

Brewing

Games Firms Play

Victor J. Tremblay and Carol Horton Tremblay

Since recorded history, people have combined water, cereal grain, and yeast to make beer. Ancient brews were dark in color and fairly sweet until bittering agents such as hops were added to preserve freshness over a thousand years ago. Today, grains, hops, and water are cooked together in large vats. Spent grains are removed and yeast is added to the remaining liquid, called wort, which starts the fermentation process. This converts the sugars in the wort into alcohol and carbon dioxide. The final product is then aged, filtered, pasteurized, and packaged into cans, bottles, or kegs.

Beer draws much of its flavor from malt, the most commonly used grain in the brewing process. Malt is roasted barley that can range from pale in color when lightly roasted to almost black when roasted at high temperatures. Beer becomes darker and heartier when brewed with darker malt and with top fermenting yeast. Top fermented styles of beers include ales, porters, and stouts. Porter and stout are not only darker but generally have higher alcohol content than ale. Lager is made with bottom fermenting yeast and is lighter in color and milder in flavor than ales, porters, and stouts. Many lagers are made lighter by using paler malt and replacing some of the malt with adjuncts, usually corn or rice. Brewers can also increase bitterness by using more hops and can increase alcohol content by adding sugar to the wort and extending fermentation time.

Today, U.S. consumers have access to a wide variety of styles and brands of beer. The largest domestic firms, called the macro brewers, produce a pale lager beer. These include the Anheuser-Busch, Miller, Coors, and Pabst brewing companies. Traditional domestic lager is brewed with some corn or rice and is marketed at three price points: popular, premium, and super-premium. The leading super-premium brand, Michelob by Anheuser-Busch, was an all-malt beverage until 1961 when rice was added to lighten its flavor.¹ To keep costs and prices low, popular-priced beer is typically brewed with 60 to 65 percent corn or rice, compared to 25 to 30 percent for premium beer.² A typical 12-ounce can of premium lager, such as Budweiser, has about 145 calories and is about 4.6 percent alcohol by volume. “Light” beer, such as Coors Light, is an extremely pale lager, with about 30 percent fewer calories and 10 percent less alcohol than premium lager.³ Other lager styles that are marketed by the leading U.S. brewers include malt liquor, dry beer, and ice beer. Brands in these categories frequently have 10 to 20 percent more alcohol than premium lager.

Darker beers and ales are produced by foreign brewers and by many small domestic brewers, originally called microbreweries. Most of these foreign and small domestic firms brew all-malt beer, ale, porter, and stout, products that do not

compete directly with the lighter lagers brewed by the macro brewers. On average, these darker beers have about 180 calories per 12-ounce serving and are about 5.4 percent alcohol by volume. Because some domestic microbreweries have become quite large, they are now called domestic specialty brewers. Beer brewed by the domestic specialty brewers is generally known as craft-style beer to distinguish it from imports.

With these beer styles and brewers in mind, we turn to the strategies used by the major players as they compete in the U.S. brewing industry. We begin by providing a discussion of the industry and the contentious economic environment that has shaped the strategic actions of brewers.⁴ We find that many of these actions are consistent with the strategies found in game theoretic models. For example, brewers were forced into a preemption race in television advertising during the 1950s and 1960s and into a war-of-attrition game in the 1970s, which continues even today. Common games and strategies found in the U.S. brewing industry include the prisoners' dilemma, mixed strategies, trigger strategies, brand proliferation, devolution strategies, and Hail Mary strategies.⁵

Games Brewers Play

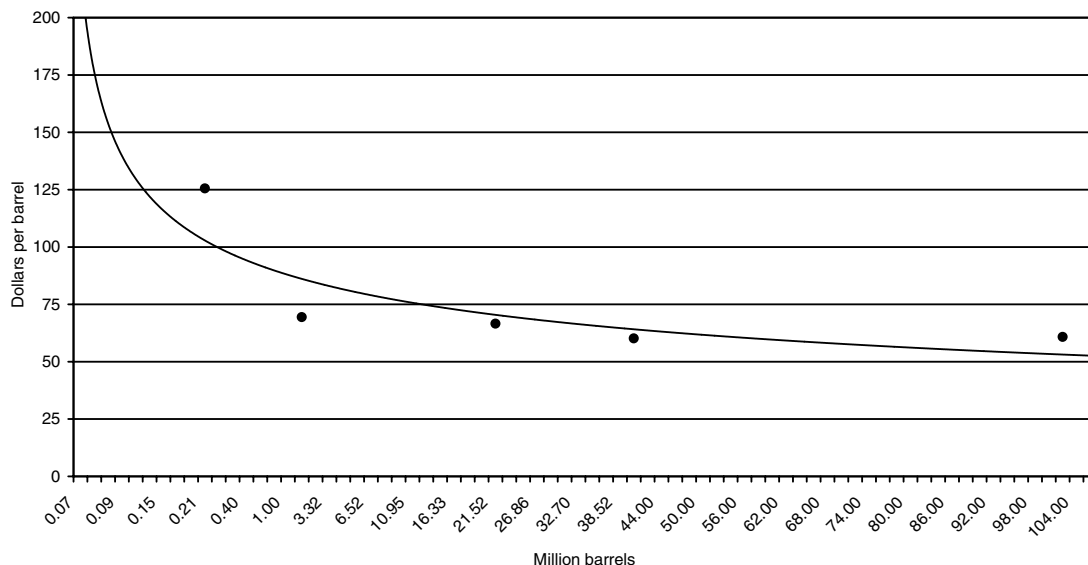
The actions chosen by firms depend on the business environment, government regulations, and strategic considerations. Consumer preferences and technology shape environmental conditions, which are reflected in a firm's demand and cost functions. Although most environmental conditions are exogenous, a firm can make strategic investments in order to manipulate its business environment. For example, a successful advertising campaign may increase product demand, and investments in research and development may lower future production costs. In imperfectly competitive industries like brewing, a firm's profits will be affected by the

actions of its rivals as well as its own actions. Thus, a successful firm will develop a strategy that takes into account the expected response of its rivals to any action taken by the firm. This is the purview of game theory. We compare game-theoretic predictions about the cooperative and noncooperative actions of firms to the behavior of firms in the U.S. brewing industry.

In the last half century, two major changes in market conditions influenced strategic activity in the U.S. brewing industry. First, the advent of television after World War II gave an advantage to firms that marketed their products nationally. Pressure to attain national status grew in the 1950s and 1960s as television became more popular. U.S. households with a television set increased from 9 percent in 1950 to 95 percent by 1970. An important advantage of national television advertising is that it reaches a given audience at lower cost than local television advertising. For example, in 1980 the price of advertising during sporting events was about 43 percent lower for national compared to local television ads.⁶ This competitive advantage caused the major brewers to race to gain national status in order to use television advertising to foster a premium image for their flagship brands. Ulrich Doraszelski and Sarit Markovitch term this a preemption race in advertising.⁷ As a result, this strategic investment in advertising made the national brewers tougher competitors, or "top dogs" in the taxonomy of Drew Fudenberg and Jean Tirole, causing the exit of their smaller regional competitors.⁸

Second, changes in technology provide a cost advantage to large-scale brewers. One example is canning and bottling lines in the packaging industry. A high-speed canning line could fill and seal 750 cans per minute in 1966 and 2,000 cans per minute by 1987. To operate just one full-time canning line efficiently, a firm would need to produce about 0.82 million barrels per year in 1966

Figure 3.1 Average Cost of Production for Various Brewers, 2004



Source: Beer Industry Update: A Review of Recent Developments, 2005.

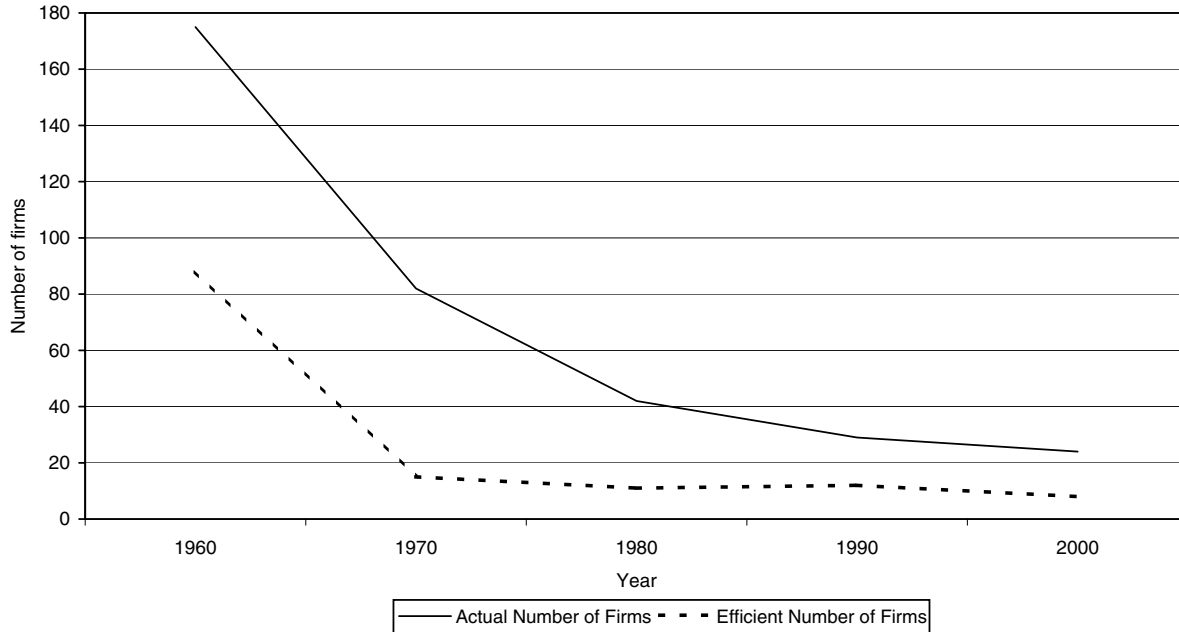
and about 2.18 million barrels by 1987. These and other innovations caused the industry leaders to build larger breweries and greatly expand their total brewing capacity. Evidence from industry experts, cost function estimation, and survivor tests suggest that minimum efficient scale (MES) at the firm level rose from 1 million barrels in 1960 to about 8 million barrels in 1970, 16 million barrels in 1980, and 23 million barrels in 2001.⁹ The raw data on the cost of goods sold per barrel, plotted in Figure 3.1, suggest that MES may have exceeded 23 million barrels by 2004.¹⁰

The rapid growth in MES put a great deal of pressure on smaller brewers to grow in size. Because market demand increased more slowly than MES, not all existing firms could grow sufficiently to reach MES. This can be seen in Figure 3.2, which compares the actual number of brewers with the number of brewers that would exist if each firm produced at MES. From 1960 through 2000,

there were too many firms for them all to produce at MES. Thus, many firms were inefficiently small and could only grow by gaining market share from competing brewers. This forced brewers into a war of attrition, a game in which there are too many firms than can efficiently produce and profitably survive in an industry.¹¹ The war produced tough competition and low profits in brewing. For example, the average profit-to-sales ratio was 2.72 percent in U.S. brewing from 1960 to 1994, compared to 4.82 percent in U.S. manufacturing for the same period.

The preemption race in advertising and the war of attrition sparked vigorous competition as firms struggled to survive. In the mid-1970s, product differentiation and brand proliferation became important strategies for firm success. In what follows, we first consider product differentiation and the emergence of new products and brands in the brewing industry. This sets the stage for

Figure 3.2 Actual and Efficient Number of Macro Brewers



Source: The Office of R.S. Weinberg and Victor J. Tremblay and Carol Horton Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*, MIT Press, 2005.

subsequent discussion by identifying products and brands that are tied to pricing, advertising, and other strategies.

Product Differentiation and Brand Proliferation

An early decision when entering a market is the choice of brands and product characteristics. The major brewers choose to market a portfolio of different styles and brands of beer. In 2005, for example, Anheuser-Busch marketed thirty brands of domestic malt beverages, Coors offered sixteen, Miller offered thirty-five, and Pabst offered over thirty. Of the leading specialty brewers, the Boston Beer Company offered twenty-one and the Sierra Nevada Brewing Company offered thirteen different brands of beer.

Consumer demand for variety drives product differentiation and brand proliferation. Strategic considerations might also stimulate proliferation. For example, firms may flood the market with a wide variety of brands of different styles in order to leave few, if any, profitable product niches for potential entrants to exploit. The economics literature categorizes product differentiation as vertical and horizontal. Differentiation is horizontal when consumers disagree over the preference ordering of the horizontal characteristic. In brewing, this would include bitterness, as some consumers prefer bitter beer and others a milder beer. Products differ vertically if consumers agree on the preference ordering of the characteristic. Product quality is one example, as all consumers prefer a high to a low quality good, *ceteris paribus*. Unlike spirits and wine, beer quality depreciates over time, so

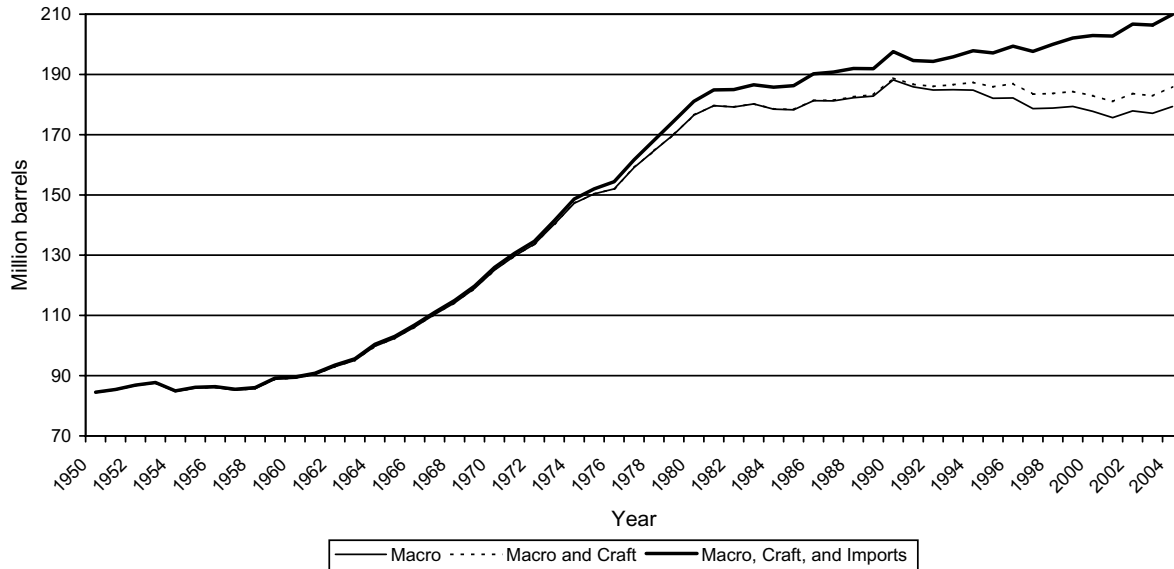
product freshness is an important vertical characteristic in brewing.

Before the mid-1970s, almost all of the beer consumed in the United States was traditional lager beer. Because the horizontal characteristics of one brand were so similar to those of another brand, firms tried to differentiate their brands along the quality dimension. The national brewers' "premium" brands typically sold for a higher price than regional brewers' "popular-priced" brands. Premium brands are more expensive to produce, but the cost difference is small compared to the price difference. In the early 1970s, for example, the cost of producing a 12-ounce container of premium Budweiser was half a cent more than the cost of producing popular-priced Busch, two brands produced by Anheuser-Busch. Yet the price premium for Budweiser was fifteen cents. Immediately after World War II, most of the cost difference between the premium brands of national brewers and the popular-priced brands of regional brewers was due to differences in transportation costs, as the national brewers shipped their beer around the country from a single brewing facility in either Milwaukee (Miller, Pabst, and Schlitz) or St. Louis (Anheuser-Busch). Transportation costs for these "shipping brewers" began to fall in the 1950s, however, with the construction of a faster interstate highway system and as they built new brewing facilities in multiple locations. Today Anheuser-Busch, for example, has relatively low transportation costs due to its network of eleven breweries located around the country. In spite of the decline in shipping costs, the price of premium beer over popular-priced beer has actually risen over time. To illustrate, the price difference between premium and popular-priced beer was about 25 percent in 1953 compared to 38 percent in 2004. Perhaps a higher price increases the image of the national brands or signals a higher level of quality.

The national brewers claim that their national brands are of superior quality. Premium beer is brewed with a large percentage of malted barley, which is more expensive than corn and rice. The belief that all-malt beer is superior in quality may have been inspired by Germany's beer purity law of 1516, the *Reinheitsgebot* (meaning, literally, "commandment for purity"). This law required that all German beer be made from three ingredients: *gerste*, *hopfen*, and *wasser* (barley malt, hops, and water). The role of yeast was unknown at that time. Beer made from a larger percentage of barley malt has a heartier flavor, but there is no evidence that this is a vertical characteristic, as some consumers prefer lighter lagers that are made with more corn or rice. For example, men on average prefer all-malt beer, while women on average prefer a lighter lager.¹² The viewpoint that the use of barley malt, rice, or corn creates horizontal rather than vertical differentiation is consistent with the recent opinion of the Court of Justice of the European Communities. In 1987, the Court ruled that the German purity law was illegal, as its modern use did not assure beer quality but was, in fact, a barrier to free trade.

Veblen effects and perceived differences in quality may be more likely explanations for the high price consumers are willing to pay for premium beer. A Veblen effect occurs when a consumer purchases a good to impress others.¹³ This is normally associated with high-status brands that sell for high prices. As the average consumer in the United States grew wealthier, demand for high-quality and high-status goods increased. Veblen effects may explain the higher prices paid for premium beer because blind taste tests reveal that most consumers cannot distinguish one brand of traditional domestic lager from another.¹⁴ The demand for high-status goods was initially met by premium beer and later by super-premium, import, and domestic craft-style beer. By offering both

Figure 3.3 U.S. Macro, Craft, and Import Sales, 1950–2004



Source: The Office of R.S. Weinberg.

popular-priced and high-status brands, brewers are able to price-discriminate between consumers who prefer high-status brands and consumers who are more price conscious. Status and quality can be conveyed and enhanced by advertising, and some consumers may believe that more intensive advertising spending signals higher quality. The topic of advertising as a strategic variable will be discussed in a later section.

As traditional domestic lager became lighter and more homogeneous through the 1970s, some consumers became dissatisfied with the lack of variety. This was a time when import demand began to grow and the microbrewery movement emerged (Figure 3.3). Import and domestic craft-style beer are generally bitterer, due to higher hop content, and have a maltier flavor, due to a higher malt content. They are also higher in alcohol, calories, and carbohydrates. These differences can be seen in Table 3.1 for the major brands of import, domestic specialty, and traditional lager brands.

At the same time, the macro brewers began to develop new styles of beer and introduce new brands. Miller was the first major brewer to brand-proliferate, a strategy that was common to the tobacco industry and began at Miller when the company was acquired by the Philip Morris Tobacco Company in 1970. Through the mid-1970s, Miller introduced Miller Ale, Miller Malt Liquor, Lowenbrau, and Miller Lite. Of these, only Miller Lite was a hit. Although Miller did not invent light beer, Miller Lite was the first successful light brand. Previous light brands were promoted as diet beers, and part of the success of Miller Lite is attributed to the company's decision to market it as a light rather than a diet beer. The success of Lite induced other brewers to brand-proliferate. In 1970, today's largest four macro brewers (Anheuser-Busch, Coors, Miller, and Pabst) produced an average of three brands, consisting of malt liquor and of traditional lager at different price points. This number had risen to thirty by 2005.

Table 3.1

Alcohol, Calorie, and Carbohydrate Content for a Twelve-ounce Container of the Leading Brands of Beer

Style	Brand (brewer)	Alcohol by volume	Calories	Carbohydrates (grams)
Regular domestic lager	Budweiser (A-B)	5.0	143	10.6
	Busch (A-B)	4.6	133	10.2
	Coors Original	5.0	142	10.6
	Michelob (A-B)	5.0	155	13.3
	Miller Genuine Draft	4.7	143	13.1
	Miller High Life	4.7	143	13.1
	Old Milwaukee (Pabst)	4.6	145	12.5
	Pabst Blue Ribbon	5.0	153	12.0
Light and low carb	Aspen Edge (Coors)	4.1	94	2.6
	Bud Light (A-B)	4.2	110	6.6
	Budweiser Select (A-B)	4.3	110	6.6
	Coors Light	4.2	102	5.0
	Michelob Light (A-B)	3.3	134	6.7
	Michelob Ultra (A-B)	4.2	95	2.6
	Miller Lite	4.2	96	3.2
Malt liquor (ML) and ice beer	Bud Ice (A-B)	5.5	148	8.9
	Colt 45 ML (Pabst)	6.1	174	11.1
	Icehouse (Miller)	5.5	149	9.8
	King Cobra ML (A-B)	5.9	166	11.7
	Magnum ML (Miller)	5.6	157	11.2
	Old English 800 ML (Miller)	7.5	202	13.4
Domestic specialty	Anchor Steam	4.9	153	16.0
	Samuel Adams Lager (Boston)	4.7	160	18.0
	Samual Adams Stout (Boston)	4.6	195	23.9
	Sierra Nevada Pale Ale	5.6	200	12.3
	Black Butte Porter (Deschutes)	5.2	180	n.a.
Imports (country of origin)	Corona Light (Mexico)	4.5	105	5.0
	Guinness Extra Stout (Ireland)	6.0	194	17.6
	Heineken (Netherlands)	5.4	166	9.8

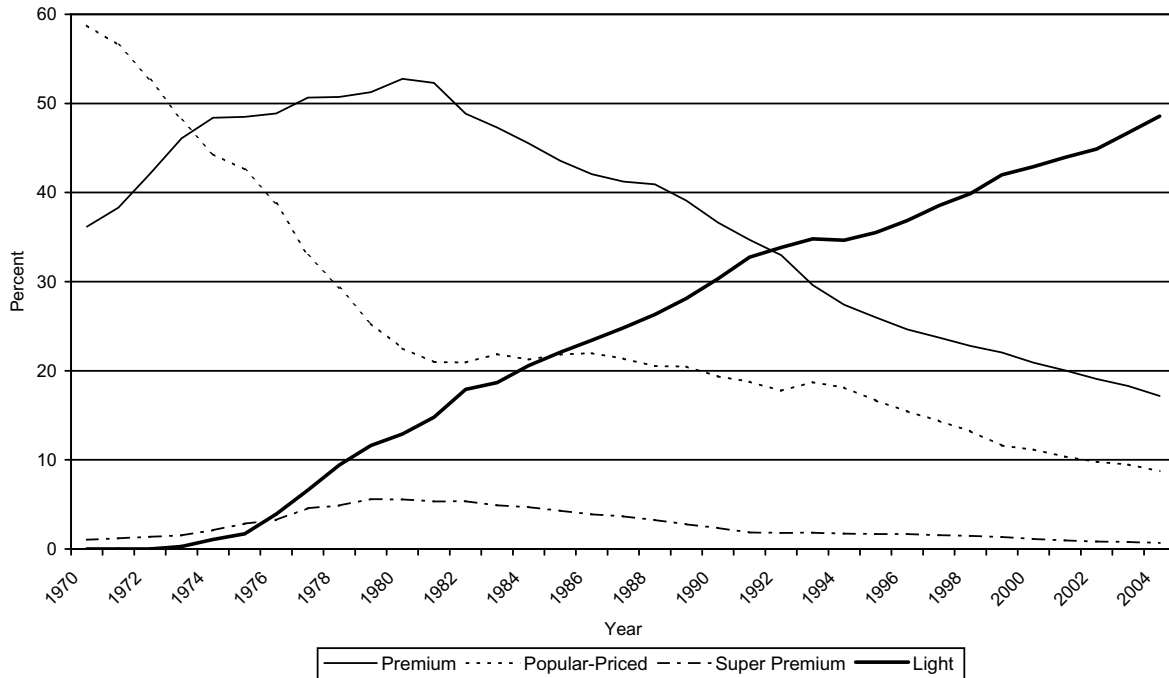
Sources: *Modern Brewery Age Weekly*, May 16, 2005, and company Web pages.

Note: Busch and Old Milwaukee are popular-price brands. Pabst was a premium brand until the early 1960s, and Miller High Life was a premium until the early 1990s. Pabst and High Life are popular-priced brands today.

Product- and brand-proliferation was especially intense during the era of the beer wars, 1971–89. By filling up the product space with new products and brands, the macro brewers made it increasingly more difficult for the weaker regional brewers to

find a successful market niche. In fact, Miller Lite was developed to combat the successful Coors Banquet. In the early 1970s, Coors was a strong regional brewer, and Coors Banquet was the number one brand west of the Rocky Mountains. Banquet

Figure 3.4 Market Share of the Leading Beer Segments, 1970–2004



Source: Beer Industry Update: A Review of Recent Developments, 1997–2005.

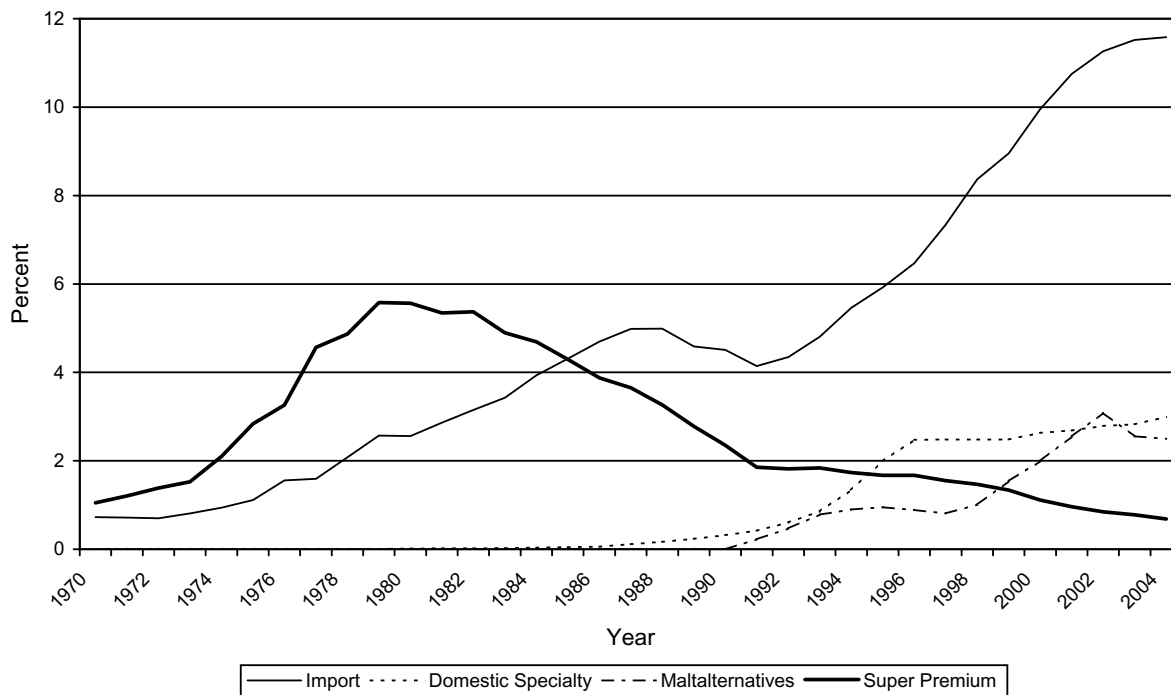
was lower in calories and alcohol than other leading premium brands and was marketed as “America’s Fine Light Beer.” The introduction of Miller Lite squeezed Banquet between regular premium beer and Miller Lite in terms of calories and alcohol content. As a result, Banquet experienced a steep sales decline beginning in 1977. Coors’s survival is attributable to the company’s successful introduction of Coors Light in 1978 and to its subsequent introduction of several heartier beers in the premium and super-premium categories: Herman Joseph’s in 1982, Killian’s Red in 1982, and Coors Extra Gold in 1985.

Of the new product styles introduced by the macro brewers, light beer has proven to be the most successful.¹⁵ As documented in Figure 3.4, light beer has gained considerable market share at the expense of other segments, particularly the

popular-priced brands produced predominantly by the regional brewers. From 1973 to 2004, the domestic market share of light beer rose from 0.3 to 48.6 percent, while the share of popular-priced beer declined from 48.1 to 8.7 percent.

By producing all-malt lagers, porters, and stouts, import suppliers and domestic specialty brewers have successfully minimized direct competition with the domestic macro brewers. The brewing facilities of the largest macro brewers are not designed to produce small quantities of craft-style beer, the one segment where the leading macro brewers do not have an important presence. This limits competition between the macro brewers and the import and domestic specialty suppliers. It also explains why most small regional brewers produce craft-style beer today. These include the Yuengling & Sons, Latrobe, and High Falls (Genesee) brew-

Figure 3.5 Market Share of Specialty, Import, and Maltalternatives



Source: Beer Industry Update: A Review of Recent Developments, 1977–2005.

ing companies. The relative success of the specialty and import sectors can be seen in Figure 3.5. The figure suggests that consumers now prefer craft and import beer over super-premium beer.

Of late, beer companies have faced stiff competition for the alcoholic beverage consumer from wine and spirits suppliers. In response, the macro brewers have introduced a number of flavored malt beverages. These are called malt alternatives, which consist of a lager beer that is filtered to remove any malt flavor and is usually sweetened with a fruit flavor. Their sales trends are depicted in Figure 3.5. The strategic response of the brewing industry to the growing success of the wine and distilled spirits industries will be addressed in a later section.

Pricing Strategies

Prices vary considerably from one style of beer to another. Imports sell at a relatively high price (Table 3.2), due in part to high shipping costs. In 2004, the average imported beer was about 25 percent more expensive than similar styles of beer produced by the domestic specialty brewers. Whether brewed as a regular or light beer, domestic premium brands are priced at 38 percent more than popular-priced brands. Of all malt beverage styles, malt alternatives command the highest price and are about 74 percent more costly than regular premium beer. Their higher price reflects higher production costs because malt alternatives require greater filtering and added flavorings. A high price

Table 3.2

Price Trends by Segment of Malt Beverages

Segment	Average price per case		
	2002	2003	2004
Imports	23.51	23.67	24.53
Domestic specialty	18.43	19.06	19.63
Regular			
Premium	15.51	15.84	16.20
Popular priced	11.22	11.43	11.71
Light			
Premium	15.52	15.82	16.16
Popular priced	11.31	11.55	11.79
Malt alternatives	26.89	27.61	28.13

Source: *Beer Industry Update: A Review of Recent Developments* (2005).

Note: The price is the average supermarket price, measured in dollars per case of 24, 12-ounce containers.

may also enhance a premium image, as quality appears to be important to potential consumers who are interested in wine coolers and sophisticated mixed drinks.

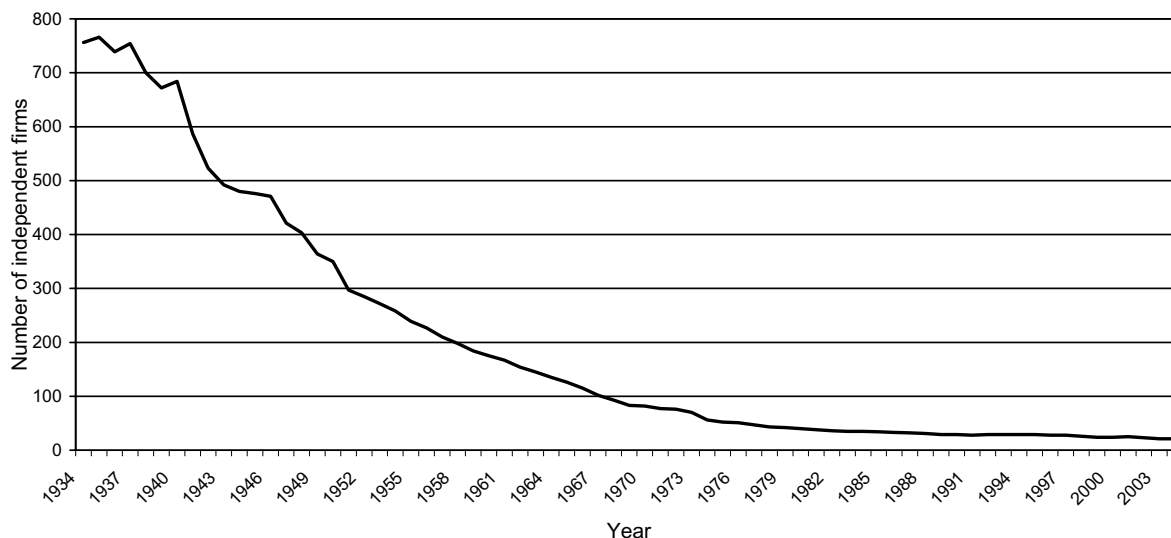
Prior to the mid-1970s, however, most macro brewers focused their marketing efforts on a single flagship brand of regular domestic beer, such as Budweiser by Anheuser-Busch, Coors Banquet, Miller High Life, and Pabst Blue Ribbon. Although there were slight differences among brands, blind taste test results reveal that most consumers could not distinguish one brand of macro brew from another. In a market where firms produce perfectly homogeneous goods and compete by simultaneously choosing prices, the static Bertrand-Nash equilibrium predicts that price competition will be fierce. This is called the Bertrand paradox because the Bertrand model predicts that pricing will be perfectly competitive, even in an oligopoly market, when brands are perfectly homogeneous. It also illustrates one of the most famous outcomes of game theory, the prisoners' dilemma. In a game characterized by a prisoners' dilemma, it is always best for an individual player to deviate from co-

operation.¹⁶ In an oligopoly market, all firms are better off by jointly setting the monopoly or cartel price, but each firm has an incentive to undercut its competitors when acting independently. One way to avoid competitive pricing is for firms to differentiate their products. In brewing, extensive product differentiation did not occur until the mid-1970s. Thus, one would expect pricing to have been competitive before that time.

Concentration and Price Competition

In a Cournot-Nash or in a repeated game, the number of competitors may also affect the degree of price competition. This is an issue of concern in brewing, as the number of independent macro brewers has continued to decline. After beer production ceased with Prohibition (1920–32), the number of independent brewing companies, what we term macro brewers, reached 733 in 1935 and declined to 22 firms by 2004 (Figure 3.6). This element of market structure is called industry concentration, which characterizes the number and size distribution of firms. One way to describe industry concentration is with a concentration curve, which plots the cumulative market shares attributable to the largest one, two, three, . . . n firms in the industry. An upward shift in the concentration curve implies greater industry concentration, which will occur as the number of firms in the industry declines or as the largest firms gain market share, *ceteris paribus*. Concentration curves for domestic beer production of the largest forty firms in brewing are plotted in Figure 3.7 for 1970 and 2004. They show that concentration grew considerably. This can also be seen by using common indices of industry concentration: the four-firm concentration ratio (CR_4) and the Herfindahl-Hirschman index (HHI).¹⁷ These indices are plotted in Figure 3.8 and reveal the steady increase in brewing industry concentration during the period. For example,

Figure 3.6 Number of U.S. Macro Brewers, 1934–2004



Source: The Office of R.S. Weinberg.

the market share of domestic beer production for the largest four firms was 44.2 percent in 1970 and reached 94.0 percent by 2004.¹⁸ According to the standards established by the Department of Justice, the brewing industry would have been classified as moderately concentrated by 1972 and highly concentrated since 1981.¹⁹ The high level of concentration and the growing degree of product differentiation suggest that price competition may have begun to diminish in brewing by the early 1980s.

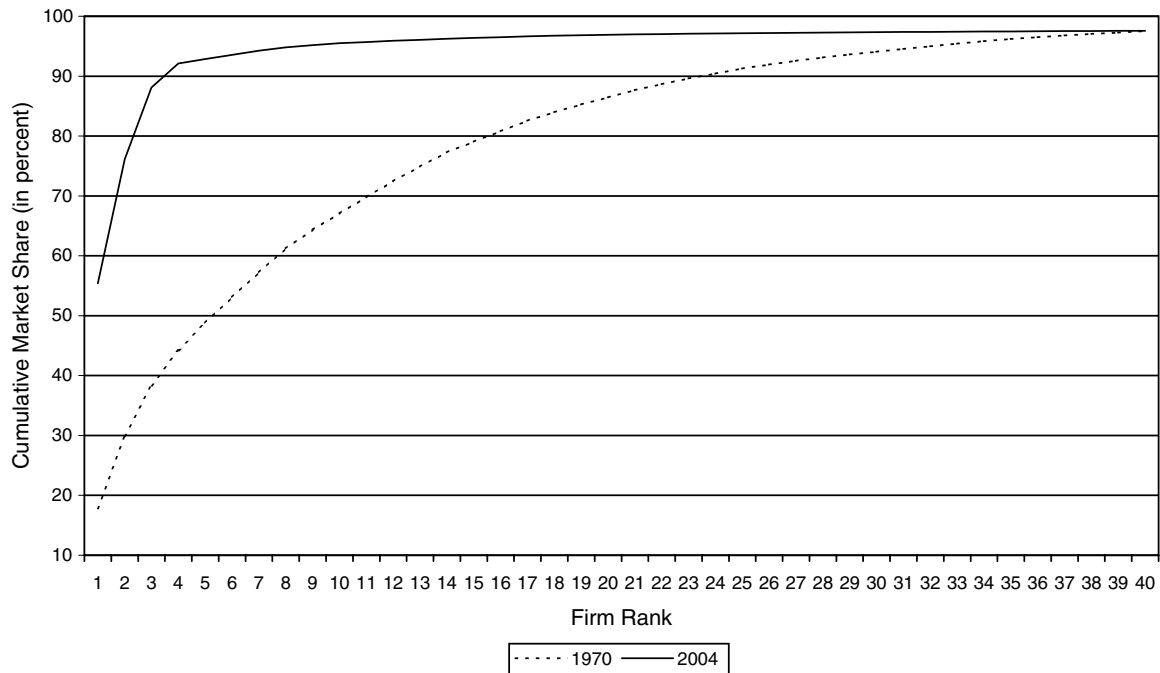
A common measure of the degree of price competition or market power is the Lerner index. This is defined as $(p-mc)/p$, where p is the market price and mc is marginal cost. When a market is perfectly competitive, price equals marginal cost and the Lerner index equals 0. With less competition, price rises above marginal cost and the index becomes positive. Thus, a higher value of the Lerner index implies less price competition. Because marginal cost is generally unobservable, average cost is frequently used to approximate marginal

cost. With this substitution, the index is called a price-cost margin. Although the price-cost margin provides a poor estimate of market power unless there are constant returns to scale, it does provide an accurate picture of how profitability changes over time, assuming that accounting methods remain the same and the market is never far from long-run equilibrium.

Competition and Profits During Three Eras: 1950–70, 1971–95, and 1996–2004

The price-cost margin, plotted in Figure 3.9, indicates that profitability in the brewing industry declined in the 1950s, remained low in the 1970s and 1980s, and has risen substantially since 1995. In spite of greater product differentiation and industry concentration, price competition remained high until the mid 1990s. To better understand the forces that have influenced profits over time, we focus our study on three periods or regimes. The first, 1950–70, corresponds to a time when

Figure 3.7 Concentration Curves for the U.S. Brewing Industry: 1970 and 2004



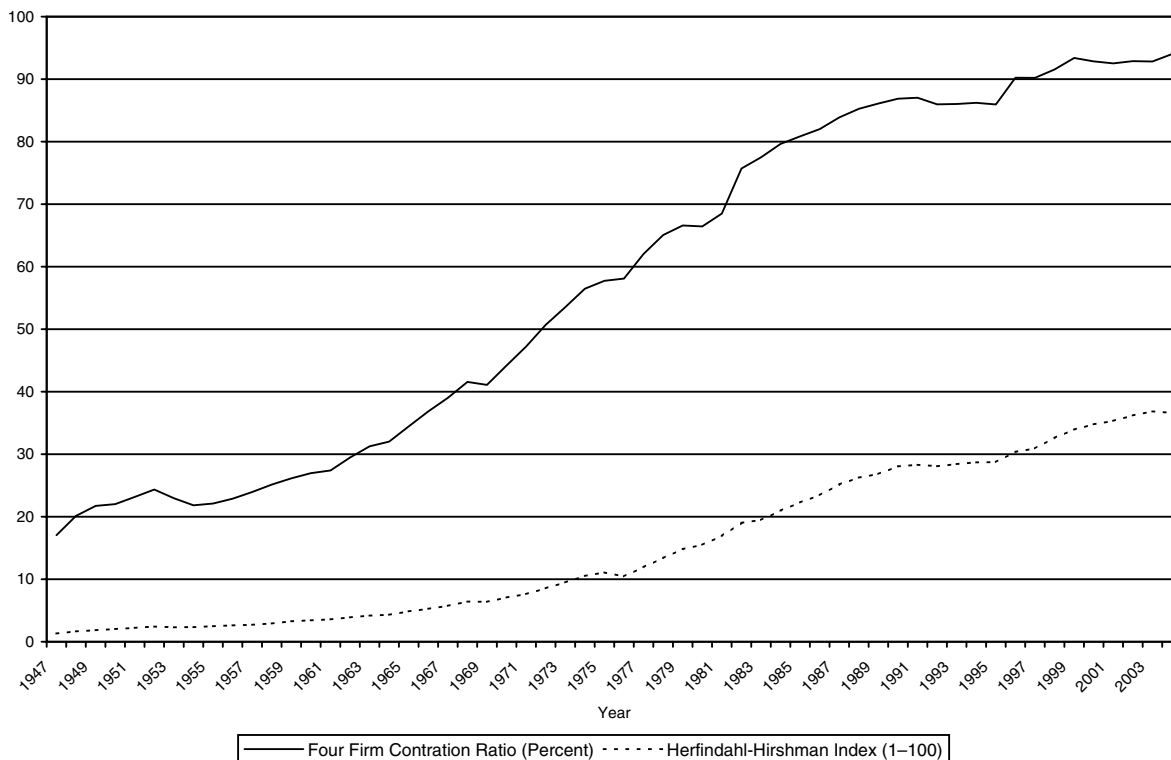
Source: The Office of R.S. Weinberg.

the major brewers produced nearly homogeneous goods and fought a preemption race in television advertising. The preemption race fostered tougher price competition and lower price-cost margins as leading brewers invested more heavily in television advertising. Markets were regional rather than national in scope during this time, however, and some regions of the country may have been insulated from intense competition, especially early on in this regime.

The second period, 1971–95, identifies the so-called beer wars. By the beginning of this period, the market became national in scope and the leading brewers built large new brewing facilities around the country to lower shipping costs and take advantage of growing MES. From 1970 to 1979, capacity expansion of the three largest brewers at the time (Anheuser-Busch, Miller, and

Schlitz) far outstripped growth in market demand. Total beer consumption increased by about 36 percent, while Anheuser-Busch increased its brewing capacity by almost 100 percent, Miller by almost 500 percent, and Schlitz by more than 80 percent. In addition, Philip Morris purchased Miller in 1970, a merger that caused Miller to mimic tobacco companies and undertake a brand-proliferation strategy during the 1970s. Another important event was Coors's expansion into new regional markets in an effort to become a national brewer during the 1980s. Coors sold beer in twenty-one states in 1980 and served every state by 1991. The substantial increase in MES forced firms into a war of attrition, a war that was intensified by the merger between Miller and Philip Morris and by the expansion of Coors. Thus, price and other forms of competition were fierce during this

Figure 3.8 Concentration in the U.S. Brewing Industry, 1947–2004



Source: The Office of R.S. Weinberg.

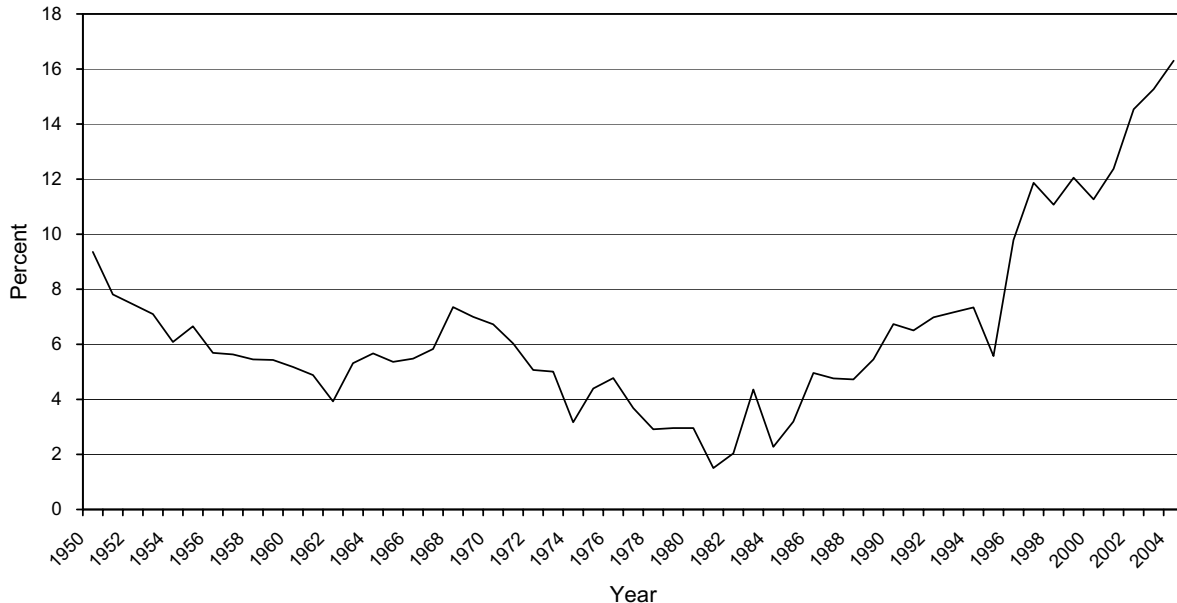
regime, which explains the record low price-cost margins.

The third period, 1996–2004, represents a time when competition appears to have subsided. By 1996, all of the remaining regional companies had exited, were on the verge of failure, or had contracted to serve a local niche market. The dominant three brewers, Anheuser-Busch, Coors, and Miller, took over almost all of the domestic beer production. Their market share of domestic beer production grew from 81.9 percent in 1995 to 94.0 percent in 2004.²⁰ The historically high price-cost margins suggest that industry concentration may have been sufficiently high to suspend intense competition in brewing during this period.

Trigger Strategies

One strategy that has been used in brewing to encourage cooperation is the trigger strategy. To illustrate how this works, consider a market in which each firm sets its price at a noncompetitive level (e.g., at the cartel price) if all rivals had set their prices at a noncompetitive level in the previous period. If a competitor chooses a more competitive price, this will trigger a harsh punishment in the form of a substantial price cut in the next period (normally to the Nash equilibrium price). By punishing noncooperative behavior, a trigger strategy will support cooperation as long as the punishment phase is sufficiently long, the

Figure 3.9 Price-Cost Margins in Brewing (Before Taxes), 1950-2004



Source: Brewers Imanac (various issues) and U.S. Treasury Department, Internal Revenue Service, Source Book.

discount of future profits is not too great, and the number of firms is sufficiently small. If effective, firms will cooperate and a punishment phase will never be observed. A punishment phase can occur, however, if firms miscalculate the present value of future profits, perhaps because the length of the punishment phase is unknown.

There is evidence that Anheuser-Busch has used such a strategy to support higher beer prices. The first known example occurred in the mid-1950s after a union agreement led to higher wages for brewery workers. Anheuser-Busch responded to this cost increase by raising the price of Budweiser, a price increase that was not followed by many of its rival brewers. Evidence from the St. Louis area indicates that Anheuser-Busch retaliated by lowering the price of Budweiser by as much as 20 percent. After cutting price for over a year, Anheuser-Busch raised the price of Budweiser once again. This time, rivals followed with a price

increase of their own. There is no question that Anheuser-Busch was attempting to use a punishment phase to facilitate coordination. According to court testimony, the president of Anheuser-Busch is quoted as saying that he ordered the price cuts to “punish them [rival firms] for refusing to increase prices. . . .”²¹ The punishment phase occurred in 1954, a year when price-cost margins took a noticeable dip (see Figure 3.9).

Similar events are documented in 1988 and 1995, when Miller and Coors discounted the prices of their flagship brands in order to gain market share from the remaining large regional brewers, the Heileman and Stroh brewing companies. Anheuser-Busch responded to these episodes with warning statements that Coors and Miller would “pay dearly if they continued the price slashing. . . .”²² Threats of a price war were effective, as less competitive pricing ensued (see Figure 3.9).

Aggressive advertising campaigns can also trig-

ger a punishment phase in pricing. In late 2004, Miller began a series of attack ads against Bud Light, the best-selling brand of light beer. The ads stated that Miller Lite has “more taste and half the carbs of Bud Light.” Initially, Anheuser-Busch responded with its own attack ads, but ultimately resorted to a price cut of its Bud Light brand in the summer of 2005. Price cuts on other Anheuser-Busch brands soon followed. This form of punishment may have worked, as Miller executives complained that such price cuts are not in the interest of the industry and encouraged all brewers to use advertising to promote a positive beer image. Anheuser-Busch subsequently announced that it would raise prices in 2006.²³

Mixed Strategies

The final pricing strategy common to the macro brewers is the use of a mixed strategy to market their flagship brands. This occurs when a brand is discounted unexpectedly with the intent of attracting the attention of price-conscious shoppers. To use a mixed strategy, a firm must identify a regular price, a discount price, and a probability of setting a discount price. When certain regularity conditions hold, a Nash equilibrium in mixed strategies will occur when it is optimal for one or more firms to discount their products in any particular time interval with some positive probability.²⁴ Unpredictability is important for a mixed-pricing strategy to be effective, since anticipated price cuts could be matched by rivals and consumers could postpone purchases until the next sale period.

Anheuser-Busch pioneered the mixed-price strategy in brewing by offering temporary discounts for Budweiser. The strategy has become common practice among the leading macro brewers.²⁵ Brewers must apply discounting judiciously, however, since a high price may be used by some consumers as a signal of high quality. In the past, brewers that

overused discounting found that the reputation of their flagship brands became tarnished. Excessive discounting of Pabst Blue Ribbon in the 1960s and of Miller High Life in the 1990s caused sales to eventually drop and these brands to slide into the popular-priced category.

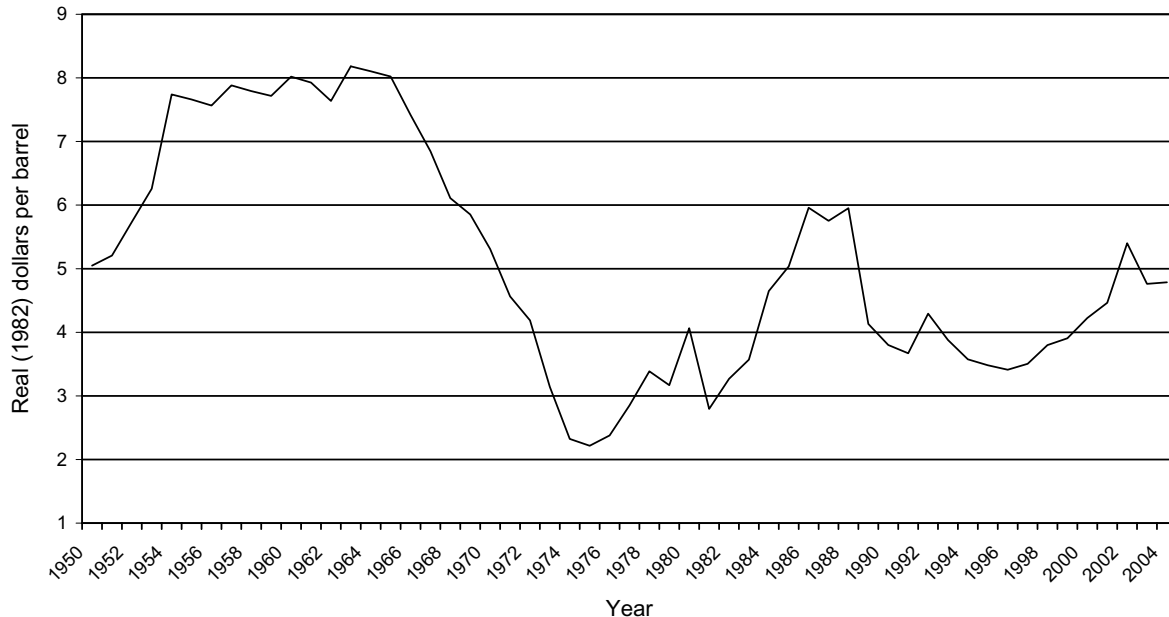
Advertising

Advertising can be an important strategic variable because it influences consumer demand and raises sunk costs. High sunk costs deter entry and generally result in high levels of industry concentration.²⁶ According to Joe Bain, advertising is “significant” and “substantial” when the intensity of advertising, measured by the ratio of advertising expenditures divided by sales revenues, exceeds 5 percent.²⁷ The brewing industry meets this criterion, as the advertising-to-sales ratio was 8.7 percent in 2004. This is similar to the advertising-to-sales ratios of other beverages and exceeds those of the cigarette, automobile, and pharmaceutical industries.

Advertising may inform consumers of product characteristics, increase brand loyalty by persuasive means, or create product images that become tied to the product.²⁸ The characteristics of beer, especially traditional domestic lager, are well-known to consumers, so there is little role for informative advertising. During the 1960s, a period of intense advertising competition, Raymond Bauer and Stephen Greyser found that consumers classified only 4 percent of beer advertising as informative.²⁹ The one exception occurs when a new brand is introduced. In order to inform consumers of its existence, the advertising-to-sales ratio is usually over five times the industry average in the first year that the new brand is introduced.

One reason why brewers spend so much money on advertising, even for established brands, is that beer advertising is “combative.” Empirical studies confirm that advertising influences firm

Figure 3.10 Advertising Per Barrel in the U.S. Brewing Industry, 1950–2004



Source: Brewers Almanac (various issues) and Beer Industry Update: A Review of the Evidence, 1977–2005.

demand but have little or no effect on total beer demand. This form of advertising is said to be combative because one brewer's advertising can increase demand for its product only by stealing customers from rival brewers. In this setting, firms face a prisoners' dilemma in advertising. This occurs because one firm's advertising imposes a negative externality on its competitors. When each firm behaves independently to maximize its own profit, the Nash equilibrium level of advertising will exceed that level which maximizes industry profits.³⁰ Much like the price wars in a Bertrand type game in prices, advertising wars will occur. This may explain why beer advertising among the macro brewers tends to be persuasive and image enhancing, as these forms of advertising are designed to cultivate brand loyalty, thereby impeding the business-stealing effect of rival advertising. As discussed previously, some wealthy consumers

may also be willing to pay a higher price for heavily advertised premium brands if advertising creates brand names and images that are associated with prestige and high quality. When effective, this form of advertising creates subjective product differentiation, which may reduce price competition.

Figure 3.10 plots real advertising spending per barrel (measured in 1982 dollars), for the brewing industry, 1950–2004.³¹ Advertising spending per barrel does not follow a simple pattern and can be better understood by investigating different events that affected advertising competition in brewing. As discussed above, television advertising became an important marketing outlet for the large national brewers during the 1950s and 1960s, resulting in heated competition in television advertising spending. From the early 1950s through the mid-1960s, real advertising spending exceeded \$7.00 per barrel, which is well above the industry average of

Figure 3.11 Advertising Per Barrel for the Leading Brewers, 1969–2004



Source: Beer Industry Updates: A Review of Recent Developments, 1977–2005.

\$5.13 for 1950–2004. The high level of advertising spending and low price-cost margins during the 1950s and 1960s are also consistent with a prisoners' dilemma in advertising. The winners in this stage of the advertising race were Anheuser-Busch, Schlitz, and Pabst, companies that marketed their beer nationally and substantially gained market share from competing brewers.

The next important event that affected competition in brewing began in 1970 when Philip Morris bought Miller. The first move by Philip Morris was to increase Miller's advertising spending. By 1971, Miller spent \$6.80 a barrel on advertising, over two and a half times the amount spent by the other leading brewers (Anheuser-Busch, Schlitz, and Coors). Next, Miller introduced new brands and made substantial investments in new brewing facilities. In response to increases in MES, Miller

increased its brewing capacity by almost five times from 1970 to 1979. These investments caused Miller's sales to rise and its advertising spending per barrel to fall (Figure 3.11). The other leading brewers responded in kind, and it appears that cuts in advertising spending were used to help finance investments in brewing facilities. In addition, total beer sales rose steeply during the 1970s (see Figure 3.3), which also pushed down advertising spending per barrel.

The third event of importance regarding advertising competition was Coors's efforts to become a national brewer. Coors entered twenty-eight new states from 1980 to 1988, which required considerable advertising spending and investment in new distribution networks. Coors's advertising spending per barrel rose from \$0.94 to \$7.06 from 1978 to 1988. This started an advertising war among the

leading brewers, as the market demand for macro beer grew very little and advertising became more combative (see Figure 3.11). During this time, advertising spending rose from \$2.17 to \$4.62 per barrel for Anheuser-Busch and \$2.94 to \$4.38 per barrel for Miller. The advertising war subsided once Coors reached national status in 1991, and advertising spending at the industry level has remained at or below the long-run industry average of \$5.13 dollars a barrel since that time.

Exit and Devolution Strategies

Changing market conditions and resulting strategic battles caused the number of traditional macro brewers to decline from 421 in 1947 to 22 firms by 2004. To be successful on a large scale, a brewer needed to have survived the preemptive race in advertising during the 1950s and 1960s, built efficient new brewing facilities during the 1970s, introduced a successful brand of light beer in the 1970s, and maintained a premium image for core brands. At this point in the game, the winners are Anheuser-Busch, Coors, and Miller. Another survival route for the traditional brewer was to retreat to a local niche market by producing craft-style beer. This strategy reduces competition with the national brewers and enables them to compete in the faster growing domestic specialty sector of the market.

Two firms fared well through the preemption race in advertising, but both later undermined their own success with serious strategic blunders. The first is Pabst, the industry leader in 1949 and the third largest brewer through most of the 1960s. Pabst's major mistake was to discount its Blue Ribbon brand, which repositioned it from a premium to a popular-priced brand in the early 1960s. This proved successful at first, since popular-priced beer dominated industry sales with a market share of over 75 percent in 1961. Unfortunately for Pabst,

sales in the popular-priced category began to decline by the late 1960s. For example, the market share of popular-priced beer fell to 59 percent by 1970 and 23 percent by 1980. Today, this segment accounts for less than 10 percent of sales. In hindsight, the repositioning of Blue Ribbon was a mistake, and at present the future of Pabst appears to be in doubt. Pabst has a declining market share, and all of the company's beer is brewed under contract with Miller. The other example of a successful firm that stumbled is the Schlitz Brewing Company, the last brewer to hold the number one spot before Anheuser-Busch took it over in 1957. Schlitz remained the number two brewer until the late 1970s, when its sales began a steep decline. Cost-cutting measures that lowered the perceived quality of Schlitz beer, poorly timed and unsuccessful introductions of new brands, and a failed marketing campaign are partially to blame for the problems at Schlitz. In Chapter 13 of this volume, Avi Goldfarb makes an effective case that the marketing battles between Anheuser-Busch and Miller in the mid 1970s, precipitated by Philip Morris's acquisition of Miller, also contributed to the demise of Schlitz.

Brewers facing a slippery slope toward failure took several different routes before exiting the market. Those with relatively weak financial positions and little chance of reaching MES chose to exit the industry rather quickly. In most cases, these firms were purchased by another domestic macro brewer.³² With so many firms on the chopping block, several firms chose to grow in size by purchasing failing brewers. Through the 1970s, the Department of Justice and the Federal Courts made it almost impossible for the leading brewers to grow by merger. Thus, only smaller, less efficient firms were able to purchase a failing brewer. As a result, most of the growth of the leading brewers came from building new brewing facilities.

The dominant strategy that evolved under these

conditions for the mid-sized firms was the harvest or devolution strategy. When under financial stress, a firm would make deep cuts to overhead costs, frequently eliminating all spending on advertising and maintenance of plant and equipment. By drastically cutting costs, exit was delayed until the company's physical capital and product goodwill sufficiently depreciated. These cuts allowed the firm to cut price and stay in business for many years. Because strict enforcement of the anti-merger laws made it impossible for the leading brewers to grow by merger, mid-sized brewers such as Heileman and Stroh were able to purchase failing breweries at relatively low cost. From 1961 through 1987, Heileman made seventeen horizontal acquisitions. When an acquisition included successful brands but inefficient brewing facilities, the acquired facilities would be closed and the new brands would be brewed at one of Heileman's existing, more efficient plants. When weak brands but more efficient facilities were purchased, the acquired brands would be discontinued and the new plant would replace one of Heileman's existing, less efficient plants. This strategy proved successful for Heileman until the supply of failing brewers dried up in the 1980s. With no new brands or facilities to replace depreciated ones, Heileman declared bankruptcy in 1991 and was sold to Stroh in 1996. Stroh went out of business in 1999, putting an end to the devolution strategy in brewing. All other small regional breweries have either gone out of business or retreated to local niche markets.

Hail Mary Strategies

It is common for a firm on the brink of business failure to pursue an unconventional strategy in its struggle to survive. Even though chances are low, such a strategy could save the firm from bankruptcy. The strategy poses little downside risk, as the firm will fail anyway unless a dramatic turn-

around takes place. Pursuit of an unconventional strategy in the face of failure is called a Hail Mary strategy, named after the long passes thrown by a trailing football team at the end of the game in a desperate attempt to complete a winning touchdown pass. Odds are against the play succeeding. Nevertheless, a long pass is thrown, knowing that the miracle pass completion would reverse the team's fortunes. Another important feature of this theory as it applies to business is that successful firms will monitor the unconventional strategies of other firms and mimic them if they prove to be successful.³³

Such behavior is common practice in brewing. In the words of industry expert, Robert S. Weinberg, "There seems to be an inverse relationship between having the means to take risks, and the willingness to take them."³⁴ The most common type of Hail Mary strategy found in brewing is the introduction of a new or unconventional brand or product. There are several notable examples of unconventional brands. The first is Old Frothenslosh, a brand of the Pittsburgh Brewing Company that was introduced in the 1960s and reintroduced in the 1970s. The Old Frothingslosh labels contained Day-Glo™ colors. The brand was marketed by a 300-pound woman, named Fatima Yechburg, and marketed as the "pale stale ale" and the "only brew you can find in the dark." Second, during Jimmy Carter's presidency the Falls City Brewing Company worked with the president's brother, Billy Carter, to develop and market Billy Beer in the late 1970s. Finally, the Eastern Brewing Company developed a brand called Nude Beer. Each container had a silver scratch off patch that when rubbed off revealed a picture of a nude woman. These brands met with limited success and were discontinued once their novelty faded. None of the leading brewers have resorted to such gimmicks.

One could also view the first introduction of light beer as a Hail Mary strategy. Light was ini-

tially introduced by three struggling regional brewers in the 1960s: Piel in 1961, Rheingold in 1967, and Meister Brau in 1968. Although light beer is the dominant beer category today, these pioneering brands were unsuccessful and did not save their failing parent companies. Part of the problem is that they were marketed as diet beers, a term that may not have appealed to beer drinkers. Light beer became a hit with the introduction of Miller Lite, a brand that was first marketed nationally in February 1975. Recall that Miller pursued a brand-proliferation strategy after being purchased by Philip Morris in 1970. Lite's success is attributable to the advertising support it received from Philip Morris, as well as Miller's decision to avoid the diet beer connotation. Instead, Lite was marketed as a beer that is "great tasting" and "less filling." The success of Miller Lite became quickly apparent, and all of the leading brewers followed by introducing their own versions of light beer by 1978.

The behavior of Schlitz provides an excellent case study, as the company resorted to the use of unconventional strategies once its financial fortunes began to wane. Until the mid 1970s, Schlitz was a leading brewer and its actions were conservative and predictable. This changed when Schlitz began to fail in 1977, as the company tried several unconventional strategies until it was acquired by Stroh in 1981. In the 1970s, the advertising campaigns of the most successful brewers were humorous and emphasized quality. To turn the company around, however, Schlitz tried an aggressive new advertising theme in 1977. The ad featured a formidable boxer who drank Schlitz. When asked to switch to another brand, the boxer glared into the camera in a threatening manner and asked, "You want to take away my gusto?" The ads were quickly taken off the air as they were viewed as menacing, and they were later called the "drink Schlitz or I'll kill you" campaign.³⁵ In the final stages of decline, Schlitz resorted to blind taste test commercials

that aired live during the professional football playoffs and Super Bowl XV (1980–81). In these commercials, 100 Budweiser or Miller beer drinkers were asked to compare and evaluate the taste of their favorite beer with Schlitz. In spite of the fact that many preferred Schlitz, the campaign was unsuccessful. This was the first attempt by a major brewer to pursue blind taste test commercials on a large scale; subsequent attempts at blind taste test commercials by other declining brewers have also proven unsuccessful.³⁶

More recently, brewers under financial stress have resorted to the so-called "beer-n-babes" advertising campaigns.³⁷ In fact, one could argue that the use of sexually provocative ads is an indicator that a brewer is under financial stress. To illustrate, Stroh was in financial trouble during the early 1990s, experiencing a 44 percent decline in market share from 1989 to 1995. In 1991 the company used a "Swedish Bikini Team" (five women wearing blond wigs and bikinis) to market its Old Milwaukee brand. Even though their jobs were at stake, a group of female employees filed a lawsuit against Stroh, claiming that the ads encouraged sexual harassment. Stroh responded by dropping the ads. This legacy continues as Pabst, another declining firm and the current owner of Old Milwaukee, revived the Swedish Bikini Team to market Old Milwaukee in 2005.³⁸ Miller has also resorted to such tactics. In an effort to turn around a gradual but steady decline in market share since 1999, Miller introduced its so-called catfight ads in 2002–3. In these ads, two beautiful women, arguing over whether or not Miller Lite's best quality is that it "tastes great" or is "less filling," end up ripping off each other's clothes in a brawl in a water fountain. Rance Crain, editor-in-chief of *Advertising Age*, described these ads as "blatant sexism and exploitation of the female body."³⁹

Domestic specialty brewers have also used sex to promote beer. After experiencing a decline in

sales, Boston aired a “sex for Sam” radio advertisement in 2002, offering a free trip to a Boston concert to couples who engaged in sex in a public place. Company president, James Koch, later apologized for the ads. The ads and publicity associated with them may have been successful, however, as Boston’s sales rose in 2002 for the first time in six years. Another specialty brewer chose its name to make this connection explicit, The Great Sex Brewing Company of Redding, California, and has used such marketing slogans as “Let’s Have Some Great Sex” and “It’s Great Sex Time.”

Internationalization of the Brewing Industry

In the last several years, leading brewers around the world have expanded their geographic scope with a series of international mergers. In 2002, Miller was purchased by South African Brewers of the United Kingdom, and the new company is known internationally as SABMiller. In 2005, SABMiller bought a controlling interest in Bavaria SA, South America’s second largest brewer. Coors acquired Carling Breweries of the United Kingdom in 2002, and Coors and the Molson Brewing Company of Canada merged in 2005 to form the Molson-Coors Brewing Company. The industry leaders, Anheuser-Busch and SABMiller, are vying for a presence in China, the world’s largest beer-drinking nation. State-owned breweries in China have sought out foreign help with privatization, and Anheuser-Busch has purchased the Harbin Brewing Group of China. SABMiller has purchased three breweries in Shanghai and has recently expanded the brewing capacity of a Chinese partner, China Resource Breweries Limited.

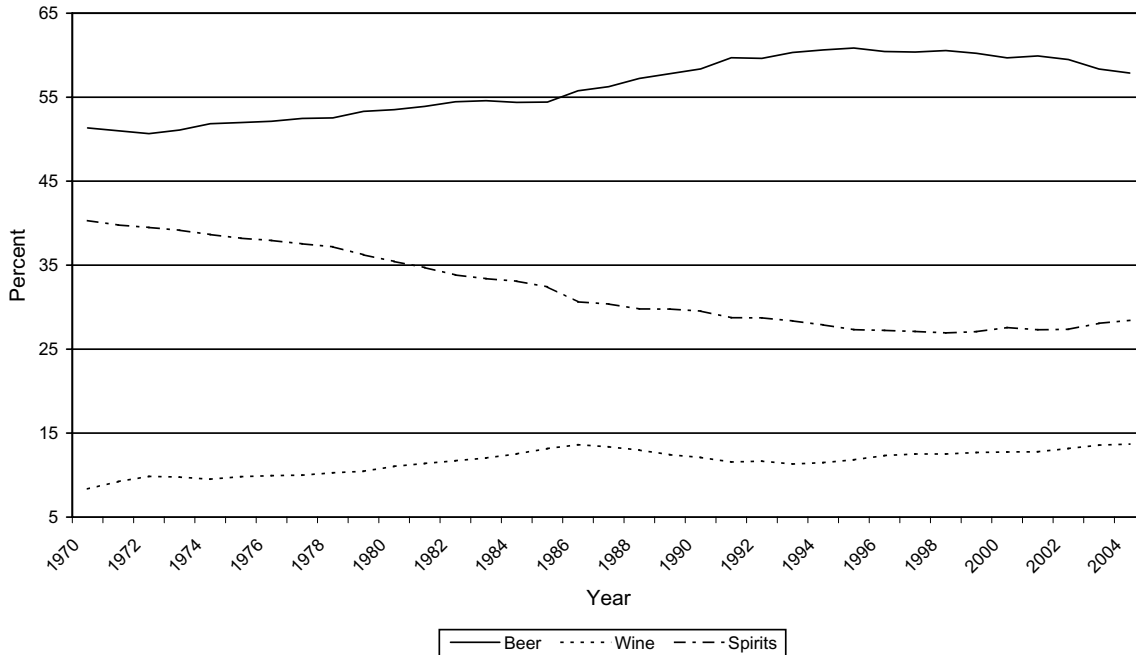
Several forces motivate a firm to internationalize. First, sufficiently low transportation costs and trade restrictions are required. The extent of scale economies can also be important. When MES is

large relative to the size of a national market, one way for a firm to reach MES is to expand into foreign markets. With sufficiently low transportation costs and trade barriers, unit costs may fall as the firm expands globally. The automobile industry fits this description and provides one explanation for the wave of international mergers in the industry during the last decade. There are substantial scale economies associated with the production of many automobile components, enabling a firm to attain lower unit-production costs as it serves a larger share of the world market. For example, Ford was able to lower its unit cost of production after acquiring Swedish-based Volvo in 1999. By designing and producing a common frame for its mid-sized Ford and Volvo cars, total production of mid-sized frames increased and unit costs fell.

In other markets like soft drinks, products are marketed internationally not because of scale economies in production but because of scale economies in the creation of a premium image. For an international brand like Coca-Cola that uses a unifying marketing theme, brand equity that is created in one country stays with consumers who travel or move to another country. A unifying, worldwide theme would be more effective for marketing campaigns that focus on a vertical characteristic, like a premium image for a high-quality good, than for a horizontal characteristic. Marketing a horizontal characteristic, like a mango- versus a lemon-flavored soft drink, may be region-specific and therefore of limited effectiveness globally. A marketing campaign that emphasizes a product’s high quality will appeal to all consumers around the world, as everyone prefers a high- to a low-quality good, *ceteris paribus*.

Marketing, more than production efficiencies, appears to be driving internationalization of the brewing industry. Like soft drinks, the premium brands receive most of the marketing effort of the leading international brewers. For example,

Figure 3.12 Market Share of Alcoholic Servings for Beer, Wine, and Spirits in the U.S., 1970–2004



Source: Alcohol Epidemiologic Data System, T.M. Nephew et al. Alcohol Epidemiologic Data Reference Manual, U.S. Apparent Consumption of Alcoholic Beverages Based on State Sales, Taxation, or Receipt Data. Washington, D.C., NIAAA.

Anheuser-Busch markets Budweiser internationally, promoting product quality and its “King of Beers” theme. Foreign brands with a reputation for excellence, such as Guinness Stout and Heineken, are also receiving greater marketing support around the world. Although marketed internationally, these brands are frequently brewed locally. In Japan, for example, Budweiser and Heineken are brewed under contract by the Kirin Brewing Company, and Guinness is brewed under contract by the Sapporo Brewing Company.

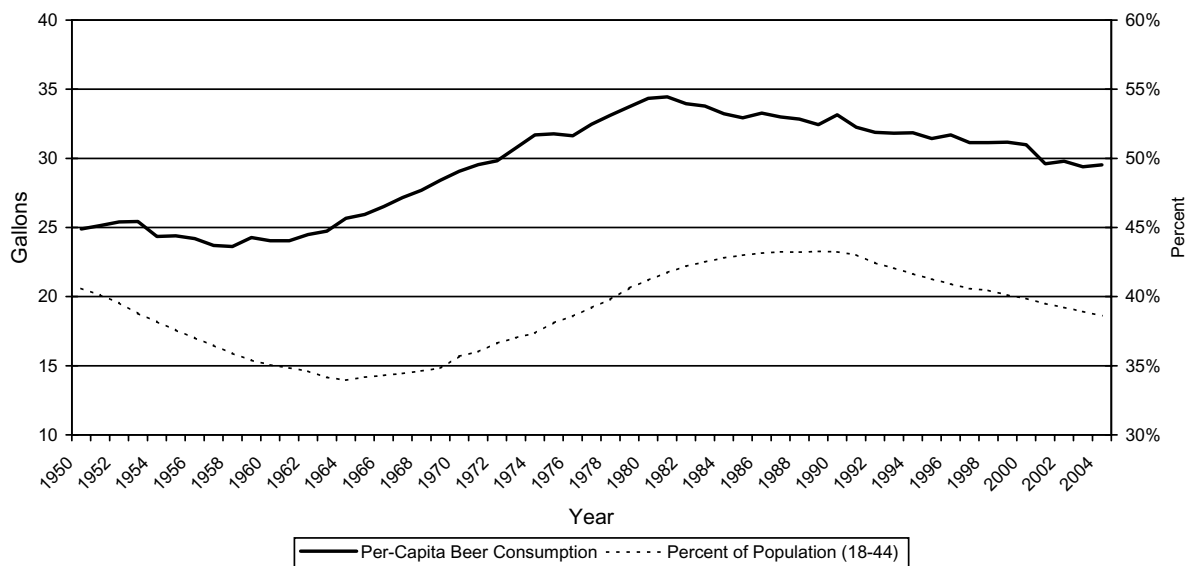
Strategic Interactions Among Beer, Wine, and Spirits Producers

The latest challenge facing the beer industry is competition from the wine and spirits industries.

Beer’s share of the market for alcoholic beverages rose from the early 1970s through the mid-1990s, primarily at the expense of the distilled spirits industry (Figure 3.12). Beer’s share has slipped of late, from 60.6 percent in 1998 to 57.9 percent in 2004, and several analysts claim “beer is dead.”⁴⁰ Wine consumption rose moderately in the mid-1980s, riding the temporary wine cooler craze. A more sustained increase in wine demand began in 1995 after a medical study at the University of Wisconsin found that moderate consumption of red wine reduces the risk of heart disease. Subsequent research has shown that part of the benefit comes from ethanol but that red wine provides added benefits due to its high concentration of antioxidants.

One explanation for these trends is the change in demographics. An important determinant of

Figure 3.13 Per-Capita Beer Consumption in Gallons and Percent of U.S. Population (18–44), 1950–2004



Source: The Office of R.S. Weinberg and Statistical Abstract of the U.S.

per-capita beer demand is the size of the primary beer-drinking population, which is eighteen to forty-four years of age. Figure 3.13 reveals a close relationship between these two variables. Demand studies suggest that older consumers prefer spirits and wine to beer. Thus, beer demand is likely to stagnate or fall with the aging U.S. population.

Changes in marketing policies may also be a factor. Unlike beer and wine producers, distilled spirits producers had agreed to a voluntary ban on all broadcast advertising since Prohibition. Motivated by declining demand and an interest in competing on a level playing field with beer and wine, Seagram Americas violated the industry's voluntary ban in June 1996. Other spirits producers followed, and the Distilled Spirits Council of the United States voted to rescind the voluntary broadcast advertising ban on November 7, 1996. Although opposition from consumer and public health organizations has limited the growth of

broadcast advertising of distilled spirits, spirits producers have increased their advertising spending relative to beer and wine since the ban was lifted. In 1996, spirits producers spent \$118 million on advertising, beer producers spent \$713 million, and wine producers spent \$83 million. From 1996 to 2004, advertising spending for spirits increased by 97 percent, while beer spending increased by 65 percent and wine spending increased by 38 percent. The increased marketing efforts of distilled spirits producers may have played a role in their growing share of the alcohol market since 1999.

According to James Arndofer, another factor working against the beer industry is the fact that many wealthy consumers and young adults who normally prefer beer are trading up to fashionable mixed drinks and high-priced wine and spirits brands.⁴¹ For example, sales of wines priced at over \$11 a bottle rose by 19 percent in early 2005.⁴² Because prestige and perceived quality are frequently linked to price,

beer is at a distinct disadvantage. When bottled and properly stored, wine quality can improve and spirits quality does not diminish with age. Thus, the price of a high-quality bottle of wine or spirits rises over time as the supply of a particular vintage falls with consumption. For example, a prominent Web merchant lists a five-liter bottle of red Bordeaux at over \$4,000 and a 750-millimeter bottle of single-malt scotch at over \$2,500. Beer is different, however, because beer quality deteriorates immediately after packaging. Most two-year-old containers of beer are undrinkable, and it is very rare to find even an imported brand of beer selling for more than \$20 for a 6-pack of 12-ounce bottles.

The leading domestic specialty brewer, Boston, has responded by introducing a series of “extreme beers” to compete for upscale spirits and wine drinkers. These include Samuel Adams Millennium, which was brewed just once in 1999, and Samuel Adams Utopia, first introduced in 2001. These extreme beer brands are unique in that they are noncarbonated and high in calories and alcohol. For example, Utopia is fermented with champagne yeast, has about 642 calories per 12-ounce serving, and is 25 percent alcohol by volume.⁴³ Millennium sold for \$200 per 32-ounce bottle, and Utopia is marketed in a 24-ounce decanter that sells for \$100.⁴⁴ An inability to store beer for long periods limits the growth potential of extreme beers, however.

To appeal to young adults, the macro brewers have introduced a variety of malt alternatives. These brews target young adults who prefer sweeter mixed drinks and soda pop to traditional beer. For example, the Zima brand by Coors comes in lemon-lime, orange, black cherry, and green apple flavors. Tequiza, by Anheuser-Busch, is a light lager beer that is flavored with lime and blue agave, a plant used to make tequila. Anheuser-Busch’s new *B^E* (pronounced B-to-the-E) brand is a malt alternative that is similar to an energy or sports drink. It is slightly sweet and brewed with caffeine, ginseng, and guarana (a Brazil-

ian stimulant). Malt alternatives contain more alcohol, calories, and carbohydrates than regular domestic beer. For example, a 12-ounce container of Zima Hard Orange is 5.9 percent alcohol by volume and contains 231 calories and 30 grams of carbohydrates. *B^E* is sold in 10-ounce cans and contains 6.6 percent alcohol, 203 calories, 22.5 grams of carbohydrates, and 54 milligrams of caffeine.⁴⁵

Sales of malt alternatives grew from 1 to over 3 percent of the malt beverage market from 1998 to 2002. This motivated distilled spirits producers to create their own malt alternative brands, such as Smirnoff Ice. Distilled spirits versions derive their alcohol from brewing rather than distilling because malt beverages are taxed at a much lower rate than distilled spirits.⁴⁶ The share of malt alternatives began to slip after 2002, and has fallen to 2.5 percent in 2004. Thus, it is unclear whether malt alternatives will have much of a lasting effect on the drinking habits of the young adults who prefer mixed drinks. Given their sweetness, it is also unlikely that regular beer drinkers will do more than sample a malt alternative beverage.

Although demographic trends are working against the brewing industry, it remains to be seen if the young adult trend toward mixed drinks will prove lasting and if the strategic responses of U.S. beer companies will be effective.

Conclusion

Two key events motivated strategic behavior among firms in the U.S. brewing industry. The invention of television and its impressive gain in popularity during the 1950s and 1960s created a new and powerful marketing tool for the national brewers. Second, technological change in the 1970s increased scale economies, giving large-scale brewers a cost advantage over smaller regional firms. Market demand was insufficient to support more than a few firms of sufficient size to

exploit national advertising and attain minimum efficient scale. Fierce competition ensued.

In this setting, U.S. brewers chose a variety of strategies, many of which can be found in game theory literature. The leading national brewers invested heavily in advertising, especially during the 1950s and 1960s, and later built super-sized brewing facilities in order to reach scale efficiency. During the beer wars of the 1970s and 1980s, the leading brewers also chose a brand proliferation strategy to usurp market share from their smaller regional competitors. The evidence also shows that Anheuser-Busch used a trigger strategy to support higher beer prices, although not always with success. Finally, the leading domestic brewers have begun to internationalize as the market becomes global.

Competitive pressure and the actions of the leading brewers created unfavorable market conditions for smaller regional brewers. As a result, they took a variety of different strategic paths. In the last fifty years, Coors is the only regional brewer to successfully gain national status. This was accomplished by increasing advertising spending and investing in distribution systems in new states. Other surviving regional brewers have retreated to local niche markets by brewing brands of craft-style beer that do not compete directly with the brands of the national brewers. Of the 421 macro brewers in 1947, 399 exited the market by 2004. Some exited rather quickly, but others pursued one of two strategies. Several regional brewers postponed their demise by using a devolution strategy: slashing costs and milking all of the remaining brand equity and productive capacity out of their plant and equipment. Others chose a Hail Mary strategy: a risky action or gimmick that has a low expected return but, if successful, could save the company from almost certain demise.

In most cases, the strategic actions of successful and failing firms have been rational and in keeping with the principles of game theory. There is some evidence, however, that a handful of firms made stra-

tegic blunders due to a lack of foresight or inadequate understanding of strategic principles. In such cases, an understanding of game theory may have enabled management to identify strategies that better fit the changing conditions in the brewing industry.

Notes

We wish to thank Bob Weinberg of the Office of R.S. Weinberg, St. Louis, for graciously providing data on firm output and the number of independent macro and specialty brewers. We also wish to thank Yan Du, John Hall, Natsuko Iwasaki, Yasushi Kudo, Maya Sherpa, and Andrew Stivers for providing helpful comments on an earlier version of the chapter.

1. James D. Robertson, *The Connoisseur's Guide to Beer* (Ottawa, Illinois: Jameson Books, 1984).

2. Ted Goldammer, *The Brewers' Handbook* (Clifton, VA: KVP Publishers, 1999).

3. *Consumer Reports*, "Can You Judge a Beer by Its Label?" (June 1996), pp. 10–17.

4. The interested reader can find a more complete discussion of the data and the economics of the brewing industry in our previous work: Victor J. Tremblay and Carol Horton Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis* (Cambridge, MA: MIT Press, 2005).

5. For a review of the game theoretic concepts found in this chapter, see Robert Gibbons, *Game Theory for Applied Economists* (Princeton, NJ: Princeton University Press, 1992); Luis M.B. Cabral, *Introduction to Industrial Organization* (Cambridge, MA: MIT Press, 2000); Dennis W. Carlton and Jeffery M. Perloff, *Modern Industrial Organization* (Boston: Addison Wesley, 2005); Lynne Pepall, Daniel J. Richards, and George Norman, *Industrial Organization: Contemporary Theory and Practice* (Cincinnati, OH: South-Western, 2004); Oz Shy, *Industrial Organization: Theory and Applications* (Cambridge, MA: MIT Press, 1995); Don E. Waldman and Elizabeth J. Jensen, *Industrial Organization: Theory and Practice* (Boston: Addison Wesley, 2000). For further discussion of games involving a war of attrition, a preemptive race, devolution strategies, and Hail Mary strategies, see Jeremy L. Bulow and Paul D. Klemperer, "The Generalized War of Attrition," *American Economic Review*, 89, 1 (March 1999), pp. 175–89; Ulrich Doraszelski and Sarit Markovich, "Goodwill and Awareness Advertising: Implications for Industry Dynamics," working paper, Department of Economics, Harvard University, 2005; Pankaj Ghemawat and Barry Nalebuff, "The Devolution of Declining Industries," *Quarterly Journal of Economics*, 105, 1 (February 1990), pp. 167–86; Debra J. Aron and Edward P. Lazear, "The Introduction of New Products," *American Economic Review*, 80, 2 (May 1990), pp. 421–26.

6. Douglas F. Greer, "Beer: Causes of Structural Change,"

in *Industry Studies*, ed. Larry L. Duetsch, p. 34 (Armonk, NY: M.E. Sharpe, 2002).

7. Doraszelski and Markovich, "Goodwill and Awareness Advertising: Implications for Industry Dynamics."

8. Drew Fudenberg and Jean Tirole, "The Fat-Cat Effect, the Puppy-Dog Ploy, and the Lean and Hungry Look," *American Economic Review*, 74, 2 (May 1984), pp. 361–68.

9. MES is defined as the minimum level of production needed to reach constant returns to scale. Evidence on the size of MES in brewing can be found in Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*, and Victor J. Tremblay, Carol Horton Tremblay, and Natsuko Iwasaki, "The Dynamics of Industry Concentration for U.S. Micro and Macro Brewers," *Review of Industrial Organization*, 26, 3 (May 2005), pp. 307–24.

10. The sample includes five brewers for which financial data are available. These include two specialty brewers, Redhook Brewing Company (with a unit cost of \$125.56) and the Boston Beer Company (\$69.43), and three macro brewers, Coors (\$66.59), Miller (\$60.18), and Anheuser-Busch (\$60.83).

11. Bulow and Klemperer, "The Generalized War of Attrition."

12. Originally, an important reason for the German purity law was to shift beer ingredients from wheat to barley. Wheat was needed for bread production and vital to the nutrition of the German people during the late Middle Ages.

13. Thorstein Veblen, *The Theory of the Leisure Class* (New York: Macmillan, 1899).

14. See Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis* (Chapter 7, 2005) for a review of the extensive literature on consumer blind taste tests of different brands of beer.

15. The other new styles developed by the macro brewers include low-alcohol beer, with half the alcohol of regular beer (offered from 1983–91), dry beer (1988–98), and ice beer (1993–). Ice beer is the only type still brewed today, but its market share has declined since 1999.

16. For a review of the prisoners' dilemma and static oligopoly games of Bertrand (price) and Cournot (output), see Robert Gibbons, *Game Theory for Applied Economists* (Princeton, NJ: Princeton University Press, 1992); Jean Tirole, *The Theory of Industrial Organization* (Cambridge, MA: MIT Press, 1988); Luís M.B. Cabral, *Introduction to Industrial Organization*, (Cambridge, MA: MIT Press, 2000); Don E. Waldman and Elizabeth J. Jensen, *Industrial Organization: Theory and Practice*, 2nd ed. (Boston: Addison Wesley, 2001); Lynne Pepall, Daniel J. Richards, and George Norman, *Industrial Organization: Contemporary Theory and Practice* (St. Paul, MN: South-Western College, 1999); and Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, 3rd ed. (Reading, MA: Addison-Wesley, 2000).

17. CR_4 is defined as the market share of the largest four firms in the industry, and HHI is defined as the sum of the

squared values of each firm's market share. When market share is measured in percentages, CR_4 ranges from 0 to 100 and HHI ranges from 0 to 10,000. To make comparisons easier, we divide HHI by 100 so that it ranges from 0 to 100. These indices are discussed in most industrial organization textbooks, including Luís M.B. Cabral, *Introduction to Industrial Organization*, Dennis W. Carlton and Jeffrey M. Perloff, *Modern Industrial Organization*, Lynne Pepall, Daniel J. Richards, and George Norman, *Industrial Organization: Contemporary Theory and Practice*, and Don E. Waldman and Elizabeth J. Jensen, *Industrial Organization: Theory and Practice*.

18. These concentration measures are only accurate if the market is properly defined. National figures are used here because the market became national by the late 1960s. Imports are ignored because this allows us to better understand the distribution of the domestic producers and because the import brands are not perfect substitutes for the traditional lager produced by the macro brewers.

19. The Merger Guidelines of the Department of Justice classify an industry as moderately concentrated when HHI ranges from 10,000 to 18,000 and as highly concentrated when HHI exceeds 18,000.

20. Although Pabst is an independent brewer, all of Pabst's beer has been brewed under contract by Miller since 2003.

21. Roland H. Koller, "The Myth of Predatory Pricing: An Empirical Study," *Antitrust Law and Economics Review*, 4, 4 (Summer 1971), pp. 105–23.

22. *Business Week*, "A Warning Shot from King of Beers" (December 18, 1989), p. 124.

23. For further discussion of these events, see *Modern Brewery Age Weekly*, "Miller Begins New Wave of Attack Ads" (October 25, 2004), pp. 1–2; "Anheuser Strikes Back, with Humor this Time" (November 29, 2004), p. 1; "Regulators Reject A-B Complaints About Miller" (April 18, 2005), pp. 1–4; "Miller Says it Will Continue Aggressive Marketing Plan" (June 20, 2005), pp. 1, 5–6; "Beer Wholesalers See Looming 'Price War' in Citigroup Survey" (August 1, 2005), pp. 1, 5; "Transcript of Analysts Panel from NBWA" (October 17, 2005), p. 1; "U.S. Brewers Look for Image Enhancement" (November 17, 2005), pp. 1, 3; "Anheuser Tells Analysts that Sales are Improving" (December 6, 2005), pp. 1, 3.

24. For a detailed description of a mixed-strategy Nash equilibrium, see Robert Gibbons, *Game Theory for Applied Economists*.

25. *Fortune*, "While the Big Brewers Quaff, the Little Ones Thirst" (November 1972), p. 103.

26. John Sutton, *Sunk Cost and Market Structure: Price Competition, Advertising, and the Evolution of Concentration* (Cambridge, MA: MIT Press, 1991).

27. Joe S. Bain, *Industrial Organization* (New York: Wiley, 1959).

28. For an excellent review of the economics of advertising, see Kyle Bagwell, *The Economic Analysis of Advertising*, monograph, Department of Economics, Columbia University, 2005.

For a discussion of the social costs of advertising in brewing, see Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*, and Jon P. Nelson, “Beer Advertising and Marketing Update: Structure, Conduct, and Social Costs,” *Review of Industrial Organization*, 26, 3 (May 2005), pp. 269–306.

29. Raymond A. Bauer and Stephen A. Greyser, *Advertising in America: The Consumer View* (Cambridge, MA: Harvard University Press, 1968).

30. In contrast, if a firm’s advertising attracts customers to its own and its rivals’ brands, then the firm will ignore this positive externality and advertise less than is jointly maximizing. See Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*, and Andrew Stivers and Victor J. Tremblay, “Advertising, Searching Costs, and Welfare,” *Information Economics and Policy* 17, 3 (July 2005), pp. 317–33, for further discussion of this point.

31. Due to data limitations, for the remainder of the chapter we use this measure of advertising intensity instead of the advertising-to-sales ratio.

32. In our previous work, we document 215 horizontal mergers and acquisitions among the macro beer companies from 1950 to 2002: Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*.

33. Aron and Lazear, “The Introduction of New Products.”

34. *Modern Brewery Age*, “The Year in Review: 1993” (March 21, 1994), pp. 8–39.

35. *Fortune*, “Getting Schlitz Back on Track” (April 24, 1978), pp. 47–49.

36. Tremblay and Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*.

37. Lauren Clark, “Beer & Babes Go Back a Long Way” *All About Beer Magazine* (September 2002), pp. 28–77.

38. *Modern Brewery Age Weekly*, “Swedish Bikini Team Lives!” (February 7, 2005), p. 1.

39. *Advertising Age*, “Can Miller Beer Survive the Mess It’s In?” (July 7, 2003).

40. James B. Arndofer, “The Death of Beer” *Advertising Age* (May 2, 2005).

41. Arndofer, “The Death of Beer.”

42. *Modern Brewery Age Weekly*, “Wine Industry Reports that Sales of More Expensive Wines are Booming” (June 6, 2005), p. 6.

43. *Modern Brewery Age Weekly*, “Koch Reviews Utopias” (July 18, 2005), p. 4.

44. Although more affordable than extreme beers, Anheuser-Busch introduced Michelob Celebrate during the holiday season of 2005, which has 10 percent alcohol by volume and sells for about \$15 for a 24-ounce bottle.

45. By comparison, a 7-ounce cup of coffee contains 80–135 milligrams of caffeine and tea contains about 40 milligrams. A 12-ounce container of Coke contains 34 milligrams of caffeine and Pepsi contains 38 milligrams of caffeine.

46. On average, the federal tax rate on an ounce of ethanol is \$0.10 for beer and \$0.21 for spirits.

Selected Readings

The following books and book chapters provide a more complete discussion of the economics of the U.S. brewing industry.

Elzinga, Kenneth G. “Beer,” in *The Structure of American Industry*, eds. Walter Adams and James W. Brock. Upper Saddle River, NJ: Prentice-Hall, 2004.

Greer, Douglas F. “Beer: Causes of Structural Change,” in *Industry Studies*, ed. Larry L. Duetsch. Armonk, NY: M.E. Sharpe, 2002.

Scherer, F.M., “Beer,” in *Industry Structure, Strategy, and Public Policy*, ed. F.M. Scherer. New York: Harper Collins, 1996.

Tremblay, Victor J., and Carol Horton Tremblay, *The U.S. Brewing Industry: Data and Economic Analysis*, Cambridge, MA: MIT Press, 2005.

The following books and articles review the game-theoretic strategies discussed in this chapter.

Bulow, Jeremy L., and Paul D. Klemperer. “The Generalized War of Attrition,” *American Economic Review* 89, 1 (March 1999), pp. 175–89.

Cabral, Luis M.B. *Introduction to Industrial Organization*. Cambridge, MA: MIT Press, 2000.

Carlton, Dennis W., and Jeffery M. Perloff. *Modern Industrial Organization*. Boston: Addison Wesley, 2005.

Doraszelski, Ulrich, and Sarit Markovich. “Goodwill and Awareness Advertising: Implications for Industry Dynamics,” working paper, Department of Economics, Harvard University, 2005.

Ghemawat, Pankaj, and Barry Nalebuff. “The Devolution of Declining Industries,” *Quarterly Journal of Economics* 105, 1 (February 1990), pp. 167–86.

Gibbons, Robert. *Game Theory for Applied Economists*. Princeton, NJ: Princeton University Press, 1992.

Pepall, Lynne, Daniel J. Richards, and George Norman. *Industrial Organization: Contemporary Theory and Practice*. Cincinnati, OH: South-Western, 2004.

Shy, Oz. *Industrial Organization: Theory and Applications*. Cambridge, MA: MIT Press, 1995.

Tirole, Jean. *The Theory of Industrial Organization*. Cambridge, MA: MIT Press, 1988.

Waldman, Don E., and Elizabeth J. Jensen. *Industrial Organization: Theory and Practice*. Boston: Addison Wesley, 2000.

