

## LIQUID BREAD: AN EXAMINATION OF THE AMERICAN BREWING INDUSTRY, 1865 TO 1940. PART I

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### Chapter 1

During the late 19<sup>th</sup> and early 20<sup>th</sup> centuries, American manufacturing underwent rapid and sustained changes. Large, mass-production factories replaced smaller, craft-based operations. As average plant size grew, the total number of firms in many manufacturing industries fell, and these industries became highly concentrated.

Curiously, this dramatic rise of large-scale manufacturing has not received much attention from neoclassical economists and economic historians. For example, Passel and Attack, in their popular American economic history textbook - *A New Economic View of American History* - devote just one chapter to this industrial transformation, as do Hughes and Cain in their work *American Economic History*.<sup>1</sup> In their brief reviews of this topic, these authors ignore many of the relevant developments raised by economic theorists and economic sociologists.

In the last 20 years, many social scientists, including Oliver Williamson, Naomi Lamoreaux, Alfred Chandler, William Lazonick, Mark Granovetter, and William Roy, have attempted to explain why firms increased in size and why industries became highly concentrated. Some studies have focused on the rise of mass production, while others have concentrated on the implications of this industrial transformation. But there has been no systematic examination of the common themes of this heterogeneous body of work. In part this is because many of the best known of the authors (e.g., Chandler and Williamson) have not responded to recent offerings which explicitly challenge their ideas (e.g., Berk, Granovetter, and Roy).

These popular writers and their followers have advanced a misperception: that interpreters of industry concentration share certain basic beliefs about the underlying causes of the process. Common to neoclassical economics and some economic history is a presumption that mass production is organized efficiently. This understanding is usually expressed in the form of truisms: unless there are exogenous shocks like government interference, market decisions regarding production and distribution are pareto-optimal. If the market senses that goods can be made more efficiently in mass rather than craft production, then the economy will naturally evolve in this manner.

The goal is simply to elucidate mass production's inherent efficiencies, to determine if they reside in technology, organization, or the ability to economize on transaction costs.

While this efficiency-driven understanding dominates the literature of industrial transformation, it does not go unchallenged. Many have questioned the presumed gains commonly associated with large firms and concentrated industries: are prices actually lower? Is the technology more efficient than possible alternatives? Are the products of higher quality? Were consumers really the driving force behind the introduction of new products and changes to existing products?

Among the first to dispute the efficiency thesis were those who saw the rise of large, vertically integrated firms as an exercise in market control. They did not see the industrial behemoth as a natural, rational creation of the market, but as the result of conscious efforts to effect greater market control. A more recent debate has exam-

ined instances in which inefficient technologies have become ‘locked in’.<sup>2</sup> These cases show that the market does not automatically subject technologies to a ‘survival of the fittest’ contest; rather, a host of cultural, social, and organizational factors interact in shaping an industry’s technological path.

In addition to differences regarding the relative degree to which efficiency guides the economic processes of the firm, there are distinct ideas about how the firm is best studied. Rosenberg<sup>3</sup> has contrasted those who take the inner workings of the firm to be an unimportant ‘black box’ with those who see the inner workings as the true subject of economic analysis. I have chosen to focus on the degree of agency that authors accord to firms. My question is this: Are firms portrayed as passive responders to market signals or as active participants in the shaping of the economic environment?

Most work in the neoclassical tradition treats firms as passive. Those who argue that large firms arose because of technological indivisibilities do not allow the firm much latitude in entrepreneurial decision-making: it simply responds to exogenously imposed technical imperatives. Williamson<sup>4</sup> attributes vertical integration to transaction-cost economizing: depending on the results of what resembles a series of cost/benefit analyses, firms either buy from the market or produce internally.

Another view maintains that the firm may advance its interest in any number of ways. It may lobby the government for preferential treatment or for a new interpretation of a law or ruling. It may seek to construct demand for its product through advertising and marketing campaigns. It may undertake efforts to redefine images of product quality. It may introduce new technologies or production processes.

In this view, the firm does not take consumer preference, government regulation, and technology as exogenous variables. Though the manner in which authors endogenize these factors varies, they share a belief that the most successful firms are the most active ones. The economists and economic historians who argue along these lines<sup>5</sup> have been joined by sociologists,<sup>6</sup> political scientists<sup>7</sup> and historians of technology.<sup>8</sup> What distinguishes these authors is their understanding of how and why economic processes unfold, and with

what implications. Some of them accentuate the positive; others recognize the potential for sub-optimal outcomes. Do firms who are shaping their economic environment always end up operating in ways that are beneficial to the economy and society or are they most interested in promoting their own narrow self-interest?

Roy, for example, discusses the rise of America’s modern brewing industry in the late 19<sup>th</sup> century, and argues that efficiency theory is unable to explain the industry’s structure prior to national Prohibition in 1920. Though this capital intensive industry might have seemed ripe for domination by a few large firms, in fact there were over 1,500 breweries in 1900. Large scale production did not guarantee the biggest firms a competitive advantage. A broad range of factors shaped the economic and social environment in which breweries operated, and a full understanding of the industry’s development must take these factors into account.<sup>9</sup> Industries do not automatically evolve along efficient or beneficial lines; rather, this process often reflects the abilities of entrepreneurial firms to shape their environment, and one result may be that consumers will face more expensive and/or lower quality goods.

To highlight the essential themes addressed in this varied literature, I propose grouping authors into four boxes in a two-by-two matrix. The two horizontal rows compare theories of how and why economic processes develop, while the vertical columns distinguish between passive and active firms.

To help test the usefulness of this matrix, I present a case study of the American brewing industry during the crucial period 1865 to 1940. The brewing industry is an especially interesting test case for these ideas concerning industry and firm development. It grew to become one of the nation’s largest manufacturing industries by the turn of the century, yet it was shut down by the federal government just years after it reached its highest production levels. In addition, brewing was also on the cutting edge of a series of advances in areas ranging from technology and science to retailing and wholesaling. By studying how these developments were put into practice, we will gain a rich understanding of how active breweries were in advancing their own interests. By considering the effects of these moves, we can evaluate whether these changes were driven by a natural search for greater efficiency.

	<i>Firm as passive responder to market signals</i>	<i>Firm as active participant in, and maker of, its social and economic environment</i>
<i>Economic processes are natural, inevitable, and efficiency driven</i>	I Technology School; I-O literature on Economies of Scale; Williamson <sup>10</sup> & Transaction Cost Literature	II Lazonick <sup>11</sup> ; Chandler <sup>12</sup>
<i>Economic processes, like all social and economic institutions, are constructed: they are neither natural, inexorable, nor driven by ahistorical conceptions of economic efficiency</i>	III Monopoly School; David <sup>13</sup> ; Arthur <sup>14</sup> ; Lamoreaux <sup>15*</sup>	IV Berk <sup>16</sup> ; Granovetter <sup>17</sup> ; St. Clair <sup>18</sup> ; Misa <sup>19</sup> ; Roy <sup>20</sup>

Table 1.1. Conceptualizations of firms and industry development

\* Lamoreaux presents an interesting case in terms of categorization. While she avoids interpreting the merger wave as an optimal market response, she does seek to explain this process in terms of 'objective' economic facts. An argument can be made for putting her in the cell above.

In Quadrant I, a belief that economic processes unfold naturally and beneficially is combined with a view of firms as passive responders to market signals such as exogenously determined consumer preference. Without nonmarket interferences, firms and industries will develop according to the dictates of productive and allocative efficiency. This quadrant, which is most reflective of standard neoclassical theory, takes tastes, technologies, and endowments as exogenous. These variables are not of primary interest. Rather, the goal is to understand how firms efficiently respond to market signals.

In Quadrant II, we have similar theories of the development of economic processes, but with a recognition that firms are direct actors in their economic and social environment. Firm activity is not feared by these authors, however, for these steps will lead to market-determined efficient outcomes. Authors in this quadrant superimpose a recognition that firms participate actively in their environment on a fundamental belief in efficient and beneficial outcomes.

Quadrant III theories hold that though firms are largely passive agents, economic outcomes may not be optimal.

If the market does not select the best outcome, then the government may need to step in and impose new regulations. Though inefficiencies may arise, the emphasis here is not on the deliberate role firms play in contributing to sub-optimal economic outcomes.

Quadrant IV integrates an appreciation of the steps that active firms take to shape their economic and social environment with an understanding that economic processes may not yield optimal results. Firms act in their own self-interest, and there is no guarantee that these actions will result in efficient or optimal outcomes, automatically lead to higher quality products or lower prices for consumers. The next step is to review in detail how these four quadrants address the issues of firm agency and economic efficiency.

### Section 1.1: Efficient processes and passive firms

Quadrant I represents the most familiar combination of themes: economic processes are efficient and firms react to exogenous shocks. Most neoclassical theories of industrial transformation fit here. One prominent example is the work associated with the field of industrial organization, especially during the 1960s and 1970s.

Contributors here claimed that the move to large-scale production was inexorable, as it was associated with technological indivisibilities. They believed that large, vertically integrated firms were simply the efficient response to production processes that rewarded high output levels.

It was these two decades that saw the emergence of analytical tools like survivor technique and terms such as 'minimum efficient scale' and 'economies of scale'. Several articles on the brewing industry estimated the ever-growing minimum-efficient level of annual production, and argued that engineering requirements necessitated ever larger plants as the average size of the surviving breweries increased.<sup>21</sup>

These works suggested that the most important factor determining firm success was output or size. Breweries simply conformed to exogenously imposed, technically determined ways of running their businesses. The market, in turn, rewarded efficiently run breweries with additional sales, while punishing smaller firms that refused to install new and larger brewing kettles.

This conception of the economy relegates the government to an external force which imposes regulations on an orderly industry. Similarly, these articles subsume their discussions of advertising and marketing campaigns to their overriding belief in efficiency. For example, Greer<sup>22</sup> emphasizes the economies of scale associated with large-scale advertising campaigns; he does not present advertising as a dynamic firm strategy.

Product quality is not an issue, as these authors generally start with the assumption of product homogeneity. The possibility of creativity by the firm is disallowed: they obviate any discussion about how firms should introduce new production processes (or how they should balance reliance on the market with internal production) by asserting that rational economic agents will, at a point in time, make the appropriate decisions.

One conclusion that emerges from this literature is that concentrated industries were not only inevitable, but also beneficial: consumers benefited from lower prices, and producers benefited from superior technologies. These findings accord well with an ideological preference for business activity unfettered by state interference and regulation.

Some less orthodox neoclassical economists have begun to criticize the technological determinism underlying traditional theories of the firm. Oliver Williamson, one of the leaders of transaction-cost economics, writes:

The prevailing orientation toward economic organization in the thirty year hiatus between 1940 and 1970 was that technological features of firm and market organization were determinative. The allocation of economic activity as between firms and markets was taken as a datum; firms were characterized as production functions; markets served as signaling devices; contracting was accomplished through an auctioneer; and disputes were disregarded because of the presumed efficiency of court adjudication. The possibility that subtle economizing purposes are served by organizational variety does not arise within - indeed, is effectively beyond the reach of this orthodox framework.<sup>23</sup>

Eggertsson makes a similar argument early in his book on economic behavior and institutions:

Price theory or microeconomics, in its conventional form treats organizations and institutions the same way as it treats the law of gravity: These factors are implicitly assumed to exist but appear neither as independent nor as dependent variables in the models. Such economy in model making can be eminently reasonable ... However, unlike the law of gravity, organizations and institutions are not invariant; they vary with time and location, with political arrangements and structures of property rights, with technologies employed and physical qualities of resources, commodities, and services that are exchanged. In fact, production involves not only the physical transformation of inputs into outputs but also the transfer of property rights between the owners of resources, commodities, and labor services. In the transfer of rights, whether within firms or across markets, agents maximize their objective functions subject to the constraints of organizations and institutions.

Once our research questions involve variable organizations and institutions, either as exogenous or endogenous variables, conventional microanalytic analysis becomes a rather blunt instrument. Our traditional tools are not well suited for examining the nature of the firm, the variation in industrial organization, institutional change in economic history, the organization of exchange in formal markets and nonmarket settings or comparative economic settings.<sup>24</sup>

It is notable that these passages were penned by neo-classical economists: both writers are clearly frustrated by the long-standing tendency of neoclassical theory to treat firms as 'production functions'. Though economists and historians have long complained about this feature of neoclassical theory,<sup>25</sup> it is only within the last few decades that (some) orthodox economists have begun to discuss the role that institutions, culture, and organizational design play in determining how firms develop and prosper. Yet, how fundamentally different is Williamson's own work?

Williamson expresses his distaste for both technological determinists and gainsayers of efficiency. Central to his story are transaction costs. Transaction costs, according to Williamson, are the 'economic counterpart to friction', that is, they represent the costs associated with the running of an economic system. He claims that transaction cost economics ushers in a new mode of analysis, where the 'concept of firm as production function is supplanted (or augmented) by the concept of firm as governance structure'.<sup>26</sup> What is needed, he argues, is 'Greater respect for *organizational* (as against technological) features and for *efficiency* (as against monopoly) purposes ...'<sup>27</sup> He senses that the various literatures on the theory of the firm can be grouped according to certain themes. He proposes organization vs. technology and efficiency vs. monopoly. While my matrix in Table 1 may seem to resemble his categorization, it is quite distinct. First, there are, in addition to the monopoly view, many arguments against efficiency. Second, I place neoclassical work on organization and technology on the same row, as they share a presumption that economic activity is efficiently motivated, differing mainly in their causal factor. Third, a key measure of whether the neoclassical spell of 'firm as a production function' has been broken is to evaluate how much agency authors grant the firm. Williamson does not raise this issue.

What his project has in common with standard neoclassical offerings is the parallel between profit maximization that is central to orthodox theory, and 'economizing', that he sees as the essence of transaction-cost economics. He clearly belongs in the first row of Table 1.1's matrix.

Williamson has been critical of both monopoly-based and technology-based interpretations. In rebutting the

monopoly school, he claims that the rise of large firms should be viewed as a welcome development - they simply replaced their less efficient, smaller competitors. He criticizes the monopoly school for their fixation with the theory of perfect competition, and their distrust of any deviations from it.<sup>28</sup> The point of reference underlying the perfectly competitive model has been so severely changed as to make this theory devoid of real-world applicability. He asserts that since the real world no longer resembles the economy pictured in the perfectly competitive model, a new theory is needed. An economy populated by atomistic firms is neither realistic nor efficient. Out of these criticisms he justifies the rise of large, powerful firms as natural responses by the market to reward efficient organizational forms.

Essential to his story is the idea that large-firm efficiency is inextricably linked to its organizational structure. Neoclassical theory, in which 'the firm is regarded as a production function', has no interest in organizational design and, hence, no need for transaction cost theory. What is interesting is that Williamson seems unsure of how to treat partisans of the monopoly and the technology schools: are they the same or do they represent related but different challenges? This is a confusion that he does not resolve. At times he discusses the problems posed by monopoly and technology advocates separately, yet he also has passages which conflate them:

The recent strategic behavior literature excepted, all the monopoly approaches to contract work within the neoclassical framework, where the firm is regarded as a production function. Inasmuch as the natural boundaries of the firm are therein defined by technology, any effort by the firm to extend its reach by recourse to nonstandard contracting was presumed to have monopoly purpose and effect.<sup>29</sup>

He seems uncertain whether the schools constitute one monster with two heads or whether they are two distinct creatures. This ambiguity aside, it is clear he intends to challenge the implications these views have for the neoclassical theory of the firm.

For Williamson, transaction-cost economics bears the burden of explaining when firms produce internally and when they buy from the market. Underlying the decision-making process is the concern with efficiency. In a passage touting the explanatory power of transaction cost economics, he writes, 'Vigorous resistance

notwith-standing, the technological and monopoly presumptions of an earlier era have gradually made way for an interpretation in which efficiency purposes are more prominently featured'.<sup>30</sup> He seeks to avoid the determinisms of earlier writings while he highlights the importance of productive efficiency as a guide and evaluator of economic activity. Englander<sup>31</sup> argues convincingly that technology is in fact a determining factor in Williamson's transaction cost story, despite all of Williamson's claims to the contrary.

With Williamson's place in Row One established, we must evaluate his view on firm agency. Transaction-cost theory holds that firms react to their given economic environment at a point in time by either buying on the market or producing internally. More fundamentally, firms passively react to transaction costs themselves which Williamson portrays as coming from nowhere. Williamson's treatment of transaction costs place him firmly in Column One, the column notable for its limited degree of firm agency. An example from the American brewing industry illustrates his approach. In a subsection titled 'Mistaken Integration', he argues that American brewers who sought to secure outlets for their beer in the late 1800s erred by not anticipating the post-Prohibition shift from draught to packaged beer that ultimately rendered direct saloon control unimportant. He interprets the purchasing of saloons as a 'short run expedient' that was rendered 'nonviable' after the shift.<sup>32</sup>

This interpretation, as I shall argue in later chapters, ignores the complexity of how and why the brewing industry evolved. Large national brewers worked assiduously to construct a demand for packaged beer. They took these steps for several reasons, including the higher profitability of packaged beer, and the fierce competition they faced from pre-Prohibition local breweries in the dominant draught-beer market. Williamson reasons backwards from a historically contingent outcome: packaged beer replaced draught beer. He does not explore the reasons for this outcome, and he fails to appreciate the role the leading breweries took in shaping their economic environment. A detailed review of the brewing industry will show that the national breweries did far more than choose whether to internalize production or buy from the market. The problem here is that Williamson takes an outcome, treats it as historically inevitable, and then cooks up a transactions costs analysis to evaluate whether the process was effi-

cient or not. The basis of the difficulty here is that Williamson picks his way through summaries of historical and contemporary case studies, looking for vignettes that he can adopt. This approach can often backfire when the case he seeks to appropriate turns out to be far more complicated than he appreciates. That is certainly the case with his treatment of examples from the brewing industry, and I anticipate that it may similarly weaken some of his other examples. What does become apparent is that Williamson's view that firms simply respond to their economic environment places him in Column One.

Williamson trumpets the influence of his work on the role of the government. He maintains that part of the problem with traditional industrial organization theory is that it emphasized market power and denigrated the efficiency gains associated with dominant firms. In part because of his work, he claims, courts and the federal government have begun to balance a concern with monopoly power with the efficiencies associated with larger organizations.

Williamson fully supports attempts to replace government regulatory efforts with cost/benefit analyses. Summarizing changes in the judiciary, he asserts:

Matters changed in the 1970s as a greater appreciation for efficiency benefits developed and as the conception of the firm as a governance structure took hold. The perverse hostility with which efficiency differentials were once regarded gave way to an affirmative valuation of efficiency benefits.<sup>33</sup>

The government's 1960s antitrust policy was far too officious; he argues for less regulation and a greater appreciation for the benefits of mergers (horizontal, vertical, and conglomerate). He sees government as an exogenous force operating on the economy, and makes no effort to endogenize its activity. The government's role in the economy should be minimal: it should maintain a consistent legal framework and clearly articulate property rights and contract law.

In Williamson's 1985 book *The Economic Institutions of Capitalism*, there is no mention of product quality or of marketing and advertising. This disregard is in keeping with the neoclassical assumption of product homogeneity. Authors in Column Two recognize (to

varying degrees) that advertising, marketing, and product quality are all issues integral to firm performance. Williamson's framework relegates the key decision-making of firms to steps taken at a point in time. He focuses on whether or not firms vertically integrate in response to a given set of market conditions, and is far less interested in tracing out the consequences of these decisions as abilities and needs change, and as the economic environment evolves. Thus, I argue that he belongs in Quadrant I, along with the standard industrial-organization work he seeks to strongly to distance himself from.

### Section 1.2: Efficient processes and active firms

Quadrant II combines an underlying belief in an efficiency-driven economy with an understanding that firms actively participate in their social and economic environment. Alfred Chandler is the best-known representative of this perspective. Like Williamson, Chandler attributes the rise of concentrated industries to vertical integration. In a series of pioneering books and articles, he presents his interpretation of the modern business enterprise's birth and development.<sup>34</sup> He uses an array of industry and firm studies to illustrate the story of the forces that led to industrial concentration. Paramount to his narrative is decision-making within the firm.

Chandler's ultimate goal is to account for the changing processes of production and distribution. As indicated by the title of his 1977 book, *The Visible Hand*, he believes that the invisible hand of the marketplace was gradually replaced by the manifest actions of management. This occurred when 'new technology and expanded markets permitted a historically unprecedented high volume and speed of materials through the processes of production and distribution.'<sup>35</sup> Large-scale producers came to dominate their industries not simply from gains that arose from economies of scale, but from those associated with economies of speed:

Increases in productivity and decreases in unit costs (often identified with economies of scale) resulted more from the increases in the volume and velocity of throughput than from a growth in the size of the factory or plant. Such economies came from the ability to integrate and coordinate the flow of materials through the plant than from greater specialization and subdivision of the work within the plant.<sup>36</sup>

Thus, the greater efficiency of large firms is due not to their size, but to an adept coordination of their many parts.<sup>37</sup>

Like Quadrant I authors, Chandler views the rise of the modern business enterprise as a natural and inexorable development. He sees his interpretation as an improvement on crude technological determinism. The ascendancy of big firms is attributed to developments in infrastructure, organization, and technology; the move to concentrated industries is seen as a consequence of the emergence of the modern, integrated managerial structure. The process, once underway, was irreversible and the increasing domination of industry leaders became inexorable. In a direct challenge to the monopoly school, Chandler argues that large companies developed not primarily to avoid price competition or to erect barriers to entry, but to take advantage of the productive and distributive efficiencies associated with vertical integration. Horizontal mergers, regardless of their motivating force, were not a viable longer term strategy unless combined with the efficiencies generated through vertical integration.<sup>38</sup>

The move to large-scale production was a positive-sum process, Chandler believes, for consumers also benefited from these efficiencies through access to goods of 'high quality at low prices'.<sup>39</sup> In an improvement over the writers in Quadrant I, he sees that discussions of productive efficiency must include product quality, though he does not consistently explain how the resulting products were improved.

Often, Chandler seems to mistake the ability to standardize a product with the ability to improve a product's quality. The application of new technology and the introduction of scientific methods may have enabled greater and more consistent production, but this does not necessarily mean that product quality rose. Furthermore, though he and Williamson often talk about how productive efficiencies lead to lower prices for the consumer, they do not document how often consumers actually benefited from sustained lower prices.

Unlike Williamson, Chandler gives consideration to the role of advertising and marketing campaigns. His discussion of these issues raises two questions: how important were advertising and marketing in the modern

business enterprise's rise to prominence? What is the relationship between advertising, marketing, and productive efficiency? He addresses the first question, but sidesteps the second.

He uses the examples of tobacco magnate James Duke and Quaker Oats founder Henry Crowell to demonstrate the reliance of many first generation businesses on costly yet effective advertising and marketing campaigns, that served to 'enlarge and maintain' their markets. Duke, along with other manufacturers who adopted continuous-process technology, used 'massive marketing campaigns' to gain control of the tobacco market.<sup>40</sup> In 1889 Duke's advertising expenditure was \$800,000, which he could afford because he had a higher production volume (and thus a larger cash surplus) than his rivals.<sup>41</sup> Henry Crowell, the builder of the first continuous-process mill, made an immediate impact on the breakfast cereal industry when he decided to package, market, and advertise his own brand of oats.<sup>42</sup> According to Chandler, Crowell's success was in no small measure due to his ability to help construct a consumer market for oatmeal as a breakfast cereal.<sup>43</sup> The burgeoning cereal market, and Crowell's place in it, depended heavily on advertising and marketing.

While Chandler is well aware of the importance of advertising and marketing strategies, he shies away from drawing out their implications for the rise of the large, integrated firm. After spending several paragraphs detailing the importance of advertising to Duke's successes as a purveyor of tobacco, he reverses himself: 'By combining mass production with mass distribution Duke was able to maintain low prices and reap high profits'.<sup>44</sup> He seems unable to attribute Duke's achievements to processes unrelated to production; by emphasizing low prices he returns to his theme that alert entrepreneurs and consumers benefited from organizational and technological innovations.<sup>45</sup>

Writing of the burgeoning field of mass marketing, he argues,

By means of such administrative coordination, the new mass marketers reduced the number of transactions involved in the flow of goods, increased the speed and regularity of that flow, and so lowered costs and improved the productivity of the American distribution system.<sup>46</sup>

Yet this claim about the greater efficiency of mass marketers doesn't address the central issue, which is the degree to which key firms owed their commercial successes to clever advertising and marketing campaigns and not simply to changes in organization and technology. Chandler seeks to show that consumers doubly benefited from products that were both better and cheaper, but asks us to assume that these benefits naturally follow from a firm's ability to construct and enlarge a consumer market.

Though Chandler's treatment of firm agency is quite distinct from Quadrant I entries, his treatment of government is similar. By ignoring the role of politics, he strengthens the hand of those who believe that government interference or intervention is undesirable. His work provides another justification for laissez-faire ideology: the replacement of the invisible hand of the marketplace with the visible hand of management was associated with better and cheaper goods. At no point in his telling of the story does this process depend on government participation, either in creating, facilitating, or sustaining these propitious results.

William Lazonick's work also belongs in Quadrant II. Lazonick<sup>47</sup> pursues many of the themes advanced by Chandler in *The Visible Hand*. Like Chandler and Williamson, he makes vertical, not horizontal, integration, his focal point. Both Williamson and Lazonick borrow heavily from Chandler in their studies, but Lazonick felt that Williamson misinterpreted Chandler's work.

While Chandler seemed content to describe and interpret, Williamson developed theories on the rise of large-scale businesses. Sensing that a theoretical extension of Chandler's work was needed, but rejecting outright Williamson's conclusions, Lazonick constructs a theory of the modern business enterprise more in keeping with his understanding of the spirit of Chandler's work.

Lazonick begins by distinguishing between what he calls adaptive and innovative firms. The key difference between these types of enterprises is whether they actively try to shape the factors that make up their economic environment or whether they passively take those factors as given. Innovative firms willingly make developmental investments (high-fixed cost outlays)

so that they may ‘produce high-quality (desirable) products at low unit (affordable) costs’.<sup>48</sup> In contrast, adaptive businesses simply respond to their economic environment. At any point, both types of firms may coexist, but over time only innovative firms will prosper.

For Lazonick, innovative firms must be more vertically integrated than their adaptive counterparts. The rise of large, vertically integrated enterprises is to him an essential part of the American economy’s evolution. Industry concentration is deemed a necessary development, as large innovative firms replaced their smaller, adaptive competitors. This conception of the firm as an active maker of its own environment is markedly different from traditional neoclassical and transaction-cost treatments of the firm. Lazonick is extremely critical of neoclassical theory that either ignores the firm or relies on a crude technological determinism. While he shares with Williamson a belief that organizational form is the important factor missing from standard conceptions of the firm, Lazonick also argues that Williamson’s analysis suffers from a static conception of the firm. Lazonick states that

Williamson’s transaction cost approach puts forth a theory of the adaptive organization and ignores the role of the business enterprise in the innovation process...The passive role of the enterprise in the determination of strategy and structure is also implicit in Williamson’s statement that ‘in the beginning there were markets’.<sup>49</sup>

Lazonick evinces a much richer, Column Two understanding of firm agency; he is quite critical of Williamson’s Column One portrayal of the firm as a passive responder to its economic environment.

What is needed is an understanding of why, over time, some firms succeed while others fail. Lazonick takes from Chandler’s work a belief that the theory of the firm must be dynamic, not static. The fatal flaw in Williamson’s work, then, is not that it is wrong *per se* (though he does equivocate on this point), but that it does not go far enough. Lazonick feels that his conception of ‘innovative’ and ‘adaptive’ firms encompasses, but also goes beyond, the static world of transaction-cost economics.

Unlike Williamson and other neoclassicists, Chandler and Lazonick know they have to consider how firms

sell their output. They both integrate discussions of advertising and marketing strategies into their stories, though both seem somewhat unsure of how to treat these activities - are they ‘good’ or ‘bad’? At one point Lazonick notes that the advertising in America of the 1950s and 1960s was an *adaptive* strategy since it utilized ‘existing productive resources but [did] not develop new productive resources’.<sup>50</sup> Elsewhere, he seems to reverse himself: ‘It is only through ... investments in marketing that the innovative enterprise can hope to transform its high fixed costs into low unit costs’.<sup>51</sup>

Lazonick suggests that it is appropriate for innovative firms to employ advertising and marketing campaigns in order to facilitate sales of their high-quality output. In this context, such strategies are not economically wasteful, since innovative firms make ‘higher quality products’ utilizing ‘cost-reducing processes’.<sup>52</sup> Marketing enables efficient companies to transform their mass production into mass sales.<sup>53</sup>

Though Lazonick cites several studies detailing the key roles marketers and advertisers played in constructing and maintaining consumer demand, he seems not to know how to relate these findings to his ideas about innovative and adaptive firms. He wants to trumpet the benefits of the innovative firm, as long as he can attribute their successes to productive efficiencies. In this view, a marketing and advertising strategy is useful only for selling superior, lower-cost goods, and thus is bootless in the hands of an adaptive firm.

Innovative firms win out because they are more efficient, and the economy prospers from the market’s natural selection. Lazonick differs from Column One entries in that he recognizes that firms are active players in their economic and social environment. While the distinction between innovative and adaptive firms is useful, his preoccupation with productive efficiency narrows his understanding of innovation. Dynamic businesses may seek to strategically pursue rival patents or sway tax authorities or government regulators or to create and sustain consumer demand for higher cost and/or lower quality goods: these are just a few examples of winning strategies which do not rely upon or foster productive efficiency.

Quadrant II studies offer more compelling understandings of firm behavior than those in Quadrant I.

Lazonick and Chandler are interested in how and why firms introduce new production processes; tracing the consequences of these investment decisions, they show an appreciation for the role of the entrepreneur. Column Two stories highlight the interactions between firms and industries and the government, and recognize the important role of aggressive marketing and advertising campaigns. The main weakness in Quadrant Two readings, I believe, lies in their uncritical interpretation of these steps. They presume that greater efficiency and increased consumer welfare are the natural results when firms lobby the government to change policies, as Chandler shows Pabst, a large Milwaukee brewery, did in order to win approval of a new taxing system for bottled beer in 1890. They presume that firms only heighten consumer awareness when they launch sustained marketing and advertising campaigns. They do not consider that firms may be using these campaigns to shape consumer preferences for dubious goods (e.g., tobacco) or for goods of dubious quality (e.g., pasteurized, packaged beer rather than fresher, unpasteurized draught beer).

Authors in Row One share a view of the economy as meritocracy. While adducing quite discrete explanations for the rise of large firms, they all manifest a belief that large firms came to the fore because they deserved it. Their success may be traced to the cost savings associated with high production levels (minimum efficient scale), or to the transaction cost savings that accrue under specific behavioral and asset-specificity assumptions or to the shrewdness some innovative firms show in making key fixed-cost investments. Regardless of their specific line of analysis, efficiency-driven stories have a certain amount of appeal, especially to those schooled in neoclassical economics.

But, is this optimism warranted? Arguments made by those on the bottom row of Table 1.1 would suggest not. Row Two authors reject the view that the move to vertically integrated firms was inevitable, irreversible, efficient and beneficial. Some focus on the anticompetitive consequences attendant on this industrial transformation;<sup>54</sup> others examine the manner in which technologies become standardized in the economy;<sup>55</sup> and a select few discuss how firms shaped their economic setting, often at the expense of greater social and economic well-being.<sup>56</sup>

### **Section 1.3: Constructed processes and passive firms**

Quadrant III combines passive firms with a recognition that industries, firms, and technologies may not evolve automatically along the most economically efficient paths. Concentrated industries may reflect a desire to set prices; technologies may become standardized despite sub-optimal performance.

Chronologically, the first representatives of this view were those that Williamson and others have grouped under the heading Monopoly School.<sup>57</sup> Writing in the midst of the late 19<sup>th</sup> century industrial transformation, they concentrated more on its consequences than on its causes. They saw an economic environment that began to deviate significantly from that of the perfectly competitive model, and they held that concentrated markets reflected a desire for economic power rather than a natural development to be welcomed by society. Though long out of fashion, the work of the monopoly school is important because it emphasized that the rise to prominence of large firms may not be justified on economic grounds.

In addition, this work legitimized an active role for government. While it does not present the sophisticated understanding of the relationships existing among government, firms, and industry articulated by later writers (e.g. St. Clair, Berk, Misa, Granovetter), it does recognize that the market may not automatically pick the most economically efficient outcomes.

Lamoreaux<sup>58</sup> offers a more current rendering of the turn-of-the-century Monopoly School thesis. In discussing the 1895-1904 merger movement she rejects the widely held view that the merger was a natural response to the maturation of large, integrated firms. In her view, industry concentration came about because companies sought to increase their market power - or, at least, to ease the debilitating consequences of market shocks. While she departs from neoclassical stories by showing that changes in industry structure do not necessarily reflect market led movements toward greater efficiency (that is, she offers a Row Two view of how economic processes evolve), her view that firms are passive responders to their environment has more in common with Column One than Column Two analyses.

Lamoreaux shows that businesses responded to depressions by engaging in destructive pricing campaigns or by consolidating, and she claims that consolidations arose as manufacturers tried to avoid the destructive price wars common in the 1880s and early 1890s. But why did some industries consolidate while others continued in competitive pricing campaigns? Lamoreaux identifies a series of characteristics shared by merger-prone industries: they tended to be capital intensive, mass producing, relatively young, rapidly growing, and subject to high fixed costs.<sup>59</sup> Firms sharing these measurable features were often prime candidates for horizontal mergers.

In this view, firms adapt to their environment rather than interact with it. By focusing on how businesses respond to exogenous shocks, she ends up with a fairly static portrayal of firm agency. Missing from this picture are efforts taken by firms to shape government legislation and consumer demand, and efforts to alter the nature and status of their competitiveness.

If her treatment of firm decision-making is not entirely persuasive, her work is still quite significant. She goes against the grain when she argues that the move to concentrated market structures was not necessarily benign.<sup>60</sup> She recognizes that firms may merge because of a desire to effect market control, and this leads her to conclude that large operations may emerge victorious not from improved product quality or greater efficiency but from efforts to subvert or alter competitive market forces.

Paul David's and Brian Arthur's work also belongs in Quadrant III. They each examine cases in which less than optimal technologies become the industry standard. Their recognition that inefficient technologies may become 'locked in', firmly places them in the Second Row of Table 1. Discussing the struggle for supremacy over VCR format, Arthur comments that 'if the claim that Beta was technically superior is true, then the market's choice [of VHS] did not represent the best economic outcome.'<sup>61</sup> The interesting question, then, is why VHS quickly became the industry standard.

Arthur offers two reasons for this development, corporate maneuvering and sheer chance. While aware of the influence of conscious business activity, he focuses on the role of randomness:

Economic activity is quantized by individual transactions that are too small to observe, and these small 'random' events can accumulate and become magnified by positive feedbacks so as to determine the eventual outcome. These facts suggested that situations dominated by increasing returns should be modeled not as static, deterministic problems but as dynamic processes based on random events and natural positive feedbacks, or nonlinearities.<sup>62</sup>

It is significant that the key to this discussion of possible technological inefficiencies comes only in increasing returns industries. He willingly cedes constant cost and decreasing cost cases to standard analysis, so he is left with a theory applicable only to a subset of the many sectors in an economy at a given point in time.<sup>63</sup> Furthermore, his decision to ignore the constructive role of the firm places his work in Column One of Table 1.1.

Arthur also notes that his theory gives policy an active, if somewhat limited, role:

Steering an economy with positive feedbacks into the best of its many equilibrium states requires good fortune and good timing - a feel for the moments when beneficial change from one pattern to another is possible. Theory can help identify these states and times, and it can guide policymakers in applying the right amount of effort (not too little but not too much) to dislodge locked in structures.<sup>64</sup>

Admitting that suboptimal technologies may become 'locked in' clears a path for a more active government. As this passage indicates, Arthur doesn't use his insight to advocate extensive governmental micromanaging in the economy, but unlike the authors of the first row of Table 1.1, he recognizes that market forces may not automatically pick the winning strategy.

David's best-known work in this area<sup>65</sup> is his discussion of the layout of the typewriter keyboard, in which he shows how the familiar top row 'QWERTY', became the industry standard despite the fact that it is an inefficient organization of keys. The story goes as follows.

Late in the 19<sup>th</sup> century, several versions of the typewriter emerged. One early problem common to them all was that the keys jammed. For one machine, the most jam-free ordering of keys resembled today's QWERTY. Within 20 years new developments made such concerns

obsolete, yet these advances did not usher in an arrangement friendlier to the fingers. By the time of these new designs, QWERTY had become 'locked in' as the industry standard. Firms were not interested in investing in a new arrangement, and typists would have been reluctant to learn a new system.

In discussing the general processes at work here, David borrows from Arthur to note that, *ex ante*, we cannot tell which of a variety of potential technologies will emerge dominant:

That part of the story is likely to be governed by 'historical accidents' which is to say, by the particular sequencing of choices made close to the beginning of the process. It is there that essentially random, transient factors are most likely to exert great leverage.<sup>66</sup>

He discusses inefficiencies when they relate to broader, random processes, but he does not consider the degree to which a particular firm's actions or inactions may have engendered systemic inefficiencies. A question arises: do successful businesses sit idly by hoping for 'lock in' of their technology, or do they take steps to ensure adoption of their techniques and production processes?

While David's and Arthur's work is valuable for showing that less-than-optimal technologies can survive and prosper, it is less useful as an explanatory mechanism for the processes underlying these developments.<sup>67</sup> Arthur reduces the firm to a passive responder to its either good or bad luck.<sup>68</sup> Consider again his compelling example of the struggle for supremacy in the VCR market: to attribute the triumph of VHS to luck would seem to suggest that advertising, marketing, and strategic-planning departments are colossal wastes of money.

David and Arthur's work is useful as it questions one of the underlying assumption of neoclassical economics, that unfettered markets deliver optimal. While their articles have focused on how sub-optimal technologies may become 'locked-in', it may be possible to extend their thesis to consumer buying patterns. Do the highest quality and lowest priced goods always emerge triumphant, or are skilled entrepreneurs sometimes able to market successfully their heavily branded, more expensive, and perhaps lower quality products? During

transitional periods, when consumer tastes for new goods are taking form, adroit firms will maneuver to 'lock-in' a consumer preference for their product. By combining less than optimal results with active firms, this extension of David's and Arthur's thesis is best examined in the discussion of Quadrant IV.

The authors in Quadrant III do not emphasize the measures that firms take to shape their economic environment. Lamoreaux ignores advertising and marketing and the issue of product quality, and she declines to discuss the steps that businesses take to influence government policy. She is not interested in why firms introduce new technologies, or whether they decide to integrate vertically, but focuses instead on how they adopt to their economic environment. David and Arthur focus on the evolution of production processes (specifically the course by which they become 'locked in') and they offer explanations of how technologies that produce inferior products can emerge triumphant in the marketplace. However, they stop short of connecting this view of product quality to a more active view of firm agency. By attributing these inefficiencies to historical accidents, they minimize the role firms played in creating and shaping their economic environments.

What is needed is a view that combines some of the ideas developed in Quadrant II and Quadrant III studies. Successful (that is, innovative) firms triumph by dynamically interacting with their social and economic environment, though their achievements do not necessarily translate into improvements in productive or allocative efficiency.

#### **Section 1.4: Constructed processes and active firms**

In Quadrant IV, the active view of the firm suggested by Lazonick and Chandler is combined with Quadrant III's recognition that economic processes do not follow a visible or invisible map outlining the most efficient technologies or forms of industrial organization. The bottom-right quadrant comprises a corpus of interdisciplinary work. Fields represented here include political science, sociology, anthropology, economics, and history. It is not surprising that this disciplinary breadth coincides with the cell associated with anti-efficiency stories that emphasize the abilities of firms to help shape their own destiny. These ideas are incompatible with

neoclassical theory, and other disciplines have begun to fill in the vacuum created by orthodox economists.

The strength of several of these entries is their foundation as case studies. What they lack in theorizing, they compensate for with detailed portraits of industry and firm evolution. Berk<sup>69</sup> and St. Clair<sup>70</sup> avoid explicit theorizing, and are content to critically evaluate the multitude of factors affecting firm and industry growth.<sup>71</sup> They share a distaste for the uni-causal theories of Row One. Each case study rejects standard arguments of the inevitable ascendancy of particular technologies and of specific firm and industry structures. Roy<sup>72</sup> and Granovetter<sup>73</sup> provide broader criticisms of the efficiency perspective, aiming to combine detailed industry analyses with new understandings of economic outcomes.

On the other hand, Misa<sup>74</sup> attempts to reconcile the gulf between ‘macroperspectives’ and ‘microperspectives’ on the relationship between technology and society. He argues against both overaggregated general studies and underaggregated labor, firm, or industry studies.<sup>75</sup> The generalizations rising from macro-studies must be ‘tempered with the nuance, detail, and contingency that only detailed studies can provide’.<sup>76</sup> To bridge the gap between these two approaches, he proposes an interpretation that highlights the complex interaction of the producers and consumers. The intersection between producers and consumers is the product. The topic of product has too often been ignored in traditional industry studies and in aggregated histories.

By highlighting ‘user groups’, those industries and firms that constitute the dominant (user) market for a good, Misa argues that he is able to integrate broad, macro-level generalizations with the particulars of time and place. As will be detailed below, Misa’s study of the steel industry provides an important example of what Quadrant IV theorizing can achieve. Not only does it challenge traditional understandings of economic efficiency and the role of firms, it suggests that both microperspectives and macroperspectives are necessary; in addition, it brings to the fore the integral roles played by the consumer and the product.

The next step is to review these Quadrant IV studies. St. Clair<sup>77</sup> offers a persuasive reading of the decline of public transportation in American cities. He seeks to explain why ridership on public transit fell, and how this falling

off related to the growing popularity of privately owned automobiles. Using Census Bureau and trade-journal data, he compares streetcars, trolley coaches, and motor buses in several categories, including the number of urban transit miles, the number of vehicles, and the number of riders. In a series of tables he shows that though streetcars dominated the public transit scene up to the early 1920s, motor buses slowly replaced them. Trolley coaches, he concludes, never became a serious contender. Furthermore, he claims that this process did not proceed evenly in all cities. The pace at which motor buses replaced trolleys varied by the size of the city: larger cities continued to offer streetcar operations longer than did smaller towns.<sup>78</sup>

While the data St. Clair cites are noncontroversial, the conclusions he draws are, to say the least, open to discussion. The standard understanding of this process holds that as car prices fell and as consumer credit expanded, automobile usage gained in both popularity and feasibility. This growing demand for cars led to a concomitant decline in public-transit ridership. The public simply abandoned public transportation. As ridership dropped, revenues and profits fell and cities soon found themselves guardians of transit systems that were no longer self-supporting.

On the surface, the problem seemed to be that streetcars were ill-equipped for the changing times. Designed for densely populated cities, they were not well-suited for metropolitan areas of thinning urban cores and spacious suburbs. It was argued that the high fixed costs and set routes of streetcars made them unattractive in the age of automobiles. If public transit was to survive at all, it would have to be through the introduction of a more appropriate mode. Hence, the replacement of streetcars by motor buses was seen as a natural, efficient response to changing socio-economic needs and desires. St. Clair summarized the standard interpretation by noting that ‘the substitution of buses for streetcars is viewed as a valiant but unsuccessful attempt at salvaging transit operations in the wake of the automobile’.<sup>79</sup> Cities with public transportation systems tried to react as best they could to changing times, but the power of the auto proved to be too much. In the end, even the move to buses was not enough to offset the rising popularity of the car.

St. Clair argues that while there is some truth in the standard treatment, it is at best incomplete and at times

incorrect. Contrary to the common presumption, he argues that the motor bus strategy was ‘was the result of a willful campaign designed to debilitate transit operations in this country’.<sup>80</sup>

St. Clair makes several points which distinguish his work from that of the authors in Row One of the above matrix. First, he shows that the standard presumptions underlying the accepted explanations for the demise of the streetcar are incorrect. In a very innovative use of existing data, he calculates that streetcars were actually cheaper to operate than buses. This finding successfully challenges the claim that buses triumphed simply because they were more efficient. New modes of transport may arise that are not more efficient; sometimes success has more to do with market power and entrepreneurial acumen than innate efficiency. Second, he constructs a narrative to show how and why a group of firms had the incentive and the wherewithal to replace streetcars with a more costly alternative.<sup>81</sup> Central to this story was the consortium’s adeptness in lobbying different levels of government. Third, he recognizes that, if correct, his interpretation means that these firms would have to be ‘credited’ with great entrepreneurial talent. They lobbied government, they bought and eviscerated public-transit systems, and they adeptly promoted their own goods and services. Though he didn’t try to situate his story more generally, it is clear in his narrative that outcomes were not efficiency-driven and that firms did not passively respond to market signals.

A second entry in this quadrant comes from Misa.<sup>82</sup> In his 1995 book, he examines the evolution of the American steel industry from the late 19<sup>th</sup> century to the mid 20<sup>th</sup> century. Rather than attempting a comprehensive economic and technological history of steel, he focuses instead on what he terms ‘producer-user relationships’. He argues that the history of the steel industry can be understood through its interaction with key users of steel such as the railroads, the construction industry (in particular skyscrapers), the armaments industry, and the automobile industry.

Central to Misa’s thesis is that the evolution of the steel industry depended directly on the needs of the downstream industries that used steel. This explicit call for integrating consumers and producers sets his work apart, not only from contributors in the other three quad-

rants of Table 1.1, but also from several representatives of Quadrant IV.

Nearly all industry studies emphasize the production side of the equation, often ignoring both the consumer and the product. In neoclassical economics, this approach reflects an unusual tension. Neoclassical economists frequently disregard the product, relying confidently (or conveniently) on the assumption of product homogeneity. Their treatment of the consumer is a bit harder to square with the theory. In general, the presumption is that autonomous, rational consumers continually evaluate their options as they choose which array of good and services to purchase. This is as true for household consumers as for firms that are buying intermediate inputs or raw materials. Producers then passively respond to the signals consumers send them through the market. The focus in this process, though, has not been on how or why consumer demands arise, but on how firms efficiently respond to these demands.

At first glance, it may appear that Misa continues this trend. He does indeed argue that the large steel makers largely responded to the needs and desires of their key users. For example, he writes that the steel industry ‘responding to wide shifts in demand ... transferred and adapted the Bessemer process’.<sup>83</sup> In another passage, he maintains that steel makers responded to changing consumer preferences regarding quality and quantity.<sup>84</sup>

But it becomes clear that his goal is to explicate the relationship between producers and consumers of steel. In this industry, he reveals, consumers did indeed have the upper hand. Addressing the railroads, the first of the user groups he examines, Misa notes:

To a striking extent, steelmaking in the United States was created for a single product: Bessemer steel rails. Because railroad officials promoted, funded, and even founded early Bessemer steel works, in addition to consuming almost all the new steel, their influence was immense.<sup>85</sup>

This example raises two issues. First, if steel makers did respond to consumer demands in this industry, it was in a manner far different from that pictured in traditional economic theory. Steel producers responded to a small number of well-informed, powerful consumers. This relationship between consumers and producers of

steel appears to be based more on power than on the workings of the invisible hand of the marketplace. Second, in what types of industries did consumers or producers have the upper hand?<sup>86</sup>

Misa does not argue that steel producers were black boxes subject to the dictates of neoclassical economic efficiency. In explaining how Henry Bessemer's process for making steel rose to the fore, Misa notes that it

was inspired by association with powerful institutions, especially the military; that his efforts to develop and commercialize his process rescued it from failure and obscurity; and that his considerable flair for publicity and patronage was as important to his overall success as his original technical conception.<sup>87</sup>

The commercial success of the Bessemer process was a product of its developer's 'ability to arrange financing, retain patent control, and fend off rivals'.<sup>88</sup>

Steel companies actively pursued their own ends, often at the expense of economic efficiency. For example, the Bessemer Association, the firm Henry Bessemer founded, controlled access to its technology, and succeeded in limiting rival competition:

From 1877 until 1915, with the exception of the depression decade of the 1890s, the process of steel rails was largely determined by the Bessemer Association and its successors. These restrictive practices can be understood only by recognizing that railroad and steel mills were not atomistic actors meeting in a classical free market; rather, even beyond the market-killing coordination of the Bessemer Association, the users and producers of rails could be owned or controlled by the same (railroad) corporation.<sup>89</sup>

Misa also shows that the ascendancy of US Steel, the industry's largest firm, can not be explained by technological or organizational efficiencies. US Steel, he says, 'was designed not to foster technological change but to promote stability in the industrial system'.<sup>90</sup> He goes on to argue that US Steel set the tone for the steel industry during and after World War I, and that 'administrative centralization, technological innovation, and downward pressure on costs and prices were of little concern'.<sup>91</sup> US Steel's rise to the top reflected not its inherent productive efficiencies, but its market power.

Misa's work is significant on several fronts. He emphasizes the interrelationship between consumers and producers. Though this case study makes clear that a small number of concentrated, powerful user groups were able to shape and influence the direction of the product they bought, it also considers the circumstances under which producers may be able to shape and direct consumer demand. He makes it clear that product quality was an important aspect of this relationship, though again this reflected the special knowledge base of the steel industry's user groups. Finally, he shows that the largest firms in the steel industry did not arise in response to technological or organizational efficiencies, but sought to capitalize on their size in order to stabilize the industry and control prices.

Berk<sup>92</sup> is the third author representative of this quadrant's themes. He too impugns the traditional argument that the rise of the modern firm, with its concomitant increase in industry concentration, constituted a natural, inexorable process. He also criticizes the work of the New Business History School<sup>93</sup> for dismissing the inordinate power that modern business enterprises wielded in the political and judicial realms as the small price society had to pay for the large efficiency gains that such firms engendered.<sup>94</sup> He goes on to highlight two explanatory variables that this work took as exogenous: technology and markets.<sup>95</sup>

With the development and evolution of the railroad as his case study, he argues that 'there was more than one path to industrialization possible in the United States'.<sup>96</sup> Central to his story is the thesis, advanced by others,<sup>97</sup> that 'technologies can typically be put to more than one use, each having unique and nonordinal efficiency advantages'.<sup>98</sup> This understanding runs counter to standard explanations which take technology as given. Accounts such as Chandler's assert that 'different technologies have inherent efficiency characteristics, that, in turn, determine the best form of economic organization'.<sup>99</sup> Berk's alternative view is that as there is no 'metarule of efficiency', one cannot assume that the right or appropriate technology will emerge dominant. Rather, the technology that triumphs may do so for reasons related to legal and political standing rather than economic efficiency.

He also argues - contrary to economic theory - that railroad managers did not, indeed could not afford to, take

their markets as given. His contention that railroads ‘were compelled to organize demand’ indicates his view that railroads actively shaped their economic environment. As he shows in great detail, the central question facing railroads in the late 19<sup>th</sup> century was whether they should serve ‘a national hierarchy of centralized markets or a decentralized pattern of regional markets’.<sup>100</sup> This view of the difficult growth of America’s railway system reveals the vacuousness of Williamson’s comment that ‘there were always markets’. Markets, like all economic institutions, are constructed, and their form and history may have little to do with appealing ideas such as efficiency.

Berk begins by showing that the nationally oriented railway system which came to dominate the American landscape by the end of the 19<sup>th</sup> century was not an inevitable development. It prevailed not for reasons of technological indivisibilities or cost savings, but because of a series of political and legal decisions. First, the move to a centrally organized railroad was inextricably linked to changes in the post-Civil War capital market. He claims this system arose in response to, and was guided by, a new ‘distribution of entitlements’. Second, the federal courts came to the rescue of railroads that had overextended themselves. The courts granted the owners/managers of railroads ‘power to protect systems from dismemberment and to restructure capital costs’.<sup>101</sup>

Powerful individuals like Jay Gould and J.P. Morgan effectively lobbied the judiciary and legislature for help in reworking their debt, or, as Berk refers to it, their ‘railroad fixed costs’:

Having overbuilt and overcapitalized, many huge systems collapsed in the 1880s and 1890s and fell into court-ordered receivership. Here federal judges made choices that had profound effects upon the developments of the industry and the internal structure of the modern corporation. Under prevailing norms of corporate doctrine, which granted priority to property (debt) holders, the architects of national railroads would have been divested of authority and their systems threatened by dismemberment into regional parts. Like historians looking back, however, many on the federal bench were convinced that only incumbent managers were capable of reorganizing these systems. The law, they concluded, would have to adapt, even if this meant stripping debt holders of their traditional property rights in insolvent corporations ...

As I show in Part II, smaller-scale regional railroads were both viable and valuable. Still, the result of the transformation in receivership practice during the 1880s and 1890s was to institutionalize national systems, the legal doctrine that the corporation was a natural entity, and to reduce the fixed costs of railroad technology on average by one-third.<sup>102</sup>

Berk argues in this passage that fixed costs do not reflect technical indivisibilities, but are in part defined by prevailing (and malleable) legal traditions. Interpretations that attribute the rise of nationally oriented railroads to economy of scale efficiencies ignore the manner in which fixed costs have been manipulated and reconstituted.

By providing detailed evidence of a regional railroad that ‘achieved comparable levels of productive efficiency’ without recourse to powerful political forces, Berk shows how alternative, moderately sized, firms were at least as efficient as Chandler’s large-scale, vertically integrated firms. Firms and industries do not evolve naturally but follow paths constructed by key individuals and businesses. He concludes that productive efficiency does not guarantee economic success, just as economic dominance does not imply greater efficiency.

The fourth author challenging the traditional presumption that firms and industries passively evolve along efficient modes is Granovetter.<sup>103</sup> Though he too begins with a case study, in this instance the development of the American electricity industry, his work is more theoretically oriented than St. Clair and Berk. He expands upon this example by trying to build a more general model for understanding industrial development. This is well shown by the title of his and his co-authors’ book: *The Social Construction of Industry: Human Agency in the Development, Diffusion and Institutionalization of the Electric Utility Industry*.

Granovetter sees his project as responding to two different literatures, both of which he finds wanting: the functionalism associated with neoclassical economics, and the great man story, common in an older vintage of business, economic, and technology history. He and his collaborators

stress the role of human agency and social structure in determining which firms become associated into an industry

and in defining the scope and structure of the resulting collectivity. Standard discussions of industrial organization neglect human agency since they assume that industrial structure is an inevitable and efficient consequence of existing technology and market conditions.<sup>104</sup>

One who tries to determine the proper weight of human agency - not to undervalue or to overvalue but to 'correctly value' - can be criticized for vagueness. However, this determination is an important first step in understanding how key individuals may affect the development of firms and industries. These ideas correspond to Quadrant IV's emphasis on the role of the entrepreneur.

In his discussion of firm and industrial organization, Granovetter seeks to transcend deterministic explanations. He rejects the technological, organizational, and transaction-cost stories of Chandler, Williamson, and others. In their stead he proposes a 'theory of the social construction of industry', which addresses four integral issues. First, it examines the internal structure of firms in a particular industry. Second, it analyzes how firms interact with their input and output markets. Third, it considers how firms within an industry interact. Fourth, it recognizes that government and industry relations are essential to understanding industrial development.<sup>105</sup> While all of these areas may not be equally applicable across all industries, they do suggest an outline for socially constructed industry studies. Granovetter's attempt to theorize firm and industry development distinguishes this work from most case studies.

Granovetter bases his broader ideas on a detailed study of the emerging American utility industry from approximately 1880 to 1920. He and his co-authors argue that this industry's development was neither determined by the available technology nor driven by the pursuit of maximum productive efficiency:

We believe that the way the utility industry developed from its inception in the 1880's was not the only technologically practical one, nor the most efficient. It arose because a set of powerful actors accessed certain techniques and applied them in a highly visible and profitable way. Those techniques resulted from the shared personal understandings, social connections, organizational conditions and historical opportunities available to these actors. This success, in turn, triggered pressures for uniformity across regions, even when

this excluded viable and possibly more efficient alternative technologies and organizational forms.<sup>106</sup>

This passage ably captures Granovetter's main themes: the role of human agency, the degree to which alternative technologies co-existed in the beginning of the industry's development, and the belief that industry growth may not be based on economic efficiency.

Let us consider each of these themes in more detail. As he argues in several places, the utility industry's organization did not reflect pre-ordained technological imperatives; rather, it reflected the personal preferences of one of the industry's dominant players, Thomas Edison. As the industry was taking shape, at least two equally promising organizational patterns were available: centralized electrical power plants and isolated, decentralized power plants. Edison favored the first, while J.P. Morgan, among others, promoted the second option.<sup>107</sup> The important role played by key individuals cannot be denied. Decisions relating to short run and longer term finance, to invention and innovation, to the possible technological tracks, and to government regulation, all depended heavily on the personalities involved. However, the industry's successes and failures only partly mirrored individual actions; they also depended on the roles played by trade associations, by the research communities, by domestic and international financiers, and by other social institutions.

The eventual organization of electricity was not guided by the invisible hand of efficiency. It reflected, in part, power struggles among individuals pursuing wildly different goals and objectives. Morgan had specific financial reasons for favoring de-centralized electrical-power generation, Edison had equally compelling reasons for centralized organization, and they both had a stake in thwarting efforts to develop natural gas.

The fifth example from Quadrant IV is Roy,<sup>108</sup> who does not present a case study but offers a general interpretation of why the large industrial corporation arose in America between 1880-1920. Roy, an economic sociologist, states that he has joined many other scholars in the debate 'over the extent to which the economy operates according to an economic logic based on efficiency or operates according to a social logic based on institutional arrangements, including power'.<sup>109</sup> He challenges the prevailing efficiency

hypothesis that presumes that large corporations replaced other forms of economic organization because of their greater productive efficiency. In his second chapter, he develops a series of empirical tests designed to test efficiency theory quantitatively. He bases his first test on Chandler's argument that modern business enterprises arose and prospered in industries characterized by new technology and growing markets.<sup>110</sup> As his dependent variable, he uses the extent to which industries incorporated in major corporations between 1901-1904. For the independent variables he uses Industry Growth, Worker Productivity, Capital Intensity, the Average Size of the Firm, and the Number of Firms. According to Roy,

growth, productivity, and change in productivity - variables widely cited as major factors stimulating the rise of corporations - explained virtually no variation. The results challenge the conventional wisdom in general and the logic of efficiency theory in particular that major corporations arose in industries that were unusually efficient, technologically advanced, or had the greatest functional need for high technology.<sup>111</sup>

After rejecting efficiency theory, he proposes an alternative view of how large corporations came to the fore. He sees 'major corporations as a form of property set within a broader institutional structure shaped by the dynamics of power'.<sup>112</sup> He claims that through studying the concepts of property, institutions, and power, a new understanding of the corporate revolution emerges. This alternative view yields a story

very different from that found in efficiency stories. Instead of rational managers making pragmatic organizational innovations adapting to new technologies and growing markets, the story depicts a series of political and financial developments redistributing power into new institutional structures and eventually resulting in a new property regime. The lead players in the story are the state; the corporate institutional structure, including investment banks, stock exchanges, brokers, and others, newly privatized railroads; and finally manufacturers themselves. It is the larger structures that best explain why the corporation became the dominant form.<sup>113</sup>

Roy advances an understanding of the rise of large corporations that highlights firms pursuing their own self-interest. This self-interest, he argues, did not trans-

late into a pareto-optimal outcome for the economy overall.

### **Section 1.5: The key contributions of Quadrant IV**

Table 1.1 is helpful in explicating the assumptions that underlie many authors' discussions of firm and industry evolution. Common to Row One arguments is a belief that production processes evolve naturally, as more efficient systems continually replace outdated modes of production and distribution. The body of work grouped in Quadrant IV challenges this belief that a rational, orderly market system automatically winnows the wheat from the chaff. These studies bring to the fore the issue of efficiency as they question whether technologies, industries, and products develop optimally over time.

Equally important in this quadrant is the recognition that firms are active participants in their social and economic environment. There are many ways in which firms actively shape their surroundings, but six are of particular importance. Before we examine them, we must keep in mind that Quadrant IV studies are unique, not because they deal with new topics, but because they approach these topics from a new perspective. Though the relevance of these issues may vary case to case, I have ordered them according to their overall importance to Quadrant IV stories, and to the degree of divergence from traditional neoclassical explanations.

#### **1.5.A: Firms and consumer demand**

Neoclassical theory posits that consumer tastes are exogenous, and that firms react to these exogenous demands. In this view, firms only engage in advertising to provide information, since rational consumers would not be swayed by expensive efforts in persuasion.

Quadrant IV consumer product studies present a very different view. They assert that firms seek to construct demand for their goods and services. A key component of these efforts is the marketing-and-advertising campaign. Williamson, closest to the traditional neoclassical position of the authors reviewed here, simply ignores advertising and marketing. Chandler and Lazonick do incorporate these activities into their

broader stories, but encounter problems as they try to reconcile their emphases on productive efficiency with the efficacy of these demonstrably nonproductive campaigns.

Quadrant IV studies see advertising as an integral part of successful firms' strategies. Effective marketing campaigns may enable less efficient companies, or those that offer products of lower quality, to triumph ultimately. Roy<sup>114</sup> argues that Chandler's understanding of the development of the cigarette industry in America reflects his mistaken belief in the primacy of productive efficiency. Chandler attributes the size and growth of the cigarette market in the late 19<sup>th</sup> century to innovations in organizational structure and continuous process machinery.<sup>115</sup> Roy criticizes Chandler's view of an 'established industry that rationally adapted to the new technology by changing its organizational structure'.<sup>116</sup> As Roy argues, there was no natural mass-market for cigarettes; the industry, led by the American Tobacco Company, constructed the market through heavy and sustained marketing and advertising: 'The marketing structure made the industry when the innovative advertising strategies created the demand for cigarettes'.<sup>117</sup> Firms using advertising and marketing to construct their own demand cannot be evaluated within the confines of efficiency theory. According to Roy, the ascendancy of the American Tobacco Company, reflects 'the dynamics of power', not of efficiency.<sup>118</sup>

St. Clair, Berk, Granovetter, and Misa do not examine the relationship of advertising campaigns to the broader themes of economic efficiency and firm activeness, but this can be attributed to the kinds of products they are examining. Transportation policy (St. Clair, Berk), electricity (Granovetter), and steel (Misa) do not involve branded goods intended for household consumption. Strasser<sup>119</sup> provides detailed examples of many consumer goods that underwent the transformation from unbranded bulk products to heavily advertised and cleverly packaged trademarked goods. She makes a compelling case that the development of branding, advertising, and trademarking was integral to the development of the industries and to the success of individual firms. Williamson, Chandler, and Lazonick all cite examples of branded goods such as beer and tobacco, but they fail to consider the inefficiencies that accompanied the uses of branding by firms in these industries.

### 1.5.B: Firms and product quality

Neoclassical theory often sidesteps the difficult issue of product quality. By taking simplifying assumptions such as product homogenization, neoclassical economists frequently avoid discussions regarding product differences, and hence product quality.

Quadrant IV studies recognize that product quality is often of great importance. They know that firms frequently mold conceptions of product quality; but, they also admit that product quality is an elusive term, whose meaning varies across industries. Misa argues convincingly that steel makers responded to their well-informed user groups on a host of issues, including product quality. The Navy, the railroads, construction engineers, and automobile manufacturers all had very specific needs for the steel they bought. These user groups may have approximated the neoclassical conception of rational consumers who know what they want to buy, and are able to articulate their desires in the marketplace.

For many consumer purchases, however, the degree of consumer rationality and sovereignty assumed in neoclassical models is a myth. While Misa's conception of consumer groups is a helpful device in industries such as steel, it fails to capture how consumers relate to producers in many other markets. Quality in many consumer goods does not lend itself to such easy analysis. If consumers are not well-informed, rational calculators, there emerges the possibility that their conceptions of quality may be shaped or constructed by firms. Central to this process are advertising and marketing campaigns, in which firms try to convince buyers of the quality or value of their product. This line of argument runs directly counter to neoclassical thought, which places primacy on the ability of individuals to articulate what they desire, and why they desire it.

Strasser asserts that 'as participants in the branded mass market, consumers entered mutually dependent but unequal relationships with large corporations'.<sup>120</sup> In the emerging mass-production marketplace, consumers were losing their ability to critically evaluate many of the goods that they either needed to buy or were pressured to buy. The rules of the game in this market differed greatly from those outlined in economic textbooks. If 'manufacturers operated on the new principle that demand could be created by the manufacturer', as

Strasser argues was the case, then it follows that these firms were also developing the ability to construct conceptions of product quality.<sup>121</sup>

### **1.5.C: The role of entrepreneurship**

Neoclassical economists treat the role of the entrepreneur in a rather ambivalent way. Though willing to admit the need for entrepreneurs and entrepreneurship, they rarely study these topics in great detail, leaving them instead for business-school case studies.

In contrast, Quadrant IV studies trumpet the importance of key entrepreneurs, and of entrepreneurial leadership in general. Schumpeter stated that the role of the entrepreneur was to

reform or revolutionize the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way, by opening up a new source of supply materials or a new outlet for products, by reorganizing an industry and so on.<sup>122</sup>

What is left open here is whether the entrepreneur, acting in his own self-interest, will automatically benefit the rest of the economy. Quadrant II authors such as Chandler and Lazonick accentuate the positive in entrepreneurship. Quadrant IV authors are more skeptical. St. Clair and Granovetter both acknowledge the important roles that entrepreneurs played in constructing the automobile and electricity markets; but, they also point out that these developments were neither natural nor economically efficient. In a sense, Quadrant IV studies should provide the richest interpretations of entrepreneurs, as entrepreneurs are not constrained to do good works. It is more difficult, and thus more impressive, for an entrepreneur to successfully introduce an inferior or more costly production process or product. Lazonick's innovative entrepreneurs benefit both producer and consumer. Quadrant IV's entrepreneurs may benefit only themselves.

### **1.5.D: Firms and government policy**

When neoclassical economists discuss how firms shape government policy, the emphasis is on how these activ-

ities impede efficient market outcomes. Quadrant IV studies share the same concern about inefficient outcomes, but they also highlight the dynamic steps firms take in this process. St. Clair shows that a group of automobile and tire companies took direct steps to change the nature of transportation policy in American cities. These firms did not regard existing public transit systems as inviolate institutions. Instead, they concentrated on trying to figure out how they could emasculate and eliminate this competition.

Similarly, Berk documents how nationally minded railroads lobbied legislative and judicial officials for favorable policies. Berk, St. Clair, Misa, and others emphasize that one of the failings in standard accounts is the treatment of government as an exogenous force. Row One studies have largely ignored the government, and their analyses suffer correspondingly.

### **1.5.E: Firms and vertical integration**

Neoclassical theory was long rather silent on vertical integration, but economists such as Williamson have made such issues an integral part of their studies. However, the question here is whether his transaction costs analysis offers the most robust means for studying this process?

Active firms will continually review their decisions to buy from the market rather than to produce internally. Decisions to integrate vertically must be continually re-evaluated, and successful firms must be willing to cast off what worked well in the past. The flexibility that firms manifest in pursuing vertical integration in some periods, but not in others, is often a key source of competitive advantage. Williamson does not fully appreciate this in the examples he advances in his discussion of mistaken reasons for backward and forward integration.<sup>123</sup> One key aspect of vertical integration that Williamson's work ignores is market power. Forward and backward integration can be successful strategies by innovative firms in bolstering their competitive position in the marketplace. A prime example of this was the control of saloons by pre-Prohibition breweries, a phenomena misinterpreted by Williamson's transaction cost analysis.

### 1.5.F: Firms and new technologies and production processes

Neoclassical theory often considers new technologies and production processes as they are introduced, but they rarely consider motive. Many Column Two writers, including Chandler, Lazonick, Misa, and Granovetter, examine what new technologies are introduced, and why. These authors, however, may vary in how they interpret the effect of these innovations: Are new technologies always more efficient? Do new production processes automatically signal improvements to, or changes in, the product? Do consumers or producers benefit more from these innovations?

### Section 1.6: A Quadrant IV case study of the American brewing industry

I plan to contribute to Quadrant IV's growing corpus of work through a detailed study of the American brewing industry from 1865 to 1940. This period represents the birth of what may be called the brewing industry's modern phase. During these years, production rose to unparalleled levels while the technology of beer making, and the culture of beer consumption, underwent rapid and systematic changes. I begin by briefly reviewing the existing literature on the brewing industry. Most of it is not theoretically oriented, but that which is may be placed firmly in Quadrants I or II. As there is no comprehensive history of the brewing industry, Chapter 2 traces what a standard economic history of the brewing industry would most likely resemble. It draws extensively on the literature addressed in this section. Consistent with these studies, it presents an interpretation of a brewing industry dominated by passive firms which operated in a productively and allocatively efficient manner by responding to market signals (that is, autonomous consumer preferences).

The relationship between general economic history and case studies should, ideally, be symbiotic. Broad understandings of economy-wide transformations depend on firm and industry studies, but case studies are more compelling when situated within an appropriate theoretical framework.

A limited partnership of this sort has characterized some of the writing on the brewing industry. Chandler,

Lamoreaux, Lazonick, and Williamson all reference the brewing industry in their books, though only Chandler does so in any appreciable detail. In turn, a few studies of the brewing industry draw upon more general economic history.<sup>124</sup> Yet what is most striking about the literature on the American brewing industry is the paucity of analysis it has occasioned. In contrast to the United Kingdom's brewing industry which has been the subject of several case studies<sup>125</sup> and an equal number of more broadly cast industry studies,<sup>126</sup> America's has been unaccountably neglected by economic historians.

There are several possible reasons for this. Some may have viewed it as a technological backwater, a view that will clearly be shown to be false, while others may incorrectly believe that brewing did not develop any important technological linkages with other industries. As will be demonstrated in later chapters, brewing was in fact a highly developed scientific and technological field by the late 19<sup>th</sup> century. Others may have dismissed brewing as an unimportant industry, but as measured by value added to input, the *1910 Census of Manufactures* reports that it was the nation's sixth largest industry.<sup>127</sup>

To begin, there is no comprehensive economic history of America's brewing history. There has been only one historical survey, a very readable but somewhat cursory book by Baron.<sup>128</sup> Though he devotes several chapters on developments during the late 19<sup>th</sup> century and early 20<sup>th</sup> century, he uses all quantitative data sparingly. He presents no graphical or tabular presentations of national or regional production and consumption patterns during these most tumultuous decades. In an otherwise quite detailed bibliography, he does not cite the *Census of Manufactures* reports, which provide detailed data on national, state, and local trends.

Of three regional brewing histories,<sup>129</sup> Downard's study on the Cincinnati brewing industry, is the most sophisticated. Downard is the only author since Cochran<sup>130</sup> to use the *Census of Manufactures* reports. In addition, he constructs a table from the Cincinnati Chamber of Commerce *Annual Reports* tracing out the actual and relative prices of beer per barrel from 1855-1918.

Not nearly as useful are Apps,<sup>131</sup> on Wisconsin breweries, and Meier & Meier,<sup>132</sup> on the development of brewing in Oregon and Washington. Their short, histor-

ical vignettes about specific breweries do not include any systematic data trends.

One feature uniting Baron's work with these regional studies is that none tries to situate its story within an explanatory framework. They are not interested in tying their narratives to standard economic stories that reference the formation and development of the brewing industry.<sup>133</sup> The authors of these brewing studies believed these stories were of inherent interest, and saw no need to link them to broader theoretical debates.

In stark contrast, McGahan<sup>134</sup> offers a much more thorough and interesting analysis. Her work examines the evolution of the post-Prohibition (and, more briefly, pre-Prohibition) brewing industry, and is important for two reasons. First, it challenges the ahistorical approach of a series of industrial-organization articles on the brewing industry written from the mid 1960s to the mid 1980s.<sup>135</sup> These papers, all using variants of the Structure-Conduct-Performance model, sought to evaluate the causes for, and the consequences of, the brewing industry's increased concentration in the post-World War II era. None of these pieces attempts to situate its story historically, each implicitly asserting that it could prove its case by citing only post-WWII data. McGahan questions this presumption, arguing that recent developments could only be fully understood by studying the evolution of the industry following the repeal of Prohibition in 1933.

The other significant feature of McGahan's paper is that it explicitly incorporates Chandler's thesis. Citing *The Visible Hand*, she explains that the move to fewer but larger breweries in the late-19<sup>th</sup> and early-20<sup>th</sup> centuries occurred because the 'advent of the railroads and improvements in production technology allowed several breweries with high quality products to seek wider distribution'.<sup>136</sup> Like Chandler, Lazonick, and Williamson, she views the ascendancy of integrated firms as inexorable and beneficial: larger breweries made better and cheaper beer by means of a series of technological advances that were insightfully implemented by the successful firms. Though she does not explore the specific organizational developments that Chandler and Lazonick saw as crucial to the rise of the modern business enterprise, she does emphasize the importance of implementing new, more efficient technologies.

In terms of Table 1.1 McGahan's work falls somewhere between Quadrants I and II. It presumes that efficiency acts as a market discipliner, yet equivocates on the agency that firms have in shaping their economic and social environment. She discusses the product only in passing, and she views the government and the consumer as exogenous forces. Her interpretation is of a brewing industry that rationally responds to external changes in technology and science and, to a lesser degree, to changes in consumer demand and government regulation. Her conclusion is that new technologies led to bigger, more efficient breweries, and that industry concentration was a natural result of these growing economies of scale. She states almost parenthetically that the largest breweries made higher quality beer, at lower cost, and that these changes in firm and industry structure were both productively and allocatively efficient.

Perhaps the most widely read article on the brewing industry is Elzinga's chapter in Adams' *The Structure of American Industry*.<sup>137</sup> This essay is representative of how this topic was treated by industrial-organizational economists in the 1960s and 1970s. It dispenses with the history in a few paragraphs, and devotes one page to the role of demand. The remainder of the article reviews applications of the Structure-Conduct-Performance model to the industry's recent past. This work falls mostly into Quadrant I of Table 1.1. It presumes that large breweries arose simply in response to new technological indivisibilities that required ever greater 'minimum efficient scales'. To the extent that some of this literature has examined industry performance and found that a concentrated market organization leads to excess profits, they may argue that the outcome was not allocatively efficient. Thus, this literature may straddle Quadrants I and III; however, it is clear they do not consider firm agency and that they do not try to endogenize technology, government, and consumer preferences.

In addition to these industry-wide studies, there have been two case studies, Cochran's 1948 business history of the Pabst Brewing Company and Plavchan's 1969 dissertation on Anheuser-Busch. Of the two, Cochran's work is by far the more important. Cochran seeks less to relate Pabst's role to the development of the American brewing industry than to explore the determinants of its varying successes and failures. Though written before

the general surveys in economic history discussed above, Cochran anticipated some of their concerns. Central to his story is the entrepreneurial ability of Pabst's early managers. This is not surprising, as he intended this book to serve as a model for how to write an academic company history.<sup>138</sup> One of the leading members of Harvard's Center for the Study of Entrepreneurial History, he felt that neoclassical economists had ignored the institutional framework in which firms operated and with which they interacted.

His book cites several examples of how Pabst deliberately sought to change its environment. These ranged from lobbying the federal government, to changing tax policy on bottled beer, to hiring chemists to help stabilize the product. Considering the primacy that Cochran accords to Pabst's active strategy, it is not insignificant that both Chandler and Lazonick cited this work. Cochran's view of Pabst as an active shaper of its environment clearly places him on the right side of Table 1.1's matrix. Whether he is better placed in Quadrant II or IV is inconclusive. In general, he operates under the Row One presumption that outcomes are good and efficient. As the titles of three chapters in particular suggest ('Brewing Becomes More Scientific', 'Quality and Prestige First', and 'Holding a Quality Market'), he believed that Pabst came to the fore for 'good' reasons. Pabst introduced scientific practices that allowed it to brew a higher quality beer, and it stayed competitive on price and quality. According to Cochran, Pabst's successes were due to its ability to efficiently provide what consumers wanted.

Reflecting the agenda underlying the book - an agenda that was to further the nascent field of entrepreneurial economic history - Cochran also expounded on the particular steps taken by key leaders of the brewery. Recognizing that individual figures played important roles does not imply that 'great men' determined firm and industry evolution.<sup>139</sup> Cochran shows that some of Pabst's accomplishments depended on decisions made by early company leaders such as Captain Pabst, Gustav Pabst, and Dr Otto Mittenzwey. That these men engineered economically successful strategies does not automatically mean these steps were economically efficient, either for the company or the consumer. To the extent that Cochran focused on entrepreneurial abilities that may not relate to efficiency, his work falls closer to Quadrant IV than to Quadrant II.

The brewing industry's other firm study is Plavchan,<sup>140</sup> which examines the birth and development of Anheuser-Busch from 1852-1933.<sup>141</sup> This book, like Cochran's, was written with the cooperation of the firm, but the similarities end there. Plavchan does not attempt to relate his thesis to any broader theoretical issues, and provides very little company or industry data. His only table, an annual listing of Anheuser Busch's production levels, is relegated to an appendix. While he reviewed many company documents and a great number of trade-journal articles, he never articulates a cogent view of how the broad changes at Anheuser Busch were related to general industry developments. What emerges are pieces that are useful in trying to weave together an understanding of industry happenings during the pre-Prohibition years, but that are unsatisfying by themselves. By uncritically evaluating the consequences of the many changes wrought by Anheuser Busch's innovative introduction of new technologies and production processes, Plavchan's work decidedly belongs among the Row One accounts in Table 1.1.

Though this is a study of how Anheuser Busch adeptly differentiated itself from its many local and regional competitors, Plavchan does not address nearly the range of factors that Cochran adduces in his study of Pabst. He does, however, consider the important marketing and advertising initiatives that led to the ultimate success of Anheuser Busch, though he fails to critically evaluate whether these benefited the consumer. For example, he raises but does not resolve the issue of whether the quality of Anheuser Busch's heavily advertised, packaged, and hence more costly beer was actually a better product. Thus, his work combines a Row One understanding of how economic processes unfold with a Column Two appreciation of the many steps Anheuser Busch took in shaping its economic and social environment.

In contrast to the existing literature on the brewing industry, my interpretation rests firmly in Quadrant IV. It recognizes that many of the developments in the brewing industry were not inevitable, beneficial, or efficient. It also emphasizes how entrepreneurial breweries, and the industry overall, sought to shape many aspects of the economic environment. The combination of these two themes in my study marks a new approach to the interpretations of how, why, and with what consequences the American brewing industry evolved during these seven decades.

Chapters Three to Five present my alternative view of the brewing industry's driving forces. Underlying this interpretation is a dual understanding: a) economic outcomes are not necessarily efficient, inexorable, or beneficial, and b) firms take an active role in their economic and social environment. I will show in these chapters that breweries did not passively react to market signals, but took aggressive measures to create and shape the market. Many of the results were neither economically efficient nor socially optimal. New technologies may have enabled the production of packaged beer, but this does not mean that packaged beer was either a quality product or a beneficial development. Pabst and other leading breweries successfully lobbied to shape the Food and Drug Act of 1906, but this does not mean that consumers profited from these actions. What is needed is a discussion not only of how the brewing industry evolved, but of why it evolved, and with what consequences.

This story of America's brewing industry focuses on the interrelationships among producers, consumers, and product. Too many industry studies concentrate solely on the producers, ignoring the product they make, and the consumers who purchase it. While Misa<sup>142</sup> introduces the idea of user groups, this construct is not applicable in brewing. Consumers of beer were not the well-informed, rational buyers that one finds in the steel market: they made their purchasing decisions at a marked disadvantage to the producers. Yet, Misa provides a useful model by showing that producers and consumers interact through the product. My story will similarly address the interactions among breweries, beer consumers, and the beer itself. It will show that leading breweries modified their products to suit their own needs, and then set out to persuade consumers of the benefits of these changes. By integrating producer, consumer, and product, a new understanding of the American brewing industry emerges, one that parallels Misa's recommendation to synthesize panoramic industry studies with detailed accounts which highlight the 'importance of contingency, individuals, and politics' in industry development.<sup>143</sup>

## **Chapter 2: The orthodox narrative of the American brewing industry, 1865-1940**

This chapter presents what might be called an 'orthodox' narrative of the American brewing industry. Unlike

Britain, America has no canonical economic history of its brewing industry. For the US case, we must weave together the many disparate strands that comprise the standard economic history of the brewing industry for the period 1865 to 1940. Thus, the first step consists of the rather paradoxical exercise of constructing an orthodox narrative, parts of which are, I believe, incorrect or incomplete. Chapters Three to Five present my alternative view of the brewing industry's development, and it is here that I will show where I agree and disagree with the standard story of the brewing industry. Some of my differences concern basic assertions frequently made about the industry (were all big breweries alike? were big breweries always responsible for industry growth? were bigger breweries always the most profitable?), while others are more interpretive (did the brewing industry ignore political developments, such as the rise of Prohibition forces? did the national shipping breweries respond passively to market opportunities or did they seek to shape their economic environment?).

The orthodox narrative that I have constructed, and my alternative narrative, share the same structure. Each examines the period 1865 to 1940, and each is divided into three chronological periods: 1865 to 1920, 1920 to 1933, and 1933 to 1940. Prior to the Civil War, the American brewing industry was small and unsophisticated. Though beer brewing in America dates back to the 17<sup>th</sup> century, the modern brewing industry was essentially a post Civil War development. Between 1865 and 1920 the brewing industry grew from a rather insignificant business to one of the largest manufacturing enterprises in the nation. During these years, national beer production expanded tremendously and per capita consumption increased steadily. The second period deals with the national Prohibition years, 1920 to 1933. Prohibition has not been much studied by those interested in the brewing industry, but I believe that there is much to learn in examining the events that led to its implementation, as well as the events that, thirteen years later, culminated in its repeal. The third period focuses on the years from 1933 to 1940. This allows us to compare the industry before and after Prohibition. The standard story emphasizes the continuity across these periods, while I argue that there were quite important differences between the pre- and post-Prohibition industries. This study ends in 1940 for several reasons. In order to compare the industry before and after Prohibition, it was necessary to extend the study at least

into the 1930s, and several of the distinguishing characteristics of the post-repeal industry are clearly evident by the late 1930s. In addition, World War II had a major impact on the brewing industry, and extending this study to 1945 or 1950 would have lengthened it greatly.

We begin this chapter with an examination of beer and the brewing process. Section 2.2 presents an outline of the industry's transformation between 1865 to 1940. Sections 2.3 through 2.5 summarize the orthodox interpretations of the industry's development. Section 2.3 reviews the years from 1865 to 1920, Section 2.4 the Prohibition years (1920 to 1933), and Section 2.5 the years between repeal and World War II. Section 2.6 integrates this chapter's portrayal of the standard narrative with the conceptual matrix outlined in Chapter One.

### **Section 2.1: The brewing of beer**

As this is an economic history of the brewing industry, it is necessary to review how beer is made. After a brief overview, I re-examine some of the stages in more detail. The first step is to prepare the basic grains, the most important being barley. The barley is malted in a procedure that produces enzymes that convert the starches in grain to sugars. The malt is then mashed into a fine grist that is then added to water and heated. During this process, the enzymes work to convert the starches in the malt into sugar. This stage is known as the mashing. During this step, brewers may add in other cereal adjuncts such as rice or corn. These adjuncts do not have any enzymes, so it is up to malt enzymes to convert the starches in the adjuncts into sugar as well.

The enzymes that convert the starches to sugars are biological catalysts. The most important ones in brewing are alpha-amylase and beta-amylase. Alpha-amylase produces both maltose and dextrose, while beta-amylase yields only maltose. Maltose is highly fermentable, but dextrose is not fermented by brewer's yeast, and it helps give beer its body. As the sugars dissolve into the water, the sweet liquid that emerges is called the wort.

The hot, sweet wort is transferred over a period of several hours from the mash tun into the brewing coppers or kettles. As the wort is boiled in these kettles, the brewer adds in hops. Hops play several important roles in the brewing process. At this stage, they kill

any bacteria in the wort and destroy the starch-converting enzymes.

Before fermentation can begin, the temperature of the wort must be lowered. Once it reaches the appropriate temperature, the cooled wort is pumped into fermenting vessels and yeast is added. Enzymes in the yeast convert the sugar into alcohol and carbon dioxide. Fermentation raises the temperature of the wort by about 20 degrees F. The fermentation process varies greatly depending on the style of beer. Ales ferment in about seven to twelve days, while lagers require two to three weeks. After fermentation is finished, the beer must be conditioned before it is ready to drink. Again, the exact amount of time a beer must be conditioned varies, with lagers requiring much longer conditioning periods. Once the beer has been fully conditioned, it is ready for drinking, and the brewery must decide how it plans to retail the beer: in bottles or cans, or on tap from beer kegs.<sup>1</sup>

This overview of the brewing process has necessarily omitted many of the details that together greatly affect the character of beer. There are many different styles of beers, and it is important to understand in a bit more detail where some of these differences come from.

We will begin again with beer's raw materials. As noted above, barley is the most important cereal grain used in brewing; it is the source of beer's most fundamental ingredient, malt. Maltsters take six steps in converting barley into malt: a) they select the appropriate barley; b) they clean the barley; c) they steep the barley, a process that eliminates light-weight kernels; d) they germinate the barley, a process that causes the kernels to grow under very controlled conditions; e) they kiln the barley: in this stage, they dry and roast the barley, a procedure which produces the malt's flavor, color, and aroma; f) they clean and store the malt.<sup>2</sup> Malting produces the enzymes that convert the starches in grain to sugars.

There are, however, important differences among the types of barley. The broadest distinction is between two-row and six-row barley. American six-row barleys include Manchurian, Odessa, Oderbrucker, and Wisconsin No. 38, while two-row barleys include Hannchen and Hanna. European brewers have historically preferred two-rowed barley, and brewing experts argue that because its kernels are better developed and its husks thinner, it is more suitable for malting and

	6-row barley		2-row barley	
	'As is' Basis Per Cent	Dry Basis Per Cent	'As is' Basis Per Cent	Dry Basis Per Cent
Moisture	14.03	-	8.19	-
Protein	11.38	13.23	9.01	9.81
Ash	2.11	2.45	2.67	2.91
Oil	1.79	2.08	2.16	2.35
Fibre (ash free)	5.72	6.65	2.52	2.74
Nitrogen-free extract	64.97	75.57	75.45	82.18
Carbohydrates	70.69	82.22	77.97	84.92
Husks	11.11	12.92	7.80	8.50
Sugar (as maltose)	0.42	0.49	0.47	0.51
Starch	42.88	49.87	54.72	59.60

Table 2.1. Comparison of the chemical composition of a 6-row and a 2-row barley.

Source. Vogel, E., Schwaiger, F., Leonhardt, H. and Merten, J.A. (1946) *The Practical Brewer: A Manual for the Brewing Industry*. St. Louis, MO: Von Hoffman Press. p.9.

brewing.<sup>3</sup> There are readily identifiable chemical differences between these two barleys.

Six-row barley has much higher levels of nitrogen. High levels of nitrogen result in problems in head retention in finished beers. Brewers using six-row barley must also use cereal adjuncts such as corn or rice that counter some of these difficulties.<sup>4</sup> Six-row barley has thicker husks, and this thickness can cause a haze in beer. Brewers must use cereal adjuncts to counter this problem as well.<sup>5</sup> Six row barley has much higher levels of kernel protein. Protein enzymes are well suited for converting the starches in malt and in adjuncts such as corn and rice into sugar. So, six-row barley has several negative attributes, which are only offset through the use of adjuncts, but six-row barley is also well-suited for being combined with adjuncts. It is clear that one of the reasons many American breweries began using six-row barley in the late 19<sup>th</sup> century is that it was much cheaper than two-row barley. One of the areas that needs to be further researched is whether American farmers were able to grow two-row and six-row barley.<sup>6</sup>

As American brewers switched from two-row to six-row barley, they began to use cereal adjuncts such as

corn or rice to counter the negative chemical properties of six-row barley. One consequence of brewing with these adjuncts was that the beer was paler in color and less flavorful. It must also be noted that corn and rice are much cheaper than barley malt: by switching to six-row barley, brewers used a less expensive barley, and a barley that they could adulterate with even lower cost cereal adjuncts. Many beer writers and brewers have been quite critical of the use (or at least the overuse) of cereal adjuncts. If corn and rice are to be used, they must be used in very small amounts, or they will ruin the flavor and complexity of the beer.

Hops, the second major ingredient in beer, have several uses. They act as a preservative, helping to stabilize the beer by preventing bacterial infection, and they add aroma and bitterness, important counterparts to the sweetness of malt. Just as there are many types of barley, so too are there many varieties of hops. Some of the more famous include Cascade, Fuggles, Saaz, Styrian, Hallertauer, Kent Goldings, and Tettnanger.<sup>7</sup> Hops are used in four forms: a) loose leaf; b) pellets; c) extract syrup; and d) pre-isomerized extract.<sup>8</sup> Because bittering is an essential contribution of hops, it is important to be able to evaluate the bitterness of different beer.

Bitterness is measured by an internationally accepted scale, International Bitterness Units (IBUs). IBUs in a beer reflect the quantity of the hops used and the level of the hops' acids.<sup>9</sup> Mass produced American beers such as Anheuser Busch's best-selling Budweiser have an IBU around 10. The Czech beer, Pilsner Urquell has an IBU of 43, and Ireland's Guinness Stout has an IBU of 50.<sup>10</sup>

The third key ingredient in beer is water. It varies greatly in its chemical components, and different styles of beer require different types. The basic distinction is between hard and soft water. For example, the waters of Burton Upon Trent, a famous ale producing region of England, are known for their hardness (a large amount of calcium sulphate) while Pilsen in the Czech Republic and Munich have much softer water.<sup>11</sup> In the United States, water composition varies greatly across cities.<sup>12</sup>

As noted above, hops are added to the wort in the beer kettle. The temperature of the wort is then lowered as brewers prepare for fermentation. Once the cooled wort reaches the appropriate temperature, it is pumped into fermenting vessels and yeast is added. Enzymes in the yeast convert the fermentable sugars into alcohol and carbon dioxide. The amount of yeast needed varies with the original gravity of the wort: very low and very high gravity beers require more yeast. For high gravity beers, this reflects the larger amount of extract that needs to be fermented.

Before detailing the fermentation process, it is necessary to review the different types of yeast. While there are thousands of strains, yeasts are most commonly divided into two categories, top-fermenting (*Saccharomyces cerevisiae*) and bottom-fermenting (*Saccharomyces uvarum*). Top-fermenting yeast floats on the top of fermenting vats and produces ale. Bottom-fermenting yeast produces lager.<sup>13</sup> Lager beer is much more temperature-sensitive than ale, and must be fermented at lower temperatures. Whereas ale ferments between 59 and 77 degrees Fahrenheit, the optimal temperature range for lager is 41 to 50 degrees.<sup>14</sup> In the days before artificial refrigeration it was much more difficult to brew lager than ale, especially in warmer months

Fermentation involves four basic stages. About 12 to 24 hours after adding the yeast to the wort, some white

foam begins to appear at the top of the fermenting tank. The second stage occurs during the second and third days, and is called 'low or young krausen'. The wort comes to be covered by a great frothy blanket. This foamy covering is the result of the yeast feeding on the fermentable sugars and multiplying. The third stage is called 'high krausen'. At this point, some of the foam at the top of the tank will be skimmed off. This is the period during which most of the carbon dioxide is produced. The fourth stage sees the foamy head beginning to break down, and a rapid decline in the production of carbon dioxide.<sup>15</sup> Total fermentation time varies greatly by style of beer. Ales ferment in five to ten days, while lagers require 15 to 22 days.<sup>16</sup>

After fermentation, and a couple of days to mature, most ales will be filtered, pasteurized, and then packaged in bottles or cans. Carbon dioxide is then pumped into the container during packaging to give the beer a lively head upon opening. A small percentage of ale, called real ale, is handled quite differently. Real ale leaves the brewery in casks in an unfinished state, and final conditioning occurs in pub cellars. During this final conditioning, the remaining yeast continues to convert the residual sugars into alcohol. Carbon dioxide produced through fermentation is still in the barrel, and some of it is released to reduce pressure in the cask, but some is retained so the real draught beer has a natural sparkle.<sup>17</sup>

Lagers are handled a bit differently. After a primary fermentation of between two to three weeks, they are pumped into storage tanks for a much longer period of cold conditioning, lasting from two weeks to several months. Any remaining yeasts will continue to convert sugars into alcohol. During this storage period, brewers will carbonate the beer. Most large American breweries collect the carbon dioxide produced during fermentation and they inject it into the storage tanks. However, European lager breweries do not favor this process, and usually opt to encourage a secondary fermentation. This step produces additional carbon dioxide and brewers retain this in the storage and packaging containers. This step resembles real ale production, in that both processes prefer to trap in naturally occurring carbon dioxide, rather than pump it in during the storage period.

After lagering is complete, the finished beer will, like most ales, be filtered and pasteurized. Pasteurization, a

process developed by Louis Pasteur in the 1860s and 1870s to sterilize beer, has gained wide currency in mass production brewing, but it necessitates a series of tradeoffs. The process entails heating beer to a certain temperature in order to kill any residual yeasts or bacteria. This makes the beer more stable, and allows it to be shipped longer distances and stored without refrigeration for extended periods of time.<sup>18</sup> But, heating the beer to over 140 degrees F unbalances the aromas and flavors of the beer. Brewing chemists agree that pasteurization damages the flavor and nature of beer.<sup>19</sup>

It is traditional to age lager after primary fermentation to heighten specific flavor attributes.<sup>20</sup> The Czech brewery Pilsner Urquell, for example, stores or 'lagers' its beer for 70 days, using oak vessels to bring the flavor to its full potential.<sup>21</sup> In contrast, it is estimated that Anheuser Busch's largest selling beer, Budweiser, is usually lagered for 21 days.<sup>22</sup> Protz clearly suggests that Anheuser-Busch, and other mass production American breweries have willingly sacrificed flavor for increased production levels.

Before we leave this section on brewing, there are two additional issues we should briefly discuss. The first examines the factors that influence the color of beer. In general, color reflects two factors, the types of grains (all malt or malt plus adjuncts) and the roast of the malt. Using adjuncts in beer will lighten the color. The other major factor is the roast of the barley malt. There are scales in America (Degrees Lovibond) and Europe (European Brewing Convention) to assay a malt's roast.<sup>23</sup> Among the palest beers in the world are those produced by America's largest breweries, Anheuser-Busch, Miller, and Coors. These breweries all use large amounts of cereal adjuncts and very lightly roasted, or pale, malts.<sup>24</sup> Darker beers use amber, chocolate or black malts. The process of roasting malt is very similar to the roasting of coffee beans: the darker the roast, the blacker the coffee bean or malt. The use of darkly roasted malts distinguishes porters and stouts from the lighter colored ales, and the dark lagers such as dunkels from the lighter lagers.

The second issue concerns how to measure alcohol content. There are two main techniques utilized to assay the strength of beer, alcohol by volume (ABV) and alcohol by weight (ABW). Most countries have adopted ABV, though the United States continues to use ABW. An

alcohol content of 4% by weight means that there are four grams of alcohol dissolved in 100 grams of the beer. In contrast, an alcohol content of 4% by volume means that for a given volume - a gallon - 4% is alcohol. ABW levels are approximately 25% lower than the corresponding ABV values.<sup>25</sup> For example, if ABW is 4, then ABV is 5.<sup>26</sup> Until very recently, American consumers did not know what level of alcohol their beer was, under any measure, since breweries were not permitted to list alcohol strength on beer labels. The Supreme Court in 1995 changed the federal law, but many states continue to impose label restrictions.<sup>27</sup>

As this review has shown, beer making is an involved process. The character, flavor, and taste of beer reflect differences in raw materials and how the breweries handle the beer. Beer cannot be rushed; efforts to shorten the brewing or conditioning stages will usually result in a lower quality product.

## **Section 2.2: An overview of the industry, 1865-1940**

During the years of this study, 1865-1940, the brewing industry underwent several marked changes. First, national beer production grew tremendously: it was almost insignificant prior to the Civil War; it was the fifth largest manufacturing industry in America by 1910.<sup>28</sup> Second, there was a continued movement towards larger firms: average annual production per brewery steadily rose, and the size of the industry's largest firms increased. Third, per capita beer consumption increased greatly during much of this period: per capita consumption rose from 4 gallons in the early 1860s to over 20 gallons in the early 1910s. Fourth, lager replaced ale as the dominant beer: whereas ale accounted over 90% of the beer production before 1850, by 1900, lager accounted for approximately 90% of the national beer production.

The fundamental question for all writers on the American brewing industry is how to account for the developments indicated by these data. Why did production and consumption levels increase so rapidly? Why did lager beer so thoroughly replace ale? What is the significance of these movements? Using Table 1.1, in Chapter One, we can construct an orthodox interpretation of the sequence of events which underlie the data reported in Table 2.2.

Year	No. of Breweries	No. of Barrels* Withdrawn (millions)	Average Barrelage per Brewery	Per Capita Consumption (gallons)	Largest Firm (annual production, millions of bls)	Lager Output as a % of Total Output***
1865	2,252	3.7	1,624	3.4	.080	50%
1870	3,286	6.6	2,001	5.3	.085	>50%
1875	2,783	9.5	3,398	6.6	.138**	>50%
1880	2,741	13.3	4,869	8.3	.272	>50%
1885	2,230	19.2	8,604	10.5	.383	>50%
1890	2,156	27.6	12,790	13.6	.770	>50%
1895	1,771	33.6	18,967	15.0	1.0	>50%
1900	1,816	39.5	21,736	16.0	1.0	90%
1905	1,847	49.5	26,812	18.3	1.3	>90%
1910	1,568	59.5	37,980	20.1	1.5	>90%
1915	1,345	59.8	44,467	18.7	1.1	>90%
1920-33	Prohibition	No legal production	n.a.	n.a.	n.a.	n.a.
1934	756	37.7	49,839	7.9	1.1	>90%
1940	684	54.9	85,236	12.5	2.5	>90%

Table 2.2. Key trends in the brewing industry. 1865-1940.

Source. *United States Brewers Foundation (1956) Brewers Almanac pp.10, 90; Shih, K.C. and Shih, C.Y. (1958) American Brewing Industry and the Beer Market. Brookfield WI. pp.56, 108; Cochran, T. (1948) Pabst Brewing Company: The History of an American Business. New York: New York University Press. pp.73-74, 109; Krebs, R. and Orthwein, P. (1953) Making Friends is Our Business: 100 Years of Anheuser-Busch. St. Louis, MO: self published book, Anheuser-Busch. pp.242-43\*\*\*.*

\* A barrel of beer consists of thirty-one gallons.

\*\* This figure is for 1877.

\*\*\* The percentages of production accounted for by ale and lager prior to Prohibition are inexact. Lager was not brewed in the United States until the 1840s, and it did not become popular until the 1850s. The timeline of percentages provided here, while inexact, reflects the fundamental trend: lager steadily replaced ale during the decades from 1840 to 1880, and by 1900 lager fully dominated beer production in the United States (Baron, S. (1962) *Brewed In America: A History of Beer and Ale in the United States. Boston: Little, Brown, and Co.; Cochran, T. (1948) op. cit.; Downard, W. (1980) Dictionary of the History of the American Brewing and Distilling Industries. Westport, CT: Greenward Press.* For example, Cochran lists the sixteen largest breweries in 1895. Of these firms, only two (Ballantine and Frank Jones) brewed much ale. The top four (Pabst, Anheuser-Busch, Schlitz, and Blatz) concentrated nearly exclusively on lager.

\*\*\*\* All of the national production and consumption figures come from the *Brewers Almanac*. It is worth noting that there are discrepancies between these data which are based on Internal Revenue Service calculations and similar data reported in the *Manufacturing Censuses*. For example, footnote twenty-eight citing the 1910 Census states there were 1,531 breweries in 1910, while Table 2.2, based on IRS data, lists the number as 1,568. There are similar differences in national production and per capita consumption levels.

Central to the standard story is its belief that the changes in the industry were driven by changes in demand. Most of the standard narrative concentrates on how the largest, most successful breweries were able to adopt to those changes. In meeting demand, the narrative argues,

breweries capitalized on advances in technology, science, and transportation infrastructure. They also began to incorporate the lessons that firms in other industries had learned about efficient internal organization, and coordination of production and distribution. In this

view, the industry naturally evolved towards a market structure dominated by a few number of nationally oriented breweries that made high-quality, cost-competitive beer. Consumers were the clear beneficiaries of this natural market process.

This consumer-driven view of economic evolution is tempered by a recognition of one more external force, the government. In the standard story, the government appears rarely, and when it does it is as an obstacle to the natural, efficient workings of the market for beer. (The most notable example of government interference, of course, is Prohibition.) Using the matrix developed in Chapter One, we see that the story presents a Row One interpretation of how and why economic processes unfold. Contributors to the orthodox narrative do vary according to the degree of firm agency they allow. Plavchan and Cochran, for example, take a Column Two approach to the marketing and sales campaigns of Anheuser-Bush and Pabst. In contrast, McGahan<sup>29</sup> and Elzinga<sup>30</sup> tell their stories in the passive voice: new production processes such as bottling and pasteurization were implemented by the larger breweries, and the smaller firms receded from the market.

Efficiency rules as a kind of fate in the standard story of brewing in the decades between the Civil War and World War II. Though Column Two authors detail some of the steps breweries took in shaping their economic environment, even they interpret the developments as inexorable and naturally beneficial. My task now is to examine that story more closely.

### **Section 2.3: 1865-1920**

To make the timespan of this entire story more manageable, I divide the standard story in this chapter, and my alternative interpretation in Chapters Three through Five, into three chronological periods: 1865 to 1920, 1920 to 1933, and 1933 to 1940. This allows for a more detailed examination of each period.

Yet, in a sense, this approach runs counter to a central theme in the standard narrative: industry continuity. While it recognizes that details varied over these 75 years, it also emphasizes that this period was guided by a common theme: increasing industry concentration and rising average brewery output yielded greater produc-

tive efficiency and higher beer quality. The periodic introduction of new production and distribution techniques served to lower costs and improve beer quality over these years. The emphasis has been on the natural market processes that replaced small, inefficient breweries with progressively larger, more efficient firms. As interest has been focused on the steps taken by the industry in responding to changing consumer tastes, Prohibition has not warranted much attention. The standard narrative treats Prohibition as though the government had hit the pause button on a VCR: the story set in motion from 1865 to 1920 picks up again unaltered 13 years later in 1933 with repeal.

Thus, the standard narrative consists largely of two parallel parts: 1865 to 1920 and 1933 to 1940. Both parts begin with the consumer, though consumption has received more attention in the first period. From 33.4 million in 1865, the population of the US grew to 76 million in 1900, and to 131.6 million by 1940.<sup>31</sup> Beer is a normal good, so it is no mystery why demand rose. What is remarkable about the years between 1865-1920 is not so much the absolute increases in beer consumption as the increase in per capita consumption. To explain this, the standard story has examined how the US population changed in its composition. There were millions of immigrants during these years, and most of them settled in urban areas. According to Plavchan, 'A net result of the transformation of the United States into an urban society was a tremendous rise in beer sales'.<sup>32</sup> Cochran claims that the 'doubling of the number of people in cities of over 8,000' between 1873 and 1893 was even more momentous than the increases in total population.<sup>33</sup>

Furthermore, it was not just urbanization that mattered. Of even greater importance 'was the fact that a great number of these new people were Germans', who brought with them a strong beer culture.<sup>34</sup> Plavchan also emphasizes the role played by German immigrants who, he says, loved their 'lager beer and beer gardens'.<sup>35</sup> He states that from 1870 to 1900 approximately 50% of the growth in urban population 'came from abroad, and a great many of these immigrants were Germans who naturally preferred beer'.<sup>36</sup> This growth drove up the demand for beer, especially lager.

In the early 19<sup>th</sup> century, when most white Americans were of British descent, nearly all the beer brewed in

America was British-style ale. After the Civil War, Bavarian-style lager quickly became the beer of choice for most Americans.<sup>37</sup> In comparison to ale, Arnold and Penman claim lager was 'a more palatable beer, lighter in body and in alcohol content, and possessing a sparkling quality'.<sup>38</sup> Baron, too, emphasizes the determining effects of shifting preferences: 'The course that the American brewing industry took during the second half of the 19<sup>th</sup> century was dictated in general by this declared difference in taste'.<sup>39</sup> Thus, there were two forces on the demand side, changing demographics and changing tastes.

Though the standard narrative regards the two forces as causal, the bulk of the analysis has focused on changes in the industry structure, and on the specific steps breweries took to meet these new demands. Baron provides an overall view of what was happening, and what needed to be explained:

In those palmy days of the brewing industry between about 1880 and 1910, the number of brewers was steadily decreasing whereas the production of beer constantly ... increased. Improved methods of production and distribution meant that fewer breweries could manufacture more beer ... Though the bulk of the breweries at that time (and in 1910 there were still over 1500) were small, local enterprises, making all their own deliveries by horse-drawn wagon, it was the few large, highly mechanized factories, with merchandising chains extending beyond their own neighborhoods or towns, that controlled the major part of the market ... [T]he development of a national web of railroad - improved communications in general - had drawn the whole country closer together; and the great technological advances within the brewing industry itself had made it feasible for individual brewers to look for customers farther afield. This era was marked, then, by the emergence of the national brewer - a new concept in the industry, which, with its technical paraphernalia and merchandising innovations, constituted an immense step forward.<sup>40</sup>

In response to the greater consumer demand, the brewing industry dramatically stepped up its overall production. The total number of breweries rose until the early 1870s. By the mid 1870s, the number of breweries began to decline, while total production continued to increase. Thus, in the decades after the 1870s, increases in total production came from expanding firm produc-

tion levels: the average production level per brewery rose, as did the output levels reached by the largest producers.

As Baron's passage suggests, the focus has been on how the largest, most successful breweries responded to these increases in exogenous consumer demand. Interpretations of this process have argued that these firms came to the fore by way of their greater productive efficiencies. According to McGahan, the decline in the number of breweries in the late 19<sup>th</sup> century reflected 'a series of increases in economies of scale and scope'.<sup>41</sup> In his study of Anheuser-Busch, Plavchan states:

An expanding market for beer meant that the Anheuser-Busch Brewing Association had to step up production, enlarge its plant's capacity, and serve more distant markets. Adolphus Busch was also aware, as were the other larger American brewers, that old techniques had to be improved, machines had to be adopted wherever possible, and the company's organization had to be refined and expanded to meet this challenge.<sup>42</sup>

According to Baron,

The increased market for beer meant that the brewers had to step up production, enlarge their capacity, serve more extended markets - and this meant that techniques had to be improved, mechanization had to be adopted wherever possible, organization had to be streamlined.<sup>43</sup>

Cochran presents two tables detailing the size of the largest breweries in 1877 and 1895. By consolidating these data, and comparing them to the industry growth rate, the standard story highlights the importance of the largest breweries.

For the years 1877-1895, Table 2.2 compares the percentage growth in national output to that of the eight largest breweries in 1895. Much of the growth in total production was driven by the performance of the industry's largest firms.

A subset of the industry's largest firms have garnered the most attention. They were the group of breweries concentrated in Milwaukee, St. Louis, and Cincinnati, which not only realized significant levels of production, but transformed themselves from regional firms into

<u>Industry</u>	<u>242%</u>
Pabst	689%
Anheuser Busch	1,106%
Schlitz	713%
Ehret	299%
Ballantine	409%
Bernheimer & Schmid	733%
Blatz	681%
Lemp	433%

Table 2.3. Percentage change in output by the largest breweries, 1877-1895.

Source. Cochran, T. (1948) Pabst Brewing Company: The History of an American Business. *New York: New York University Press.* pp.73-74; *United States Brewers Foundation (1956) Brewers Almanac.* p.10.

shipping breweries, or ‘national breweries’ as Baron puts it. This set includes Anheuser-Busch and Lemp in St. Louis, Christian Morelin in Cincinnati, and Pabst, Schlitz, and Blatz in Milwaukee. George Ehret, Bernheimer & Schmid, Peter Doelger, Ruppert, and James Everard were all leading New York City breweries which, despite their ranking among the nation’s largest breweries, could afford to concentrate on local business; in contrast the shippers sought a national market for their beers. The orthodox narrative has focused largely on the pivotal role these shipping breweries played in transforming the industry. Indeed, the only academic histories of individual breweries ever written are Cochran’s study of Pabst and Plavchan’s of Anheuser-Busch.

The standard story is short on theories for why these three cities gave birth to the national shipping brewers. Cochran offers two ideas: the cities all had access to natural ice and cold storage facilities, and all were of middling population, which may have led brewers to look elsewhere for sales, particularly Chicago.<sup>44</sup> Milwaukee, then, enjoyed the most advantages of the

three: it was the most northerly, the smallest, and the closest to Chicago.

Cities like Chicago and New York had populations that could consume all the beer its breweries produced. Cochran also mentions that Milwaukee, St. Louis, and Cincinnati has significant numbers of skilled German laborers with backgrounds in brewing, and had facilities for transportation by rail and waterway.

The standard literature offers not much more than this by way of explanation, but it does devote a great deal of attention to the steps taken by the shipping breweries in these cities to increase output levels and productive efficiency. As noted above, the measures that have been highlighted during this period are advances in technology, science, transportation, and firm organization. These factors are viewed as interdependent. Thus, the changes in technology would not have been as transforming if they were not matched by equally important developments in science and transportation. As we review the examinations of these factors, it becomes apparent how important the role of the shipping brewers is to the story.

The factor we will begin with is technology. Of the many technical advances breweries introduced during the years between the Civil War and Prohibition, three were of special significance: artificial refrigeration, mechanized malting, and new bottling techniques. Until the advent of artificial refrigeration, brewing operations, especially for the more temperature-sensitive lager, were seasonal. Cochran notes that ‘as the production for the summer drinking had to be made in the winter or early spring months, large storage cellars were necessary’.<sup>45</sup> The sheer amount of ice required to cool these cellars posed logistical nightmares for breweries. In 1880 the Pabst brewery alone used 60,000 tons.<sup>46</sup>

Initially, the proximity to natural ice gave brewers in colder climates an advantage over Southern breweries, but in no place of the country was there a guarantee of the consistent and timely ice supplies necessary for an expanding production of quality lager beer. Thus, the implementation of artificial refrigeration in breweries in the 1870s and 1880s was revolutionary.

Artificial refrigeration expanded the brewing season and increased production levels. It facilitated the making of a more consistent, more uniform, and generally

better beer. It reduced labor costs and allowed for a more efficient use of space.<sup>47</sup> In their review of the history and science of the American brewing industry, Arnold and Penman assert, ‘None of the advances made in the latter half of the 19<sup>th</sup> century was of greater importance than the advent of mechanical refrigeration’.<sup>48</sup> Later writers echoed this view. For Plavchan, artificial refrigeration was ‘one of the greatest advances made during the second half of the nineteenth century’,<sup>49</sup> while Elzinga, in his survey article on the beer industry, notes that ‘mechanical refrigeration greatly aided the production process as well as the storage of beer’.<sup>50</sup>

Ferdinand Carre patented the first ice machine in 1860. It was first installed in an American brewery in 1869, in the warm-weather city of New Orleans.<sup>51</sup> During the 1870s and 1880s, numerous breweries evaluated the efficacy and the cost-effectiveness of ice machines and air-cooling machines. In 1883, the president of Pabst, the nation’s largest brewery, made a direct cost comparison of the amounts of machine ice and natural ice needed to cool an equal amount of beer.

Ice Machinery Expenses	
Maintenance	\$26,307.35
Repairs	\$5,185.12
Actual Expense	\$31,492.47
10% of wear and tear on whole system	\$9,804.39
Total	\$41,296.86
Cost of Natural Ice for Cooling an Equal Amount of Beer	
Cost of Ice, based on four-year average	\$29,986.47
Ten men for handling ice	\$2,700.00
Total	\$32,686.47

Table 2.4. Pabst brewery cost comparison of natural ice and ice machinery, 1883.

Source. Cochran, T. (1948) Pabst Brewing Company: The History of an American Business. New York: New York University Press. p.98.

The comparison, I believe, misses the point. When the complete range of benefits favoring artificial refrigeration were factored into the equation, the superiority of

mechanical cooling was overwhelming. Clearly, Pabst came to realize this: Cochran shows in another table that within a few years machine ice had supplanted natural ice at Pabst.

The table below shows that the move to artificial ice was in direct correlation with increasing annual production levels. While Pabst relied on natural ice, its annual production never topped 450,000 barrels. Within a few years of moving to artificial refrigeration, its production levels quickly approached 900,000 barrels, or approximately double the pre-artificial refrigeration production levels.

Data for Anheuser Busch reveal a similar trend. In 1880, the brewery’s annual production was 141,163 bls. After a decade of sustained investment in mechanical cooling systems, it produced more than 700,000 bls annually.<sup>52</sup>

However, the narrative argues that mechanical refrigeration must be kept in perspective. McGahan argues that ‘through the 1930s, the high cost of refrigeration confined production to areas where supplementary natural cold storage was readily available’.<sup>53</sup> Mechanical refrigeration, then, did not turn out to be the great equalizer for southern breweries. Cochran asserts that while ‘artificial refrigeration in the early eighties eased the internal cooling problems of the more southerly breweries ... nothing in this period replaced natural ice in shipping’.<sup>54</sup> Taken together, McGahan and Chandler’s statements indicate that mechanical refrigeration was a complement to natural cooling facilities and techniques, not a substitute for them. Plavchan argues that artificial refrigeration ‘made it possible for Adolphus Busch to produce a better quality of beer’.<sup>55</sup> He does not suggest, however, that all breweries benefited equally: the machinery was costly, and those most likely to invest were those seeking to lengthen their operating seasons, and thus, to increase production levels. Larger breweries took fuller advantage of artificial refrigeration, and were able to increase their output and to improve the quality of their beer.

Another key technical advance was in the process of malting. Until the 1870s, brewers used the labor intensive method of floor malting, in which barley was steeped in a two-foot deep pool of water, and then methodically turned or shoveled until it was ready for

Year	Production in Barrels	Natural Ice Expenses	Ice Machine Expenses (including depreciation)
1884	375,983	\$10,811	\$33,468
1885	385,234	\$14,312	\$28,052
1886	436,438	\$14,135	\$39,505
1887	463,181	\$527	\$44,162
1888	505,638	\$10	\$43,263
1889	608,908	none	\$43,919
1890	772,779	none	\$49,866
1891	804,548	none	\$64,366
1892	871,788	none	\$55,691

*Table 2.5. Pabst brewery expenditures on natural and machine made ice. 1884-1892.*

*Source. Cochran, T. (1948) Pabst Brewing Company: The History of an American Business. New York: New York University Press. p.98.*

the next brewing stage. During the 1870s, two new techniques emerged, component malting and drum malting. Both of these are forms of pneumatic malting, which greatly mechanized floor malting by using pressurized air. Chandler states that the introduction of pneumatic malting in the 1880s ‘increased speed and improved control in the process of brewing beer’.<sup>56</sup> In 1890 Anheuser Busch introduced the Galland-Henning drum system of pneumatic malting, and was able to increase its annual malting capacity. Adolphus Busch felt that investments in malting technology, though costly, were well worth it. According to Plavchan, Busch’s overriding goal was ‘to manufacture malt in the most economical and expeditious manner’.<sup>57</sup> Plavchan and Chandler emphasize that, because of the high cost, larger breweries were better able to afford-and thus benefit from-the innovations in malting technology.

The third significant technical advance was the introduction of mass bottling, which, according to Cochran, ‘may well have been the most important development in the industry’.<sup>58</sup> The standard story emphasizes that bottled beer’s share of the pre-Prohibition beer market rose steadily as the brewers, particularly the shippers, honed their bottling abilities. In the case of Pabst, the share rose from 5% of total output in the early 1880s to 10% in the 1890s.<sup>59</sup>

Breweries also made improvements in the sterilizing and labeling of bottles between 1890 and 1905. Labor-saving innovations during these years included the Gouling bottle-washing machine in 1884, which ended the need for workers to clean individual bottles by hand, and the Crown Cork and Seal Company’s metal cap in 1892.<sup>60</sup> According to McGahan, ‘The greatest impediment to widespread distribution of bottled beer was the stoppering process’.<sup>61</sup> Brewers needed a secure stopper for beer bottles that could be applied by machines and the cork-lined metal cap combined mechanization and quality assurance.<sup>62</sup>

While these innovations raised the productivity of bottling beer, not all of the efforts of shippers centered on new technologies. Cochran details how Captain Pabst improved the efficiency of bottled beer in 1890 by working to modify the outdated government policy relating to how bottled beer was taxed. When the IRS first began taxing beer in 1862, brewers only produced keg beer; the excise-tax laws did not anticipate bottling. If brewers wanted to bottle beer, they first had to keg the beer, pay the appropriate taxes, and then transfer the beer from kegs to bottles. In 1889, two Pabst employees, head brewer J. Theurer, and mechanical engineer Richard Birkholz ‘invented a pipe line and bottling system that would guarantee the government against loss or

fraud, and would greatly improve the mechanics of bottling'.<sup>63</sup> Emboldened by this work, Captain Pabst petitioned Congress to allow brewers to bottle beer directly from the plant. He succeeded, and on June 8, 1890, Congress altered the provision of the Internal Revenue Act. McGahan writes that 'a legal barrier preventing integration of brewing and bottling was...removed in the 1890s'.<sup>64</sup> Government, in this view, subverts the natural efficiencies of the market; firms and industries must occasionally work to overcome this interference. As a whole, the shipping brewers benefited the most from the measures which increased the efficiency of bottled beer. Improvements in bottling improved the fortunes of the small number of shipping brewers who were becoming increasingly dependent on bottled beer.

A second external factor in the standard story is science. According to Plavchan, 'While engineers were introducing sophisticated machinery making it possible to produce beer cheaper and more dependable, scientists who had no connection with the brewing industry were providing brewers with valuable knowledge'.<sup>65</sup> According to Cochran, 'The new contributions of pure science helped greatly in solving the industry-old problem of how to produce a beer that would always look the same, smell the same, and taste the same when produced from the same materials'.<sup>66</sup> Though there were several important scientific developments, the orthodox story has concentrated on the process of pasteurization developed by Louis Pasteur. Plavchan refers to pasteurization as 'the most important contribution to practical brewing'.<sup>67</sup> Pasteur published an entire book on fermentation and beer in 1876, but his numerous contributions can be distilled to one single idea, which revolutionized the American brewing industry: by heating or 'pasteurizing' beer to a temperature just below boiling, harmful bacteria can be eliminated, and the production and storage of beer made more reliable. That is, pasteurization prevented secondary fermentations which altered the flavor and predictability of beer, and it greatly decreased losses due to spoilage.

Since only bottled beer was pasteurized during these years, the benefit of pasteurization accrued largely to the shipping brewers who were the most involved in packaged beer.<sup>68</sup> Arnold and Penman detail how breweries in the late 19<sup>th</sup> century experimented with several pasteurization techniques before settling on the method in which 'the beer in the bottles was raised to

pasteurizing temperature, held for the required time and gradually cooled'.<sup>69</sup> As Downward claims, pasteurization 'encouraged expansion of beer bottling for shipment because it enhanced the quality and stability of beer'.<sup>70</sup>

It is believed that Anheuser Busch was the first American brewery to utilize pasteurization.<sup>71</sup> According to Plavchan, Anheuser Busch began experimenting with pasteurization techniques in the 1870s, correctly anticipating its advantages in production and distribution. The Pabst brewery too, Cochran notes, began experimenting with pasteurization so that its bottled beer 'could stand long-distance shipping'. Though Anheuser Busch appears to have been the more aggressive of the two in incorporating pasteurization, by the early 1890s both firms had fully implemented the science of pasteurization.

In 1895, the president of Christian Morelin, a Cincinnati shipping brewery, welcomed pasteurization as a development that enabled beer 'to resist the effect of changes of climate and to be opened as fresh and sparkling in the torrid as the temperate zone'.<sup>72</sup> By safeguarding the popular attributes of lager beer, pasteurization allowed nationally oriented shipping breweries to increase their production levels and distribute to a growing number of markets.

The discovery of pasteurization complemented the technical advances in bottled beer. The combination of these two factors helped breweries, notably the shipping breweries, respond efficiently to the growing demand for bottled beer. This contributed to the growing production levels enjoyed by the shipping breweries.

A third external factor in the standard story is the development of a well-articulated railroad system. According to Chandler, 'railroad transportation permitted enormous expansion in the output of individual breweries producing beer and ale'.<sup>73</sup> Cochran, too, trumpets the determining effects of railroad, claiming that 'bottled lager beer was a by-product of the railroad, and the beginning of its nationwide sales followed closely upon the completion of a railroad network'.<sup>74</sup> As McGahan puts it:

Advent of the railroad and improvements in production technology allowed several large breweries with high-quality

products to seek wider distribution. Milwaukee and St. Louis brewers brought their premium beer to towns along central distribution arteries, charged a higher price than most local brewers, and forced out smaller incumbents offering less quality for the money.<sup>75</sup>

A growing railroad network provided shippers with the necessary means for distributing their product.

To fully capitalize on the potential offered by the growing railroads, breweries needed to insure the quality of their shipped beer. The key advance in this area was the refrigerated railroad car, which was developed by the meat packing industry in the late 1870s and early 1880s. According to Chandler, 'the development of temperature control cars made it possible to distribute [the shippers] product nationally'.<sup>76</sup> Elzinga emphasizes this trend as well, claiming that 'developments in transportation technology enabled brewers to expand production beyond their local markets'.<sup>77</sup> Railroads, according to the standard story, helped breweries meet the growing demand for more brands of beer and for more bottled beer.

The final factor stressed in the orthodox narrative concerns the organizational steps taken by breweries, particularly the shipping breweries, to improve their productive and distributive efficiency. These national shippers exemplify Chandler's distinction between the mass producer and the emergent modern business enterprise, which combined mass production and distribution. Chandler argues that the modern enterprise increased the speed of production:

Economies and lower unit costs resulted from an intensification of the speed of materials through an establishment rather than from enlarging its size. They came more from organization and technological innovations that increased the velocity of throughput than from adding more men and machines.<sup>78</sup>

Efficiency came not from scale economics, but from adeptly combining new technologies, emerging organizational structures, and growing distribution networks. This implies that the best-positioned breweries were those that integrated throughput-enhancing innovations - for example, pneumatic malting, which decreased the amount of time required for malting with aggressive strategies for distribution.

In the 1880s, Chandler notes the six national shippers 'all began to build a nationwide distributing network and to use advertising agencies to reach the national market'.<sup>79</sup> To become true modern business enterprises, they had to integrate their greater productive efficiencies with equally effective techniques for distributing their beer, and the first step in this process was the creation of national sales organizations based on semi-autonomous branches. Serving as direct complements to these efforts were well developed advertising and marketing campaigns, which fostered consumer awareness of the shippers' higher-quality beers. As Cochran says:

Advertising and salesmanship of a high order were required to give Pabst beer peculiar prestige in the mind of the buying public and to make the circled "B" (for Best) trade-mark a symbol of quality that marked with distinction the retailer and his customers. The other two Milwaukee shippers, Blatz and Schlitz, shared Pabst's problems, and while still pushing their own products, all three joined in seeking national recognition of the peculiar excellence of Milwaukee beer.<sup>80</sup>

Plavchan states that Adolphus Busch 'continued to rest his sales efforts upon arguments of quality and prestige rather than price'.<sup>81</sup> As all these passages indicate, the standard narrative has emphasized how the national shippers capitalized on productive and distributive efficiencies to expand their output by offering consumers a better-quality beer.

The narrative has focused on how greater productive (and distributive) efficiencies combined to transform the industry in the decades between the Civil War and Prohibition. The writers note that as total production rose from 3.7 to 60 million barrels, the number of breweries in operation declined from a high of 3,286 in 1870 to under 1,400 by 1915. The driving force behind this efficiency-led reorganization of the brewing industry was the emergence of mass-producing, mass-distributing, vertically integrated large-scale breweries. Through their innovative adoptions of advances in technology, science, and transportation, these shipping breweries led the way for fundamental changes in the industry.

Consumers enjoyed not only lower costs but also higher-quality beer. Cochran emphasizes that much of Pabst's achievements were due to its superior product, especially compared with local brewers who 'generally emphasized low price rather than quality'.<sup>82</sup> Elsewhere

he claims that ‘careful selection of the finest materials and the adoption of the newest brewing processes made Pabst beer generally superior to that produced by some two thousand smaller brewers’.<sup>83</sup> McGahan, too, believes that the shipping brewers had ‘better recipes’,<sup>84</sup> and that they ‘produced better beer less expensively (before transportation costs) than local draft producers’.<sup>85</sup>

#### Section 2.4: Prohibition, 1920-1933

On 16 January 1920, the Eighteenth Amendment became law. It prohibited ‘the manufacture, sale, transportation, import, or export of intoxicating liquor for use as beverages’.<sup>86</sup> To enforce the amendment, Congress passed the Volstead Act over President Wilson’s veto in late 1919. It was the Volstead Act which defined intoxicating beverages as those containing over 0.5% alcohol by volume. The Eighteenth Amendment, and its accompanying legislation, remained the law of the land until 1933. For 13 years, no legal alcohol above 0.5% could be manufactured, distributed or sold in America.

In general, the standard story has been rather quiet on this gap in the brewing industry’s history, perhaps because Prohibition constitutes an irrational interference with the efficient workings of the market. According to Elzinga, the industry was ‘blissfully ignorant’ of the forces that sought its demise.<sup>87</sup> According to Baron, they ‘were also surprisingly maladroit in their public relations’.<sup>88</sup> Apps writes that the industry ‘had been complacent about the prohibition forces, fully believing that the prohibitionists would eventually disappear’.<sup>89</sup> In Downard’s view, ‘the brewers had been somewhat lethargic concerning the prohibition movement and were simply caught by force of events and the power of the [Anti-Saloon] League’.<sup>90</sup> The standard story, then, presents the brewing industry as a slumbering giant, caught unawares by the nimbler, better-organized Prohibition forces. The natural workings of the market were temporarily put on hold as politics interfered with the legal operation of the industry.

The discussion of the Prohibition years is largely confined to a crucial decision faced by brewery owners: whether to sell their plants and equipment, or to continue work at their facilities making a range of related (and in some cases unrelated) products. Some breweries,

fearing that the tide would never turn, gave up any hope of ever legally brewing again and sold their plants and equipment. The Lemp brewery in St. Louis, one of the six leading national shippers, was sold at auction at a loss of 90% of the investment.<sup>91</sup> Other breweries were more optimistic about their prospects, and busied themselves with producing a range of new products. Plavchan and Cochran detail the steps that breweries such as Anheuser-Busch and Pabst took in introducing low-alcohol beer, also called ‘near beer’.

Year	Production of low-alcohol beer (millions of barrels)
1920	9.2
1921	9.2
1922	6.3
1923	5.3
1924	4.9
1925	5.1
1926	4.9
1927	4.4
1928	4.2
1929	3.9
1930	3.7
1931	3.1
1932	2.7

Table 2.6. Production of low-alcohol beer, 1920-1932.

Source. *United States Brewers Foundation (1956) Brewers Almanac.*

These efforts, while initially somewhat promising, quickly collapsed. Anheuser Busch built a plant designed specifically for the production of a low-alcohol beer name Bevo which never became a commercial success. Other failed near-beers include YIP, ONA, PABLO, and HOPPY by Pabst, FAMO by Schlitz, CHRISMO by Christian Moerlein, VIVO by Miller, and LUXO by Henry Weinhard.<sup>92</sup> Baron attributes the failures of these near-beers to increasing supplies of bootleg beer and whiskey.<sup>93</sup> Another factor which depressed the market for these products was the growing popularity of carbonated soft-drinks, some of which were made by the breweries themselves.

Realizing that near-beer was not the answer to the problems posed by Prohibition, breweries turned to many other products. The Blatz brewery manufactured industrial alcohol. Other breweries tried ice cream, malt syrup, malt extract, and even spaghetti and macaroni. Among the more inventive plant conversions was that of the New York brewery that went into the fur storage service.<sup>94</sup>

Congress officially overturned the Eighteenth Amendment in December 1933 with the passage of the Twenty-first Amendment. Beer up to 3.2% alcohol had been legalized several months earlier with the passage of the Cullen Act in March 1933. After it took effect on 7 April, brewers throughout the country fired up their brewing vats and began operations again after the 13 year government imposed break.

In Downard's view, the case of the prohibitionists weakened as 'the problem of enforcement, antiprohibition sentiment, and the retarding effect the law had on the economy, led many to question the wisdom of the amendment'.<sup>95</sup> Apps' interpretation is similar:

Many factors contributed to the eventual passage of the Twenty-first Amendment, which repealed the Eighteenth: the depression; the inability to enforce provisions of the Volstead Act; the fact that mobsters openly took over the making and selling of liquor; political movement away from the anti-repeal Republicans toward the pro-repeal Democrats; concern that individual rights were being violated; and a general feeling that the Eighteenth Amendment simply did not do what it was supposed to do, i.e., prohibit the manufacture and consumption of alcoholic beverages.<sup>96</sup>

In both works, the brewing industry and its member firms are portrayed as institutions that only react to changes in their economic and social environment.<sup>97</sup> Just as the brewing industry did not try to prevent the imposition of Prohibition, so too were they uninvolved in its repeal. The government, an all-powerful exogenous force, could render the industry legal or illegal, depending on the direction of the political winds.

### **Section 2.5: 1933-1940**

With the repeal of Prohibition, the natural workings of the market could be set in motion again. The same

forces that had led to a more concentrated industry prior to Prohibition re-emerged after 13 years of suspension. The industry continued to consolidate: from 1,345 breweries in 1915, there were only 684 firms operating in 1940. The dominant breweries became even more dominant: the largest breweries, which had never produced more than 1.5 million barrels in a year before Prohibition were by 1940 producing between 2 to 2.5 million barrels annually. The average production level of all breweries continued to rise: from 45,000 barrels in 1915, average brewery production rose to 85,000 barrels by 1940.

Though the standard story focuses on production in the years following repeal, in a parallel to its account of the pre-Prohibition industry, it continues to treat the consumer and consumption as the driving force. According to McGahan, 'Low demand created pressure to exit on marginal producers and forced remaining brewers to adopt cost-saving technology rather than to escalate price- and advertising-based competition'.<sup>98</sup> She attributes the low demand for beer during these years to three factors: the Depression, high taxes, and the changed role of the saloon.<sup>99</sup> The Great Depression limited buying power. High taxes encouraged consumers to forsake beer for lower-priced soft drinks and, to a lesser extent, liquor and wine. Advances in packaging and home refrigeration allowed consumers to enjoy their beer in their own homes, which she implies, led to more temperate drinking patterns:

Unanticipated shifts in consumer preferences partly accounted for sluggish demand in the 1930s. Brewers were faced with drying-up demand for beer in the traditional channel (the saloon) and pent-up demand in a previously unavailable channel (retail sales of packaged beer).<sup>100</sup>

In response to these changes in demand, firms either adapted or were forced out of business. From a post-Prohibition high of 766 breweries in 1935, the total number fell to 684 by 1940. Cochran attributes this to competition which 'eliminated many of the poorly managed or inefficient breweries'.<sup>101</sup> According to McGahan, 'the propensity of smaller brewers to exit the industry in the 1930s followed a trend established in the 1890s. A series of increases in economies of scale and scope accounts for the steady decline'.<sup>102</sup> Elzinga makes the same point:

Year	Number of breweries	National production (millions of bls)	Average production per brewery (barrels)	Largest firm production (millions of bls)	Per capita consumption (gallons)
1910	1,568	59.5	37,980	1.5	20.1
1915	1,345	59.8	44,467	1.1	18.7
1933	331	11.1	33,534	0.6	n.a.
1934	756	37.7	49,839	1.1	7.9
1935	766	45.2	55,091	1.1	10.3
1936	739	51.8	65,899	1.3	11.8
1937	754	58.7	73,474	1.8	13.3
1938	700	56.3	77,000	2.1	12.9
1939	672	53.8	77,083	2.3	12.3
1940	684	54.9	85,236	2.5	12.5

Table 2.7. *The post-repeal brewing industry, 1910-1940.*

Source: Cochran, T. (1948) *Pabst Brewing Company: The History of an American Business*. New York: New York University Press; Krebs, R. and Orthwein, P. (1953) *Making Friends is Our Business: 100 Years of Anheuser-Busch*. St. Louis, MO: self published book, Anheuser-Busch.; and United States Brewers Foundation (1956) *Brewers Almanac*.

Some were family-owned firms, and heredity had been cruel to the second and third generations, not endowing them with the brewing and/or managerial capabilities of their fathers or grandfathers. Competitive pressures, with no respect for nepotism, eliminated such breweries.<sup>103</sup>

The free hand of the market asserted itself during these years, and forced many inefficient breweries out of business.

The standard story (and McGahan is the dominant voice for this period) adduces several examples of the steps the leading breweries took in increasing their productive efficiencies during these years. As she does in her treatment of the pre-Prohibition period, she focuses on advances in technology and transportation, changes in firm behavior, and the role of the government. She largely ignores the role of science, noting that its major contribution came with pasteurization in the late 19th century.

The government acted only to limit the range of options available to breweries, and to impede to the efficient workings of the market. Underlying her argument is the assumption that when breweries were free to respond to the voice of consumers, they did so in a productively efficient manner.

She focuses on three technological developments, and so too will we. First, there were the innovations in the packaging of beer, the significant event of which was the introduction of canned beer in 1935. McGahan claims that the invention of the beer can created new opportunities for breweries, especially for larger breweries.<sup>104</sup> Cochran writes that Pabst saw in it 'new hope for the future'.<sup>105</sup> Together, these authors claim, canned and bottled beer came to transform how and where beer was sold.

The shipping brewers' fortunes improved most directly as bottled and canned beer captured ever larger percent

Year	Percentage of Packaged Beer
1915 (estimate)	10-15%
1933	31.6%
1934	25.0%
1935	29.5%
1936	38.1%
1937	43.8%
1938	46.2%
1939	49.3%
1940	51.7%

Table 2.8. *The rise of packaged beer, 1915-1940.*

Source. *United States Brewers Foundation (1956) Brewers Almanac. p.17.*

ages of the beer market. By 1940, packaged beer accounted for over 50% of the beer market. Its market share has expanded ever since.

The second notable invention during these years was the metal keg, which freed breweries from dependence on heavy wooden kegs.<sup>106</sup> Metal kegs, McGahan notes, were significantly cheaper to ship and were easier to keep cool.<sup>107</sup>

McGahan's third technical advance was broader, more sweeping: the installation by shippers of 'mechanical equipment over many operations that the smaller brewers performed manually'.<sup>108</sup> The introduction of new equipment by larger brewers yielded 'vessel-related economies of scale,' which successfully differentiated shippers from smaller firms.

Another factor McGahan highlights is transportation. In the years leading up to Prohibition, shipping brewers capitalized on the benefits accruing from an expanding railroad system. The 1930s counterpoint to the railroads was the motorized truck, which gave shipping brewers much greater flexibility. Cochran notes that 'the motor truck greatly facilitated the supply of middle-distance cities'.<sup>109</sup> McGahan makes a similar point, arguing that 'with the motor truck, the large breweries were not confined to railroad arteries for distribution, and they began penetrating rural markets'.<sup>110</sup> As with the other advances of these period, the shipping brewers stood to

benefit the most from the motorized truck.

McGahan does not attribute the achievements of the large, shipping breweries to nonproductive investments. For example, she claims that advertising was notable during this period for its 'thinness'.<sup>111</sup> Her de-emphasis on advertising and marketing reflects her goal to attribute industry and firm increases in output to 'real' factors such as technology and transportation. After determining that 'industry advertising expenditures were less than one percent of sales' from 1935 to 1941, she attributes this paucity to fears of government regulation, and to the probable inefficacy of advertising during the Depression.<sup>112</sup> This means that the government, which in general appears in her story as a force that inhibits efficient production, serves here to dissuade breweries from the temptation of engaging in unavailing and wasteful expenditures on advertising and marketing.

Thus, the success of the shipping brewers was due to a combination of new technologies, economies of scale and scope, and the rising popularity of packaged beer. McGahan does not believe that it was in any way due to economically inefficient factors such as marketing or advertising campaigns. The increased dominance of the shippers and the exit of many smaller breweries were natural workings of the market for beer. The new market structure represented the survival of the fittest - that is, the most efficient. Horowitz and Horowitz offer a similar view in their survey article on the brewing industry's changing structure in the decades after repeal:

It scarcely comes as a surprise to come upon an industry in which the larger firms are the more efficient firms. In the brewing industry the greater efficiency of the larger breweries appears to have resulted from the many technological developments in the brewing process in recent decades. Among the improvements introduced since repeal were power machinery, faster bottling operations, better refrigeration which provides exact control of temperature, improved laboratory techniques for checking all stages of the brewing process, and new devices to speed up the loading of trucks with the finished product.<sup>113</sup>

Horowitz and Horowitz argue that many of the investments in technology made by large breweries were done so they could adequately 'satisfy the consumer'.<sup>114</sup> In other words, shippers responded to consumer preferences, they did not seek to construct or shape them. For

Horowitz and Horowitz, as well as for McGahan, consumers were the ultimate beneficiary of the brewing industry's steady reorganization. Among the benefits, McGahan notes, was the higher quality beer provided by the shippers

## Section 2.6: Summary

My reconstruction of the standard story brings together the most salient ideas from the leading economic and business studies of the American brewing industry. The picture that emerges is quite clear, and can be briefly described here.

Consumers were the driving force behind this period's changes in the brewing industry and in the beer. The rising industry concentration was a direct result of the productive efficiencies that favored the few nationally oriented breweries. These shipping breweries represented the industry's response to increased consumer demand. A series of advances allowed them to increase their annual production levels; smaller breweries continued to operate only by virtue of their distance from them. As transportation costs fell, the shippers expanded their distribution networks and forced hundreds of smaller, less efficient breweries out of business. Consumers ultimately benefited from these developments in production processes and industry structure, through greater access to cost-competitive, high quality beer. This process was both natural and inexorable: the combination of increased consumer demand and production-enhancing innovations automatically led to a market structure dominated by nationally oriented breweries.

My final step is to relate this standard story to the conceptual matrix in Chapter One, which also should be summarized here:

The vertical axis contains two interpretations of how economic processes unfold: Row One theories hold that economic processes are natural, inevitable, and beneficial; Row Two entries hold that economic processes are constructed - they are neither natural, inexorable, nor driven by ahistorical conceptions of economic efficiency. On the horizontal axis, the matrix categorizes studies according to their views on firm behavior: Column One entries see firms as passive responders to

market signals; in Column Two, firms are active participants in, and makers of, their social and economic environments.

The orthodox narrative maintains that changing consumer tastes thoroughly changed the industry between the Civil War and World War II. However, the focus is less on the consumers than on the industry responses. The most successful responses serve to show the natural workings of the market: large shipping breweries were rewarded, smaller, less efficient firms were punished.

While all contributors to the traditional narrative share a common Row One understanding of how and why economic processes evolve, they do manifest different conceptions of firm behavior. Column One interpretations regard firms as black boxes - entities that simply react to exogenous forces, whatever those forces might be. For example, Elzinga and McGahan argue for the primacy of technology as the determining factor in brewing.

Column Two presents a separate conception of firm behavior. It recognizes the importance of internal firm activities in the shaping of environment. Several authors, most notably Cochran and Plavchan, articulate stories of the firm which fit closer to Column Two than Column One.<sup>115</sup> My story, while it borrows from them at times, is distinct. By beginning with a Row Two conception of how and why economic processes unfold, I reach radically different conclusions about the evolution of the industry.

Beginning in Chapter Three, I articulate my alternative narrative for how and why the brewing industry changed during the years 1865-1940. By opening up my analysis to the possibility that industries may be reorganized for reasons other than productive efficiency, I am able to build on the insights of the many Row Two studies adduced in Chapter One. Specifically, I examine why the industry changed, and what the consequences of these changes were. Was the rise of large-scale shipping breweries inexorable? Was it actually beneficial to consumers? Were the changes in production techniques driven by a market-led search for greater productive efficiency?

By employing a Row Two view of economic processes, I am able to question the causality underlying the tradi-

tional story: Were consumers really the driving forces in the industry, or were consumer preferences often shaped by leading members of the brewing industry? While the standard story is mute on the sources of consumer preferences, my alternative story argues that the question of source is of prime importance.

Finally, I regard firms as active shapers of their economic and social environment, and I show them interacting with the many institutions that are important to their operations. The government, in my view, is not just a negative exogenous force which impedes the efficient workings of the market for beer, but an institution which can be influenced as much by the brewing industry as by the Anti-Saloon League.

*The second part of this study will appear in the Spring edition of Brewery History.*

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### Chapter 1

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*Economics and Business*. 21 pp.87-106.

23. Williamson, O. (1985) op. cit. p.7.

24. Eggertsson, T. (1990) *Economic Behavior and Institutions*. New York: Cambridge University, Press. pp. xi-xiii.

25. Williamson cites John Commons and Ronald Coase as early economists who ably critiqued the neoclassical treatment of the firm. Economic historians have also challenged this view. See Koot, G. (1988) *English Historical Economics, 1870-1926: The Rise of Economic History and Mercantilism*. Cambridge: Cambridge University and Kadish, A. (1989) *Historians, Economists and Economic History*. London: Routledge for summaries on the English Historical School, and Sass, S. (1978) *Entrepreneurial Historians and History*. Ph.D., Johns Hopkins University. on Harvard's Center for Entrepreneurial Research.

26. Williamson, O. (1985) op. cit. p.16.

27. *ibid.* p.17.

28. *ibid.* p.23.

29. *ibid.* p.26.

30. *ibid.* p.85.

31. Englandler, E. (1988) 'Technology and Oliver Williamson's Transaction Cost Economics', *Journal of Economic Behavior and Organization*. 10, pp.339-53.

32. Williamson, O. (1985) op. cit. p.111.

33. *ibid.* p.383.

34. Chandler, A. (1962) *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. Cambridge: MA: MIT Press; Chandler, A. (1969) 'The Structure of American Industry in the Twentieth Century: A Historical Overview', *Business History Review*. 43, pp.255-281; Chandler, A. (1977) op. cit.; and Chandler, A. (1990) *Scale and Scope*. Cambridge, MA: Harvard Press.

35. Chandler, A. (1977) op. cit. p.12.

36. *ibid.* p.281.

37. This raises the issue of whether Chandler's thesis can be empirically tested. Roy, W. (1997) op. cit. critiques Chandler's thesis in his second chapter entitled 'A Quantitative Test of Efficiency Theory'; however, these statistical exercises do not address all aspects of Chandler's assertion. What is needed is a series of firm level tests across a select number of key manufacturing industries; ideally, these tests would examine profit rates and measures of throughput for small, medium, and large firms. The difficulty, of course, lies in being able to piece together the necessary data set.

38. Chandler, A. (1977) op. cit. pp.315-39.

39. *ibid.* p.300.

40. *ibid.* p.290.

41. *ibid.* p.292.

42. *ibid.* p.293-294.

43. See Levenstein, H. (1988) *Revolution at the Table: The Transformation of the American Diet*. New York: Oxford Press for further discussion. He shows that the rise of breakfast cereals represents the only time in recent food history in which an affluent society willingly replaced meat at a meal with a grain.

44. Chandler, A. (1977) op. cit. p.291.

45. Chandler attributes Duke's low prices to efficiency (*ibid.* pp.291-292); in contrast, Roy views these low prices as instances of predatory pricing designed to win market share, a strategy that was effective (Roy, W. (1997) op. cit. pp.223-230). Chandler, holding to his Row One view of economic processes, would not want to highlight the effectiveness of a non-productive strategy such as predatory pricing.

46. Chandler, A. (1977) op. cit. p.209.

47. Lazonick, W. (1991) op. cit.

48. *ibid.* p.92.

49. *ibid.* p.197.

50. *ibid.* p.336.

51. *ibid.*

52. *ibid.* p.98.

53. *ibid.* p.134.

54. Lamoreaux, N. (1985) op. cit.

55. Arthur, B. (1990) op. cit.; David, P. (1985) op. cit.

56. Berk, G. (1993) op. cit.; St. Clair, D. (1986) op. cit.; Roy, W. (1997) op. cit.; and Granovetter, M. (1985) and Granovetter, M., McGuire, P. and Schwartz, M. (1993) op.cit.

57. Williamson does not identify any of authors associated with the anti-monopoly school at the turn of the century. Porter, G. (1973) *The Rise of Big Business, 1860-1910*.

Arlington Heights, IL: Harlan Davidson discusses several works written at the turn of the century which were emblematic of this view. Among the more influential works were Ripley, W. (1905) *Trusts, Pools, and Corporations*. Boston: Ginn and Company. and Lloyd, H. (1894) *Wealth Against Commonwealth*. New York: Harper and Brothers.

58. Lamoreaux, N. (1985) op. cit.

59. *ibid.* p.87.

60. Though there is a long tradition of writers decrying the anti-competitive consequences of large-scale business, two recent schools of thought, those associated with Alfred Chandler and Oliver Williamson, focus on the advantages large-scale production has wrought. It is in reference to this recent work that Lamoreaux's interpretation can be characterized as 'against the grain'.

61. Arthur, B. (1990) op. cit. p.92.

62. *ibid.* p.94.

63. *ibid.* p.93.
64. *ibid.* p.99.
65. David, P. (1985) *op. cit.*
66. *ibid.* p.335.
67. David's and Arthur's thesis has not gone unchallenged. Liebowitz and Margolis - Liebowitz, S. and Margolis S. (1990) 'The Fable of the Keys', *Journal of Law and Economics*. 33 (1), pp.1-25; Liebowitz, S. and Margolis, S. (1995a) 'Don't handcuff technology', *Upside*. 7 (9), pp.64-73; Liebowitz, S. and Margolis, S. (1995b) 'Policy and path dependence: From QWERTY to Windows 95', *Regulation*. 18 (3), pp.33-41 - have written several articles where they deny that there is any real evidence for market failures resulting from a locking in of inefficient technologies. They examine both the QWERTY and the videotape examples and conclude that there were rational reasons why QWERTY emerged as the dominant keyboard and why VHS bested Beta in the videotape market. In a recent rebuttal to the criticisms issued by Liebowitz and Margolis, David and Arthur defended their ideas regarding path dependence and reiterated that markets do not automatically pick winners (Gomes, L. (1998) 'QWERTY Spells a Saga of Market Economics', *Wall Street Journal*. CI (25 February: 1, 6).
68. Arthur's dependence upon randomness is in part responsible for why he ended up at the Santa Fe Institute working with physicists. The fundamental question his work raises is whether it has contributed to explanations or understandings of economic behavior.
69. Berk, G. (1993) *op. cit.*
70. St. Clair, D. (1986) *op. cit.*
71. An interesting literature which this relates to is the debates surrounding the nature of economic history at the turn of the century in England and in the 1940s-1950s in the US. The key question in both periods was whether economic history should be guided by deductive neoclassical theory or should be more inductively based on, for example, firm and industry studies. See Koot, G. (1988) *op. cit.*, Kadish, A. (1989) *op. cit.* and Sass, S. (1978) *op. cit.*
72. Roy, W. (1997) *op. cit.*
73. Granovetter, M. (1985); Granovetter, M., McGuire, P. and Schwartz, M. (1992) *The Social Construction of Industry: Human Agency in the Developments, Diffusion and Institutionalization of the Electric Utility Industry*. Book Prospectus, Cambridge University Press; and Granovetter, M., McGuire, P. and Schwartz, M. (1993) *op. cit.*
74. Misa, T. (1994) and (1995) *op. cit.*
75. Misa, T. (1995) *op. cit.* p.270.
76. *ibid.*
77. St. Clair, D. (1986) *op. cit.*
78. *ibid.* pp.4-10.
79. *ibid.* p.15.
80. St. Clair credits a predecessor, Bradform Snell, who made a similar argument. Snell testified in the Senate that General Motors and others had deliberately set out to vitiate public transportation systems. By diversifying into transit systems, they were able to substitute motor buses for streetcars. According to Snell, GM had two goals: 1- to build a market for it buses and 2- to lessen competition for its cars. In this view, the replacement of buses for streetcars was not guided by economic goals of greater efficiency and lower costs, but from a desire to construct and strengthen their market position (*ibid.* pp.16-17).
81. This recognition of the important role of entrepreneurship further distinguishes Column Two from Column One studies.
82. Misa, T. (1994) and (1995) *op. cit.*
83. Misa, T. (1995) *op. cit.* p.xx.
84. *ibid.* p.xix.
85. *ibid.* p.42.
86. Strasser, S. (1989) *Satisfaction Guaranteed: The Making of the American Mass Market*. New York: Pantheon., in her overview of the rise of the American consumer mass market, argues that in many areas producers clearly held the power in their dealings with consumers. This point is examined in more detail at the end of the section.
87. Misa, T. (1995) *op. cit.* p.5.
88. *ibid.* p.13.
89. *ibid.* p.21.
90. *ibid.* p.170.
91. *ibid.* p.171.
92. Berk, G. (1993) *op. cit.*
93. A body of thought arising from and heavily influenced by Chandler's work.
94. *ibid.* p.5.
95. *ibid.* p.170.
96. *ibid.* p.4.
97. See for instance Scranton, P. (1994) 'Manufacturing Diversity: Production Systems, Markets, and an American Consumer Society, 1870-1930', *Technology and Culture*. 35, pp.476-505 and (1998) *Endless Novelty: Specialty Production and American Industrialization, 1865-1920*. Princeton: Princeton University Press; and Sabel, C. and Zeitlin, J. (1985) 'Historical Alternatives To Mass Production: Politics, Markets and Technology In Nineteenth-Century Industrialization', *Past and Present*. 108, pp.133-76.
98. Berk, G. (1993) *op. cit.* p.7.
99. *ibid.* pp.6-7.
100. *ibid.* p.8.

101. *ibid.* p.15.  
 102. *ibid.* p.16.  
 103. Granovetter, M. (1985), (1992) and (1993) *op. cit.*  
 104. Granovetter, M. et al (1992) *op. cit.* p.2.  
 105. *ibid.* p.3.  
 106. *ibid.* p.2.  
 107. There were other possibilities as well, including, most notably, natural gas systems.  
 108. Roy, W. (1997) *op. cit.*  
 109. *ibid.*  
 110. Chandler, A. (1977) *op. cit.* p.8.  
 111. Roy, W. (1997) *op. cit.* p.28.  
 112. *ibid.* p.10.  
 113. *ibid.* p.16.  
 114. Roy, W. (1997) *op. cit.*  
 115. Chandler, A. (1977) *op. cit.* p.390.  
 116. Roy, W. (1997) *op. cit.* p.227.  
 117. *ibid.*  
 118. *ibid.* p.128.  
 119. Strasser, S. (1989) *op. cit.*  
 120. *ibid.* p.26.  
 121. *ibid.* p.27.  
 122. Schumpeter, J. (1947) *Capitalism, Socialism and Democracy*. New York: Harper & Row. p.132.  
 123. Williamson, O. (1985) *op. cit.* pp.111, 118-9.  
 124. McGahan, A. (1991) 'The Emergence of the National Brewing Oligopoly: Competition in the American Market, 1933-58', *Business History Review*. 65.  
 125. Hawkins, K. (1978) *A History of Bass Charrington*. Oxford: Oxford University Press; Wilson, R. (1983) *Greene King: A Business and Family History*. London: Bodley Head & Jonathan Cape; and Gourvish, T.R. (1987) *Norfolk Beers from English Barley: A History of Steward & Patteson, 1793-1963*. Norwich: University of East Anglia Centre of East Anglian Studies.  
 126. Mathias, P. (1959) *The Brewing Industry In England: 1700-1830*. Cambridge: Cambridge University Press; Vaizey, J. (1960) *The Brewing Industry 1886-1951*. London: Sir Issac Pitman & Sons; Hawkins, K. and Pass, C.L. (1979) *The Brewing Industry: A Study in Industrial Organization and Public Policy*. London: Heinemann; and Gourvish, T.R. and Wilson, R.G. (1994) *The British Brewing Industry: 1830-1980*. Cambridge: Cambridge University Press.  
 127. U.S. Department of Commerce, Bureau of the Census. (1913) *Thirteenth Census of the United States Taken in the Year 1910, Manufactures*. Vol VIII-X. Washington DC: GPO.  
 128. Baron, S. (1962) *Brewed In America: A History of Beer and Ale in the United States*. Boston: Little, Brown, and Co.  
 129. Downard, W. (1973) *The Cincinnati Brewing Industry:*

- A Social and Economic History*. Athens: Ohio University Press; Apps, J. (1992) *Breweries of Wisconsin*. Madison, WI: University of Wisconsin Press; and Meier, G. and Meier, G. (1991) *Brewed in the Pacific Northwest: A History of Beer Making in Oregon and Washington*. Seattle: Fjord Press.  
 130. Cochran, T. (1948) *Pabst Brewing Company: The History of an American Business*. New York: New York University Press.  
 131. Apps, J. (1992) *op. cit.*  
 132. Meier, G. and Meier, G. (1991) *op. cit.*  
 133. e.g. Chandler, A. (1977) *op. cit.*; Williamson, O. (1985) *op. cit.*  
 134. McGahan, A. (1991) *op. cit.*  
 135. Horowitz, I and Horowitz, A. (1965) *op. cit.*; Greer, D. (1971) *op. cit.*; Elzinga, K. (1990) *op. cit.*; and Tremblay, V. (1985) 'A Reappraisal of Interpreting Rising Concentration: The Case of Beer', *Journal of Business*. 58, pp.419-31.  
 136. McGahan, A. (1991) *op. cit.* p.239.  
 137. Elzinga, (1990) *op. cit.*  
 138. Sass, S. (1978) *op. cit.*  
 139. See Granovetter, M., McGuire, P. and Schwartz, M. (1992) *op. cit.* for a cogent alternative to the dominant views which either over-or under-estimate human agency.  
 140. Plavchan, R. (1969) *A History of Anheuser-Busch, 1852-1933*. Ph.D. St. Louis University.  
 141. Anheuser-Busch commissioned a book on its centennial in 1952, which it published in 1953: *Making Friends is Our Business*, by Krebs and Orthwein. While not a critical or scholarly account, it does provide some useful information.  
 142. Misa, T. (1995) *op. cit.*  
 143. *ibid.* p.270.

## Chapter 2

1. Much of this overview was taken from Protz, R. (1995a) *The Ultimate Encyclopedia of Beer*. London: Carleton. pp.8-23 and Eckhardt, F. (1995) *The Essentials of Beer Style*. Portland, OR: Fred Eckhardt Communications. pp.16-35.
2. Vogel, E., Schwaiger, F., Leonhardt, H. and Merten, J.A. (1946) *The Practical Brewer: A Manual for the Brewing Industry*. St. Louis, MO: Von Hoffman Press. pp.12-13.
3. Haiber, R. and Haiber, W.P. (1993) *A Short but Foamy History of Beer*. LaGrangeville, NY: Devel Press. p.2.
4. *ibid.* p.2.
5. Protz, R. (1995a) *op. cit.* p.9.
6. Burger, W. and LaBerge, D. (1985) 'Malting and Brewing Quality', in D. Rasmuson (ed.) *Barley*. Madison, WI: American Society of Agronomy.

7. Protz, R. (1995a) op. cit. pp.12-13.

8. Eckhardt, F. (1995) op. cit. pp.31-32.

9. Protz, R. (1995a) op. cit. p.13.

10. Eckhardt, F. (1995) op. cit. pp.45, 67, 116.

11. Protz, R. (1995a) op. cit. pp.14-15.

12. Vogel, E., et al. (1946) op. cit. p.6.

13. Eckhardt, F. (1995) op. cit. p.21. The name for lager yeast was originally *Saccharomyces Carlsbergensis*, in honor of Carlsberg, the brewery in Denmark, where the microbiologist Emile Hansen first isolated it in 1846. The name was later changed to *Saccharomyces Uvarum* (Haiber, R. and Haiber, W.P. (1993) op. cit. p.8).

14. *ibid.* p.9.

15. Vogel, E., et al. (1946) op. cit.

16. Eckhardt, F. (1995) op. cit. p.22.

17. Many brewers and consumers adamantly believe that real cask beer is greatly superior to pasteurized, packaged beer. In England, there is a consumer-led movement called CAMRA (the Campaign for Real Ale) to encourage the production real cask ale (Protz, R. (1995b) *The Ale Trail*. Kent, UK: Eric Dobby Publishing). Recently, some American microbreweries and brewpubs have also begun to offer real ale, but on an extremely limited basis.

18. We will return to an implication of pasteurization that has often been overlooked: if pasteurized beer does not require refrigeration, when and why were refrigerated railroad cars, and later refrigerated trucks, important?

19. The techniques and consequences of pasteurization are discussed in more detail in Section 3.4.A.

20. The term lager comes from the German word *lagerung* meaning to store (Protz, R. (1995a) op. cit. p.64).

21. *ibid.* pp.46-8.

22. *ibid.* p.134.

23. *ibid.* p.11; Eckhardt states that American brewers today use the Standard Research Method (SRM) which is roughly equivalent to the Degrees Lovibond method (Eckhardt, F. (1995) op. cit. p.18).

24. Eckhardt, F. (1995) op. cit. pp.45-54.

25. Alcohol weighs less than water by a factor of 0.796: 'alcohol is only 79.6% of the weight of water. Therefore the weight figure is equal to 79.6% of the volume figure' (*ibid.* pp.29-30).

26. Protz, R. (1995a) op. cit. p.18.

27. Eckhardt, F. (1995) op. cit. p.30; Protz, R. (1995a) op. cit. p.18.

28. Hughes, J. and Cain, L. (1994) *American Economic History*. 4th ed., New York: Harper Collins. cite 1860 and 1910 *Census of Manufactures* data in documenting the changing order of importance of America's industries. Using

the criteria of 'value added to materials by manufacturing processes', they show that by 1910 brewing trailed only machinery, lumber, printing & publishing, and iron & steel in value added. According to a footnote in the 1910 *Census*, value added is 'Obtained by deducting from net value of products the cost of raw materials and adding cost of mill supplies'. The 1910 *census* also shows that breweries ranked eighteenth in number (1,531), sixth in capital, twenty-seventh in average number of wage-earners, seventeenth in annual amount of wages, seventh in the net amount of the value of products and eleventh in the gross amount of value of products.

29. McGahan, A. (1991) op. cit.

30. Elzinga, K. (1990) op. cit.

31. United States Brewers Foundation (1956) *Brewers Almanac*. p.10.

32. Plavchan, R. (1969) op. cit. pp.45-6.

33. Cochran, T. (1948) op. cit. p.71.

34. *ibid.*

35. Plavchan, R. (1969) op. cit. p.44.

36. *ibid.* p.43.

37. Baron, S. (1962) op. cit. pp.135-190.

38. Arnold, J. and Penman, F. (1933) *The History of the Brewing Industry and Brewing Science in America*. Chicago: privately printed. p.57.

39. Baron, S. (1962) op. cit. p.228.

40. *ibid.* p.257.

41. McGahan, A. (1991) op. cit. p.239.

42. Plavchan, R. (1969) op. cit. p.46.

43. Baron, S. (1962) op. cit. pp.228-229.

44. Cochran, T. (1948) op. cit. p.79.

45. *ibid.* p.18.

46. Baron, S. (1962) op. cit. p.234.

47. Plavchan, R. (1969) op. cit. pp.56-58.

48. Arnold, J. and Penman, F. (1933) op. cit. p.92.

49. Plavchan, R. (1969) op. cit. p.55.

50. Elzinga, K. (1990) op. cit. p.223.

51. Downard, W. (1980) *Dictionary of the History of the American Brewing and Distilling Industries*. Westport, CT: Greenward Press. p.158.

52. Krebs, R. and Orthwein, P. (1953) *Making Friends is Our Business: 100 Years of Anheuser-Busch*. St. Louis, MO: self published book, Anheuser-Busch. p.242; Plavchan, R. (1969) op. cit. pp.56-58; Downard, W. (1980) op. cit. p.158.

53. McGahan, A. (1991) op. cit. p.242.

54. Cochran, T. (1948) op. cit. p.78.

55. Plavchan, R. (1969) op. cit. p.58.

56. Chandler, A. (1977) op. cit. p.301.

57. Plavchan, R. (1969) op. cit. p.62.

58. Cochran, T. (1948) op. cit. p.123.  
 59. *ibid.* p.124.  
 60. Baron, S. (1962) op. cit. pp.242-246; Plavchan, R. (1969) op. cit. pp.71-77.  
 61. McGahan, A. (1991) op. cit. p.247.  
 62. Baron, S. (1962) op. cit. pp.241-242.  
 63. Cochran, T. (1948) op. cit. p.127.  
 64. McGahan, A. (1991) op. cit. p.247.  
 65. Plavchan, R. (1969) op. cit. p.66.  
 66. Cochran, T. (1948) op. cit. p.102.  
 67. Plavchan, R. (1969) op. cit. p.67.  
 68. Keg beer can be pasteurized, but during these years breweries were most concerned about the stability and freshness of bottled beer. Keg beer, sold primarily in saloons, was not believed to pose the same types of problems that bottled beer would.  
 69. Arnold, J. and Penman, F. (1933) op. cit. p.99.  
 70. Downard, W. (1980) op. cit. p.141.  
 71. Plavchan, R. (1969) op. cit. p.69.  
 72. Downard, W. (1973) op. cit. p.36.  
 73. Chandler, A. (1977) op. cit. p.256.  
 74. Cochran, T. (1948) op. cit. p.123.  
 75. McGahan, A. (1991) op. cit. p.239.  
 76. Chandler, A. (1977) op. cit. p.301.  
 77. Elzinga, K. (1990) op. cit. p.224.  
 78. Chandler, A. (1977) op. cit. p.257.  
 79. *ibid.* p.301.  
 80. Cochran, T. (1948) op. cit. p.129.  
 81. Plavchan, R. (1969) op. cit. p.107.  
 82. Cochran, T. (1948) op. cit. p.72.  
 83. *ibid.* p.129.  
 84. McGahan, A. (1991) op. cit. p.241.  
 85. *ibid.* p.244.  
 86. Downard, W. (1980) op. cit. p.69.  
 87. Elzinga, K. (1990) op. cit. p.224.  
 88. Baron, S. (1962) op. cit. p.312.  
 89. Apps, J. (1992) op. cit. pp.67-68.  
 90. Downard, W. (1973) op. cit. p.130.  
 91. Baron, S. (1962) op. cit. p.315.  
 92. *ibid.* pp.313-314.  
 93. *ibid.* p.314.  
 94. *ibid.* pp.314-315.  
 95. Downard, W. (1973) op. cit. pp.134-135.  
 96. Apps, J. (1992) op. cit. pp.72-73.  
 97. It is revealing that McGahan, despite examining pre- and post-Prohibition trends in the brewing industry does not even comment on the reasons for the introduction or repeal of Prohibition.  
 98. McGahan, A. (1991) op. cit. p.251.  
 99. *ibid.* pp.251-255.  
 100. *ibid.* p.254.  
 101. Cochran, T. (1948) op. cit. p.370.  
 102. McGahan, A. (1991) op. cit. p.239.  
 103. Elzinga, K. (1990) op. cit. p.235.  
 104. McGahan, A. (1991) op. cit. p.248.  
 105. Cochran, T. (1948) op. cit. p.386.  
 106. *ibid.* p.378.  
 107. McGahan, A. (1991) op. cit. p.248.  
 108. *ibid.* p.246.  
 109. Cochran, T. (1948) op. cit. p.368.  
 110. McGahan, A. (1991) op. cit. p.250.  
 111. *ibid.*  
 112. *ibid.*  
 113. Horowitz, I and Horowitz, A. (1965) op. cit. p.151.  
 114. *ibid.*  
 115. Some authors on the brewing industry have no theoretical pretense, and are not easily grouped into either Column One or Column Two. This is true for Apps, J. (1992) op. cit. and Downard, W. (1973) op. cit.