-cost brewing of specialist ales rather than lagers, and on licensing arrangements for beers not produced (note, for example, the success of Eldridge Pope of Dorchester and Daniel Thwaites of Blackburn). Indeed, recent evidence (e.g. for Japan) suggests that the pendulum may be swinging back towards the highly efficient smaller and medium-sized breweries [8; 18].

What, then, were the most important factors in accounting for concentration differentials? Econometric studies, particularly in the United States, have focussed upon the relative significance of increased brand advertising on the one hand and technological change favoring scale on the other [e.g. 7; 9; 10; 19]. Both were clearly prominent; however, in accounting for *variations* in concentration levels, other factors must be recognized. Government regulation *per se* does not appear to have been decisive, particularly in relation to antitrust, since American concentration proceeded steadily both before 1978, when mergers were actively suppressed, and after 1978, when they were given some encouragement. The same may be said of government attitudes to vertical integration into retailing. In the United States, where concentration proceeded furthest, it was prohibited, but the nature of retailing was complicated by state monopolies and restrictions. In the UK and West Germany, however, the existence of vertically integrated brewing concerns worked in both directions; it encouraged larger corporate players to push national brands, while at the same

time enabling some smaller players to survive with a protected if limited retail market.

Thus, we are left with the hypothesis that fundamental differences in consumer preferences (which affected brand penetration levels and the scale economics not only of brewing but also of beer distribution), together with entrepreneurial attitudes, are the most plausible ingredients in an explanation of the variation in concentration levels. The level of technological change, particularly in packaging, but also in fermentation, depended on the nature and organization of the retail market, and on the receptiveness of consumers to a limited number of mass-produced brands. In the US, where concentration was highest, consumer receptiveness to heavy brand advertising (such as that promoting Miller Lite in the 1970s) and packaging in cans was also greatest. Flexibility, then, rather than economies of scale, became the production watchword in the more difficult.

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