

**Concentration in the Belgian brewing Industry and the Breakthrough of Lager in
the interwar Years**

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1. INTRODUCTION

Among economists the work of John Sutton¹ on industrial organisation has greatly altered the way they look at concentration and market structure. In his works he stresses the importance of *exogenous* and *endogenous sunk costs*² to explain the evolution of market structure in various industrial sectors. His theory has its foundations in the context of game theoretic literature which models increasingly dominated the field of industrial organisation. Among economic historians though this theory has not yet gotten its deserved attention. Apart from a notable exception³, most economic historians have stuck with older models such as Bain's *structure-conduct-performance* paradigm⁴ in their attempts to explain industrial concentration in the course of history. Sutton's model can be somewhat complicated if one is not accustomed to this economic literature and involves quite some explaining of economic methodology. Nevertheless better understanding of business history can probably be achieved by applying or testing Sutton's endogenous cost model on economic history. Aside from some robust implications of the model, the eventual outcome depends delicately on historical and institutional factors giving way to historical analysis. Since the evolution of technology has an important place in the theory, research on the history of technology can be very useful for the model.

Some subsets of industries, referred to as high-alpha industries, are especially qualified to be studied using Sutton's theory. These are industries were incurring high endogenous sunk costs, mostly through advertising or R&D spending, is possible. Most sectors of the food industry, being an advertising intensive industry where perceived quality matters a lot, qualify par excellence to apply Sutton's concept.

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¹ See: SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991 and SUTTON, J., *Technology and Market Structure*, Cambridge, 1998.

² Cf infra, p. 3.

³ BAKKER, G., 'The decline and fall of the European film industry: sunk costs, market size, and market structure, 1890-1927' *Economic History Review*, 58-2 (2005), p. 310-351.

⁴ BAIN, J.S., *Barriers to new Competition*, Cambridge, 1956.

This goes as well for the beer sector. The brewing industry was one of the first industrial sectors in Belgium where advertising and branding played an important part. The food industry in general and the brewing industry in particular have experienced enormous phases of concentration during the twentieth century, in Belgium and most of the other developed countries.

In his standard work on sunk costs⁵, Sutton examines the food industry in the United States. He attributes, according to the theory, the observed concentration in the American brewing industry to a large extent on the escalation of endogenous sunk costs. To some degree developments in the Belgian brewing sector were similar to the American experience. But the industry operated under different conditions which affected the eventual outcome.

The history of food industry is largely overlooked terrain the Belgian historiography, despite being one of Belgium's largest industrial sectors. Maybe this was caused by the fact that the industry consisted mainly out of smaller enterprises in contrast to the large-scale iron and coal industry in Belgium⁶. Besides, there is a lack of available archives for most of these smaller companies⁷. Only a few articles address the food industry specifically⁸. Within the food industry though, the brewery sector, being one of its biggest segments, belongs among the more studied sectors. Because of its cultural impact and the status of beer as an important Belgian specialty some books or articles were publicised giving a broad overview of the beer industry and the Belgian beers, meant for a larger audience⁹. There are also some more focussed publications about the Belgian brewing industry¹⁰. The work of Jansen¹¹ (1987) gives

⁵ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991.

⁶ LEFEBVRE, W.; SEGERS, Y., 'Industrialisering op het platteland. De coöperatieve zuivelnijverheid in de Brusselse rand en haar periferie tijdens het interbellum', *Belgisch tijdschrift voor Nieuwste Geschiedenis*, 33-3 (2003), p. 485-486.

⁷ DEVOS, G., 'The first shall be the last': recent developments in Belgian Business History. A first Introduction' in: FELDENKIRCHEN, W.; GOURVISH, T. (eds.), *European yearbook of business history* 2, Ashgate, 1999, p. 20-21.

⁸ LANDUYT, G., 'De Voedingsnijverheid' in BAETENS, R., *Industriële revoluties in de provincie Antwerpen*, Antwerpen, 1984, p. 87-103.; SAS, B., 'Aandacht voor een verwaarloosde regionale nijverheid. De ontwikkeling van de voedings- en genotsmiddelenindustrie in de provincie Antwerpen in de 20^{ste} eeuw: geschiedenis en geregistreerde bedrijfsarchieven' *Bijdragen tot de geschiedenis*, 82, 1999, 95-122.

⁹ f.e.: PATROONS, W., *Alles over Belgisch bier.*, Antwerpen, 1984; VAN UYTVEN, R., 'Brouwers en drinkers' in: VAN ERMEN, E. (ed.), *Waar is de tijd? 2000 jaar Leuven en Oost-Brabant.*, Zwolle, 2000, p. 35-54.

¹⁰ BAETENS, R., 'Bierbrouwerijen en stokerijen' in: BAETENS, R. (ed.), *Industriële revoluties in de provincie Antwerpen*, Antwerpen, 1984, p. 105-119.; VLASSEN BROEK, W.; DE SMET, L., 'De lokalisering der brouwerijen en aanverwante bedrijven in België' in: *De Aardrijkskunde*, Brussel, 1969. and DE JONGH, G., 'Een nationale drank, een nationale industrie: de ontwikkeling van de biernijverheid' in: VAN DER HERTEN, B., ORIS, M., ROEGIERS, J., *Nijver België: het industriële landschap omstreeks 1850*, Antwerpen, 1995, p. 277-283.

¹¹ JANSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987.

a profound exposition on the brewing industry in Belgium and The Netherlands during the twentieth century and compares both in a broad perspective. Jansen also pays some attention to the issue of market structure and concentration. Brouwer¹² (1981) wrote an article concerning the observed concentration in the brewing sector throughout a number of countries, and included the Belgian case. There is also quite some international literature available on the brewing industry and its market structure in various countries¹³. The contributions handling concentration in the Belgian brewing industry are relatively scarce and focus mainly on economies of scale in production of beer although some also mention transport costs or possible effects of advertising.

To examine industrial dynamics and concentration of the Belgian brewing industry during the interwar years, we start with a theoretical section, explaining Sutton's theory on industrial concentration. We then look briefly at the developments in the Belgian beer market up until WWI. The brewing industry remained mostly artisanal and fragmented. The market was dominated by top-fermenting beers. To understand the structural revolution entailed by the breakthrough of bottom-fermentation beers, we then return to the origins of this new technology. The technological shift was characterised by the transition to an industrial brewing process. This produced a beer that was immediately well-liked by the consumer. The breakthrough in Belgium of those beers and the developments brought forth by it are studied in the next section. The main effect of the introduction of this new technology was a considerable rise in fixed costs. This could already have been a first impetus for concentration. Then we apply the ideas of Sutton on the Belgian beer industry and the concentration that took place in the industry during the interwar years. Finally we see how historical and institutional events complicated the theory and have an impact on the eventual outcome.

¹² BROUWER, M., 'The European Beer industry; Concentration and competition' in: DE JONG, H.W. (ed.), *The Structure of European Industry*, The Hague, 1981, p.39-57.

¹³ LINTSEN, H.W. (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving, 1800-1890.*, Zutphen, 1993.; GREER, D., 'Product Differentiation and Concentration in the Brewing Industry', *The Journal of Industrial Economics*, 19-3 (1971), p. 201-219.; HOELEN, H., *De economische problematiek van de biermarkt, in het bijzonder in Nederland*, Amsterdam, 1961.; STACK, M., 'Local and regional brewers in America's brewing industry, 1865-1920' *Business History review*, 74-3 (2000), p. 435-463; HOROWITZ, I.; HOROWITZ, A.R.; 'Firms in a Declining Market: The Brewing Case' *The Journal of Industrial Economics*, 13-2 (1965), p.129-153.; DONNACHIE, I., *A history of the brewing industry in Scotland*, Edingburgh, 1979.

2. SUTTON'S THEORY ON MARKET STRUCTURE

Sutton's theory is an attempt to explain industrial concentration. Industrial concentration was a feature that puzzled economists because of the empirical observation of *coexistence of high concentration and high profitability*¹⁴. This was apparently contradicting some of the basic economic laws. The arbitrage principle¹⁵ stated that opportunities must be filled. So if a market was dominated by only a few companies making high profits, there are incentives for entry by new companies challenging the incumbents. When markets kept growing, economies of scale could not provide a sufficient explanation for this observation, since there is more room for other large-scale competitors, and therefore concentration should diminish and tend to zero.

For a long time, economic literature of industrial concentration was dominated by the "*structure-conduct-performance*" paradigm of Bain, giving an explanation for this paradox. Typical of this model is the one way causal relationship between the different components. Structure determines conduct which in its turn accounts for performance. In this model it was the given structure of the market that influenced business behaviour which explained the differences in market performance.

Structure, as the leading determinant of the model, was given because of the existence of *exogenous barriers* to entry such as the technology or economies of scale. Thus in the model of Bain concentrated market structure can be sustained when barriers impede the entry of profit seeking entrants. This way this theory emphasizes the efficiency arguments for concentration, while Sutton will look at strategic arguments as cause of concentration¹⁶.

Sutton's main criticism, originated in the genesis of game-theoretic literature, on this paradigm was that some of these 'exogenous entry barriers' are actually '*endogenous*' costs. Companies make choices on the amount of R&D and advertising, thus deciding on the real or perceived quality of their products, without being bound by some externally imposed threshold. These costs are both *fixed* and *sunk* meaning that they won't fluctuate with the level of output and cannot be recovered to any significant degree.

So, in his theory, Sutton assumes *free entry*, which is not constrained by a certain height of exogenously given entry barriers. According to Sutton the question is what

¹⁴ SUTTON, J., *Technology and Market Structure*, Cambridge, 1998, p. 490.

¹⁵ Cf infra p. 3.

¹⁶ BRESNAHAN, T.F., 'Sutton's Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration', *The Rand Journal of Economics*, 23-1 (1992), 140.

configuration of market shares and spending on those endogenous costs is both viable and stable. The situation applying to these conditions forms a Nash equilibrium¹⁷ and can be maintained because once this stadium is reached, it allows no profitable deviation. To model the strategic interaction two easy-to-grasp conditions must hold.

Naturally firms will not adopt loss-making strategies. So this means that the companies' profits should cover their costs. This is a rational condition because firms will not be able to remain in business in the long run if they make losses. Since this basically implies that firms must be able to survive, this condition is referred to as the *viability condition*.

The other condition has been mentioned already as the arbitrage principle, stating that existing profitable opportunities will be filled¹⁸. This restriction only needs one smart agent to hold. Only one firm needs to discover the 'hole in the market' to fill the opportunity. Because of these opportunities, no stability in the market can be obtained if this condition does not hold. Therefore this condition is called the *stability condition*.

For Sutton's model both the stability and the viability conditions must be satisfied.

Consider a market in which firms are willing to engage in some kind of a quality race trying to improve some attributes of a product by adopting new technology or by advertising. For this market structure to be steady we need a configuration that is both viable and stable. Structure will then depend upon the extent to which a fragmented industry can be destabilised by a high-spending deviant¹⁹. How much market share can a firm take from its competitors by raising the quality of its products? This 'quality' is broadly defined. Generally it encompasses any feature that raises consumers' willingness-to-pay for the product in comparison to rival products²⁰. Sutton calls the parameter capturing this *alpha*, whose value depends on, amongst others, the pattern of technology and consumer preferences.

If the value of alpha is positive, this implies that a firm offering a higher-quality product can attain a profit exceeding his given share of industry revenue. Accordingly this alpha is called an *escalation parameter* because it determines whether

¹⁷ A Nash equilibrium is one of the basic concepts of game theory whereas a balance between strategies forms if none of the players has an incentive (no gains will be made) to change his strategy unilaterally. When this condition is met a stable situation, which is called an equilibrium, arises. This is a configuration that allows no profitable deviation.

¹⁸ BAKKER, G., 'The decline and fall of the European film industry: sunk costs, market size, and market structure, 1890-1927' *Economic History Review*, 58-2 (2005), p. 319.

¹⁹ SUTTON, J., *Technology and Market Structure*, Cambridge, 1998, p. 10.

²⁰ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 45

a company can raise its share by 'escalating' its effort in improving the quality of its products.

This alpha sets a *lower bound* on the level of concentration. This means that if it's possible to enhance consumers' willingness-to-pay for a product to some extent by a proportionate increase in fixed costs, then the industry will not become fragmented, however large the market becomes²¹.

The degree to which this 'competitive escalation' strategy yields results, is influenced by two other factors. The first is the effectiveness of the deployed strategies in raising the real or perceived quality of the products and thus the consumers' willingness-to-pay for the firm's products. The cost of advertising for example, is negatively correlated with the value of alpha. If the effectiveness of advertising increases, the value of alpha will rise.

The second is linked to the homogeneity of the market. A more homogeneous market will make it easier for a firm to capture market share from its rivals and spread the costs of the quality escalation among a bigger amount of products. Growing market integration and product substitutability will tend to raise the value of alpha.

Thus, the peculiarities of the market, but also broader economic developments will determine whether an industry qualifies as a high-alpha industry. If this is the case there will no longer be a monotonic relationship between market size and concentration, though there will always be some *minimal level* of concentration²². If concentration lies below some lower bound, the configuration will be broken by the actions of a deviant, leading the industry towards an equilibrium level of concentration. Therefore this theory is also called the *bounds approach*. The prediction of the theory will lie between certain bounds. The forecast of the eventual level of concentration will not be precise, but will be within a certain range. This way the model holds over a large set of industries²³. The observed equilibrium level of concentration will depend delicately on the historical details of the market²⁴. First-mover-advantages or the initial level of setup costs, for example, will have a serious impact on the eventual outcome. Important for the brewing industry will be that according to Sutton sometimes a rise in exogenous sunk costs, such as setup costs will be necessary for the process to take off. This rise alone leads to some

²¹ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 47.

²² SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 308.

²³ VAN CAYSEELE, P.J.G., 'Market structure and innovation: A survey of the last twenty years' *De Economist*, 146 (1998), p. 408.

²⁴ BAKKER, G., 'The decline and fall of the European film industry: sunk costs, market size, and market structure, 1890-1927' *Economic History Review*, 58-2 (2005), p. 319.

concentration. It is possible that only a discrete jump to a higher level of advertising yields results. Only when firms are big enough and when concentration is high enough firms will be able to make this jump.

Sometimes this escalation process can be muted or stopped due to institutional factors or different reactions to historical events, leading to an other than expected outcome. The model does not mention anything about the dynamics of the process leading towards an equilibrium structure, only the end result can be specified. Whether the concentration process evolves through merger, internal growth or the disappearance of non-performing firms can only be detected through historical research and depends mostly upon historical factors.

This theory provides a valuable starting point for economic history research. In his work Sutton pays a lot of attention to the industry history giving important supplementary evidence for the theory²⁵. After all, it remains difficult for economists to test equilibrium theories, because of their specific nature. The mechanism maintaining the equilibrium is the same that would come into play if the industry structure diverged from the equilibrium configuration. Here economic history comes to their aid. The mechanism can only be observed when coincidentally the historical industry structure is not, or not anymore, an equilibrium. This is more likely to happen in the early days of an industry when the situation had not yet stabilized, or when an external shock due to technology or demand hits the system²⁶. Notwithstanding this, Sutton's approach doesn't seem to have gotten the attention it deserved by economic historians. Little research has been conducted by historians making use of Sutton's 'endogenous sunk costs model'. One notable exception stands out. G. Bakker (2005) wrote a paper providing a convincing explanation for the observed concentration in the film industry using Sutton's model²⁷.

The brewing industry was usually reckoned among the advertising intensive industries where consumers were very responsive to branding. Furthermore, the brewing sector has experienced a strong concentration, evolving rapidly from what was mainly an artisanal craft to an industrial sector. In the Belgian case especially the interwar years appear to be a very important period for these developments.

²⁵ SUTTON, J., *Technology and Market Structure*, Cambridge, 1998, p. 17.

²⁶ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 309.

²⁷ BAKKER, G., 'The decline and fall of the European film industry: sunk costs, market size, and market structure, 1890-1927' *Economic History Review*, 58-2 (2005), p. 310-351.

3. DEVELOPMENTS IN THE BELGIAN BEER MARKET UNTIL WWI

Consumption per capita of beer was traditionally very high in Belgium, both in absolute and in relative terms. This was due to, amongst others, comparatively low excise taxes and a lack of alternatives. Beer was seen by the Belgian authorities as a necessity instead of a luxury²⁸. On some of the beers of lower density that were frequently drunk during meals, even no excise tax was levied at all²⁹. In contrast to most other western countries beer was not only well-liked among the lower classes but was also drunk by the upper-class³⁰. Imported beverages such as tea were not as popular in Belgium as in countries with a long colonial tradition. There was virtually no wine production and import made this product expensive. There was some consumption of liquor, but certainly not as important as in some of the more northern countries³¹. A law from the beginning of the twentieth century prohibited the sale of liquor in pubs³².

Consumption of beer rose during the last decades of the nineteenth century and reached a peak around the beginning of the twentieth century. During the record year 1913, the average Belgian citizen drank 223 litres of beer³³. Subsequently consumption declined gradually but remained still high in absolute terms. Moreover, population growth compensated part of the consumption decline during the interwar years.

²⁸ CORBIAU, J.; VAN CAUWENBERGHE, P., 'Développement de la brasserie belge depuis son début jusqu'à nos jours' in: *Centenaire de l'Association des Ingénieurs sortis de l'Ecole de Liège. Congres. Section Alimentation*, p. 14.

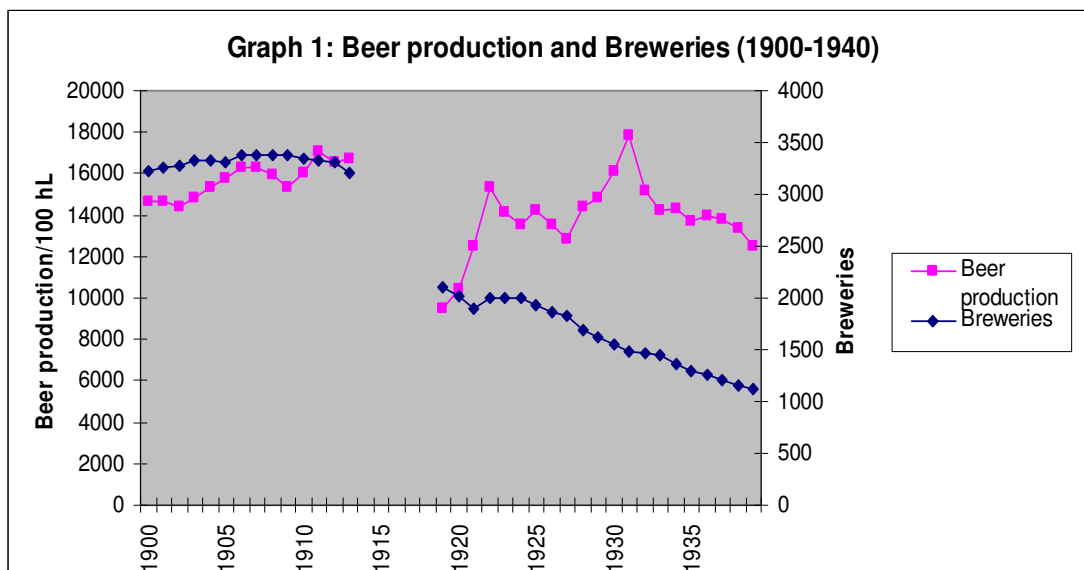
²⁹ HOELEN, H., *De economische problematiek van de biermarkt, in het bijzonder in Nederland*, Amsterdam, 1961, p.36.

³⁰ PEUMANS, H., 'de Evolutie der Belgische Brouwindustrie', *Economische Tijdingen van de Kredietbank*, 3 (1938), p. 97.

³¹ For the composition of expenditures on beverages in Belgium: SEGERS, Y., *Economische groei en levensstandaard*, Leuven, 2003, p. 240.

³² Law 'Van de Velde' JANSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987, p. 63.

³³ CBB.



(Graph 1: Source: CBB³⁴)

Before World War I the brewing industry in Belgium followed more or less the traditional path, where market growth went hand in hand with a rising number of breweries in production and a falling market concentration. Concentration was, in other words, very responsive to market size. In 1907, at the peak of this increase, 3387 breweries were active in Belgium, together accounting for a production of 16 283 000 hL. This trend had started around 1870 following a prior concentration phase between 1840 and 1870 involving the introduction of steam power in the breweries³⁵.

This traditional pattern of falling concentration in a growing market showed that setup costs relative to market size must have been relatively low, making it easy to start a new plant, and also that the brewing industry was not yet a 'high-alpha industry'. After the widespread introduction of steam power the limits of the traditional technology for that time were approached for many breweries. Little progress could be made by making large investments, contributing to falling concentration. Transport costs were very high and since beer was a bulk product, these costs mattered a lot. The railway revolution had its consequences on beer transport to a small extent, but mostly horse and cart, were still relied upon for transportation. Brewers made tours throughout town on a regular basis, providing their customers with beer. This beer was, compared to present-day standards, mostly of a rather low quality and could not be kept for long, thus hampering further

³⁴ Confederation of Belgian breweries

³⁵ MOMMENS, T., *De Belgische voedingsnijverheid tijdens de negentiende eeuw. 1. De bier- en jeneverindustrie (1810-1913). 2. De margarineindustrie (1890-1913)*, unpublished paper CES, Leuven, 1993, p. 4. and BAETENS, R., 'Bierbrouwerijen en stokerijen' in: *Industriële revoluties in de provincie Antwerpen*, Antwerpen, 1984, p. 105.

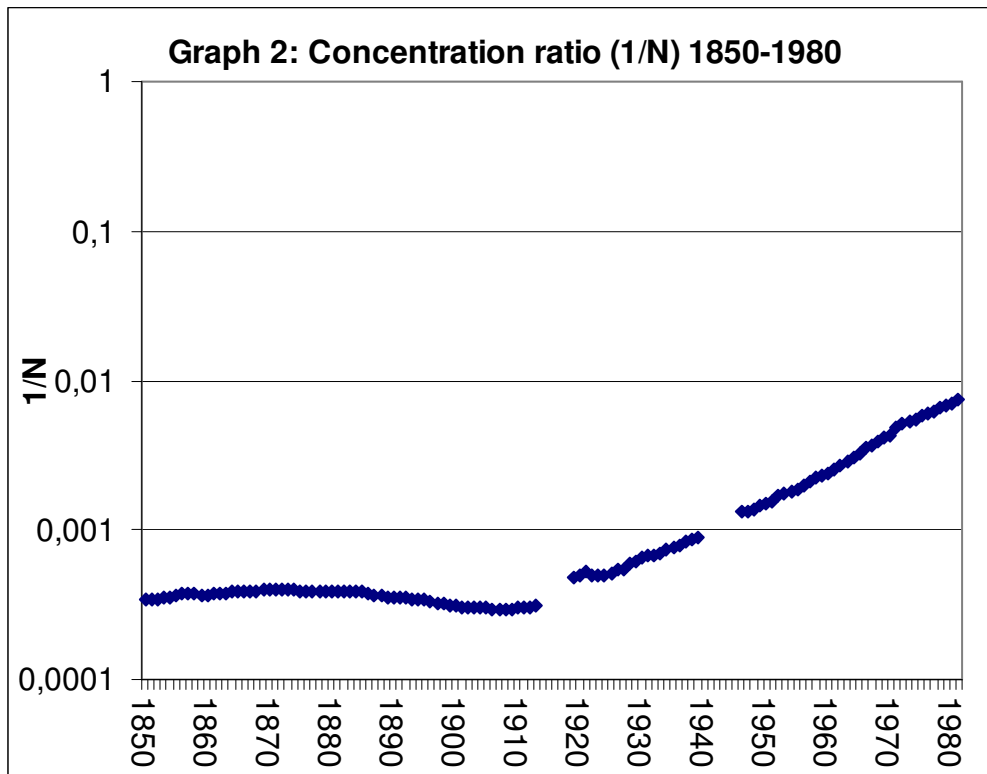
transport or trade over longer distances. Moreover, for most breweries there was the additional cost of returning the empty draughts or bottles³⁶. These high transport costs basically obstructed market integration. This market segregation was strengthened by the fact that because of the used technology each of those local brewers had their own kind of beer with a distinctly different taste.

World War I led to a split in this development. Of course war activities disrupted the proper functioning of the breweries, especially in the western part of the country, close to the frontline. Consumption during wartime was affected as well. Breweries lacked workforce because of the war and there were shortages of raw materials³⁷. Furthermore, the German occupiers demanded on a regular basis for the copper brewing kettles which made vital infrastructure disappear for the brewers and led to a lot of closures in the sector.

The effect of the WW I on the active breweries can be spotted immediately. The number of breweries in production dropped with 34% from 3214 in 1913 to 2109 in 1919. Naturally beer consumption in these first post-war years was considerably lower and production in destroyed or idle breweries had to be restarted. But, when consumption quickly recovered to almost pre-war levels during the first years of the 1920s, this evolution was not followed by a similar increase in numbers of breweries. Instead their number gradually declined further. Apparently something fundamental had changed compared to the pre-war period.

³⁶ HOROWITZ, I.; HOROWITZ, A.R.; 'Firms in a Declining Market: The Brewing Case' *The Journal of Industrial Economics*, 13-2 (1965), p.133.

³⁷ PATROONS, W., *Alles over Belgisch bier.*, Antwerpen, 1984, p. 15.



(Source: CBB)

Graph 2 showing $1/N$ as concentration ratio plotted over time demonstrates clearly in combination with Graph 1 that the traditional path followed since 1870 of a growing market and falling concentration was turned over. The initial onset for this breach with the past can probably be found in the changing pattern of technology, which on its turn accounted for a different market structure igniting a new form of competition.

For the roots of these technological developments we should return to the nineteenth century for a capital evolution in the technological history of the brewing industry.

4. THE ORIGINS OF BOTTOM-FERMENTATION

Originating modern brewing in 1842 in the Czech town Plzen with the introduction of *bottom-fermented* beer types to the town brewery is not a far-fetched claim. Both names used to describe this new type of beer refer to this. This beer was often called *Pils*, because of its town of origin, or *Lager*, due to the German word for the bottom-fermentation process. The storage period that was necessary to give this type of beer a smooth flavour was called '*Lagern*'.

The new process differed greatly with respect to the older techniques, which made mostly use of the *top-fermentation* process. In Belgium there was also a third type, *spontaneous fermentation*, having some importance. These beers of spontaneous fermentation were only produced in the region around Brussels, due to specific conditions for the micro-organisms in that area. They only constituted a small percentage of the market in Belgium.

The main distinction between the top- and bottom-fermentation types arises from the use of a different kind of yeast, whereas by spontaneous fermentation no yeast is added, depending solely on micro-organisms in the air carrying wild yeasts.

Other differences in production techniques stem mostly from this distinction. Top-fermenting yeast was the traditional kind³⁸, used since ancient times for brewing and baking. The utilisation of Lager yeast³⁹ by brewers goes way back as well, until 1400, but was restricted to Bavaria in Germany. Fermentation in cold weather and storage in cool Alpine caves had led to a natural selection of a special type of yeast, particularly suited for these conditions.

Better understanding of the fermentation process due to scientific research in laboratories led the Czech brewers of the Plzen brewery to adopt the Bavarian-style Lager yeasts in the first half of the nineteenth century. The combination of this new type of fermentation, local materials and a new industrialised method produced a new type of beer, *Pilsen*, which became immediately extremely popular.

This different type of yeast made a new kind of technique possible and thus required a whole new set of equipment.

During the brewing process, the traditional Top-fermenting yeast was added in the fermentation vessels approximately at room temperature, between 15° and 25° C. In the beginning of the twentieth century most of the top-fermenting brewers made this process happen in oak draughts, which were later on used for transport⁴⁰. When fermentation was finished, the yeast settled as foam on the surface, where it was skimmed off by the brewer. Hence they are referred to as top-fermenting beers. Because of the rather high temperature, fermentation develops fast. Fermentation and the following maturation phase take only a couple of weeks. When this process was completed, the resulting beer was ready for consumption.

Bottom-fermenting yeast ferments at a much lower temperature, between 6° to 9° C, meaning that most of the time the process needed artificial chilling to be carried out

³⁸ *Saccharomyces Cerevisae*

³⁹ *Saccharomyces Uvarum*

⁴⁰ VERHELST, L., 'Fermentation haute et fermentation basse.', *Bulletin trimestriel de l'Association des anciens élèves de l'Ecole supérieure de brasserie de l'université de Louvain*, 24-2 (1924), p. 68.

properly. At first this was done with natural ice. This was very complicated, in particular in countries with mild winters, where ice had to be shipped to from mountain regions or Scandinavia. The breakthrough of mechanical coolers came around 1880 when Carl Linde made a device based on ammonia with cooling pipes for large spaces⁴¹.

Fermentation took place in large tubs and could take up to twenty days. When finished, the yeast collected at the bottom of the tub, giving way to the term bottom-fermentation. After this process the resulting liquid was not ready yet for consumption. It needed a storing period of at least thirty days or more. This storage had to be withdrawn from the variations of outdoor climate and required temperatures close to 0° C. Thus, costly additional refrigeration in the large storage rooms was necessary. This long storage period, which could take months⁴², was needed to give the beer a smoother flavour by dissolving the sulfur created during the fermentation process.

Various countries adopted this new technology on a different time and on a different scale. Naturally Bohemia was the first region to switch to this new kind of beer. Being a part of the Austro-Hungarian Empire in the nineteenth century, the rest of that country adopted the new process quickly. In Bavaria in Southern Germany this approach was more or less equal to the traditional brewing style, so little adjustments had to be made to produce the new type of beer. The eastern part of France and the Netherlands were among the early adopters as well⁴³. Belgium was relatively late in its transformation towards the new technological developments. It took until after 1880 for some of the large Belgian breweries to switch a considerable part of their production to bottom-fermentation. The biggest laggard in this transformation was probably the United Kingdom. The United Kingdom was traditionally dominated by its top-fermenting, mostly Ale and Bitter, breweries. It was not until the 1970s that the bottom-fermentation segment started to constitute a reasonable share of sales⁴⁴.

⁴¹ SCHIPPERS, H., 'Bier' in: LINTSEN, H.W. (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving, 1800-1890.*, Zutphen, 1993, p. 198-199.

⁴² JANSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987, p. 20.

⁴³ JANSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987, p. 33-34. and SIGSWORTH, E.M., 'Science and the Brewing Industry, 1850-1900', *The economic History review*, 17-3 (1965), p. 542.

⁴⁴ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 519.

5. THE BREAKTHROUGH OF BOTTOM-FERMENTATION IN BELGIUM

So, already before WW I some of the large Belgian breweries had made a switch to bottom-fermentation, be it only as a limited extension to their standard product range. The big Brussels-based brewery *Wielemans-Ceuppens* was probably the first to make the changeover in 1884. Other large brewers such as *La Vignette* and *Artois* in 1892 followed their lead and started producing bottom-fermenting beer as variants of the Pilsen type⁴⁵. The brewery *Haecht* was the first to go completely over to bottom-fermentation production in 1902, at the same time becoming the best equipped and most modern Belgian brewery. Still it took until the interwar years for the real breakthrough of lager type beers on the Belgian market. A shift in the preferences of the consumers took place in the interwar years. Maybe the German occupation, where Lager beer had been drunk for long time, could have had some influence on public taste. In any case, growing welfare and increased buying power in the course of the 1920s made people getting used to this new taste of lager beers, which were more expensive and, up until then, seen as a more elitist upper-class beer⁴⁶. Furthermore, the price difference between top- and bottom-fermenting beers tended to diminish due to technological developments in the process of the latter. The effects of the war had their importance as well. As said before, a lot of breweries were destroyed during WW I or had lost some of their equipment to the German occupiers. Many brewers received retribution payments as a compensation for their lost copper kettles or destroyed breweries. This suddenly enabled them to recuperate some of the costs that were previously thought of as sunk. Lots of those brewers decided to exit the industry and invest the money in other businesses. But those who remained in business could more easily invest in a whole new set of equipment, often choosing for the new bottom-fermenting technology. Because of this, the Belgian consumer became ever more accustomed to this new taste, again putting pressure on other breweries to make the switch as well.

After all, there were also quite some advantages attached for the consumer to the Lager type of beer.

The first plus of the Pilsen-type was the aforementioned longer shelf life of this beer. The imperfect production process of the top-fermenting beers created beers that were of a changeable quality. The higher fermentation temperature for example, made the beer easy susceptible to contamination with micro-organisms or wild yeasts during fermentation. The more complicated production process of bottom-fermenting beer

⁴⁵ VAN UYTVEN, R., 'Brouwers en drinkers' in: VAN ERMEN, E. (ed.), *Waar is de tijd? 2000 jaar Leuven en Oost-Brabant.*, Zwolle, 2000, p. 45.

⁴⁶ HET BROUWERSBLAD, 33 (1925), p. 314.

at lower temperatures and thorough filtering of the liquid during the lagering process made this type more resistant to decay and enabled brewers to transport this type over longer distances.

Secondly, due to the same differences in production process, top-fermenting beers had a large variance in taste. Each new brew could be different from the last one, and each brewery definitely had its own taste of beer, making this beer actually a very differentiated product. The best of these beers could have a very sophisticated taste and could easily be improved by adding different kinds of herbs. This could be an advantage for the top-fermenting type, if a steady quality could be guaranteed. Unfortunately this was not the case. Variance in taste was combined with high variability in quality of taste. Bottom-fermenting beer in contrast showed a stable, decent quality, delivering a homogenous product so that the customer knew what to expect⁴⁷. Or, as Albert Mertens, a professor from the brewing school of Louvain explained in 1927: *“Top-fermenting beer, when it is well ripe is by no means inferior to bottom-fermenting beer; all lovers of good beer agree on this; but still top-fermenting beers withdraw in favour to bottom-fermenting beers in almost the whole of the country. Why? Because bottom-fermenting beers are a more regular product and accordingly more sellable. When a customer asks a Lager, either in Namur, or in Bruges, either in March or September; he knows what he is going to get⁴⁸.”*

Finally, poor filtering during the production process of top-fermenting beers made this kind of brew quiet turbid and mat looking, filled with floating particles of the malt. Since as from the nineteenth century beer was drunk from transparent glasses, this was not an appetising view. The Pilsen-process on the other hand produced a clear and translucent liquid with a radiant yellow shine, accompanied by a lavish foam collar⁴⁹, which was much more appreciated by consumers⁵⁰. The importance of this trait of the bottom-fermenting type should not be underestimated and can be shown by looking at the first brand names breweries gave to their Pilsen type beer in the Interwar Years, seeing this characteristic as one of the most important appealing to the customer. The brewery *Alken* called its Pilsen-beer *Cristal* after the crystal-clear

⁴⁷ SCHIPPERS, H., ‘Bier’ in: LINTSEN, H.W. (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving, 1800-1890.*, Zutphen, 1993, p. 192.

⁴⁸ HET BROUWERSBLAD, 35 (1927), p.1043.

“la bière de fermentation haute, quand elle est bien à point n’est nullement inférieure à la basse; tous les amateurs de bonne bière s’accordent sur ce point; et cependant la haute recule de plus en plus devant la basse dans presque tous les pays. Pourquoi? Parce que la basse est un produit plus régulier et par conséquent plus commercable. Quand le client demande un bock, soit à Namur soit à Bruges; soit en mars soit en septembre; il sait ce qu’il recevra.”

⁴⁹ HET BROUWERSBLAD, 34 (1926), p. 892.

⁵⁰ SCHIPPERS, H., ‘Bier’ in: LINTSEN, H.W. (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving, 1800-1890.*, Zutphen, 1993, p 192.

colour of their brew, the breweries *Artois* and *Caulier* called their beer *Stella* and *Perle* 28 referring respectively to clear starlight and the shine of a pearl.

These attributes of the bottom-fermenting beer positioned this type of beer, despite its relatively high cost, at the high-end of the product range. Consumers who were able to afford it preferred the Pilsen-type to the older top-fermenting beer that was increasingly seen as a product for the low-class worker.

6. TOP-FERMENTATION VERSUS BOTTOM-FERMENTATION IN BELGIUM

But this transition period wasn't a straight sailing at all. The older top-fermenting breweries, which were still a large majority in Belgium throughout the Interwar Years, felt they could not compete with the bottom-fermenting breweries. So they reacted strongly on the rise of their new large-scale competitors, whose methods they saw as treason to their ancient tradition and craft. They reckoned that their beers, if brewed in a proper fashion, were still superior to the bottom-fermenting type. A kind of beer-war developed between top-fermentation-only breweries and brewers who also made bottom-fermenting beers.

This duality was also found in the professional organisation of the Belgian brewers, the *General Federation of Belgian Brewers*. Two groups were formed in the brewing sector. This formed a rift in the brewing circles which were previously characterised by a rather large solidarity among their members.

After WW I, the modern, mainly bottom-fermenting breweries were united in the *Consortium of Belgian Brewers*. This organisation was a solid block and even adopted price restrictions for some time at these first post-war years to lessen competition among the bottom-fermenting breweries. In 1925 this group consisted of 24 large breweries, making great profits⁵¹.

In reaction to the formation of this Consortium and to the threat that was posed to them by the rise of the bottom-fermenting beers, the smaller brewers organised themselves as well in the 1920s. Their movement, the *Consortium of Belgian brewers of top-fermentation* was carried mainly by some of the smaller Antwerp based top-fermenting brewers, but assembled from time to time large delegations of Belgian top-fermenting brewers throughout the whole country⁵². Their demands were mostly situated in the legal area, basically asking for governmental protection through the rewriting of old laws or the enactment of new ones. In their opinion they were prejudiced by the current system in comparison with the powerful lobby of the big

⁵¹ HET BROUWERSBLAD, 101 (1993), p.30.

⁵² HET BROUWERSBLAD, 35 (1927), p. 82-83.

bottom-fermenting brewers. They also helped each other by sharing ideas on technological and technical developments in the top-fermenting brewery.

Competition with the better liked Lager beers, forced them to try new techniques or to use new additives on their beers to improve the taste and general quality of their product.

An important case in that matter, where the Consortium of top-fermenting brewers played a major part, was the use of Saccharin in the brewing process. Saccharin was the first artificial sweetener, invented at the end of the nineteenth century, but it only came into fashion after sugar shortages in WW I.

Because of the breakthrough of Lager beer in the brewing industry, a clear en sweet drink was appreciated by the consumers after WW I where before dark and winy types were preferred. In winter top-fermenting brewers could diminish their drawback in these by adding sugar to the liquid to sweeten the beer. In summer this was rendered impossible by the heat causing refermentation in the beer. So Saccharin was used instead. But researchers in the brewing schools as well as scientists in general quickly deemed Saccharin unfit for consumption due to the possibility of endangering human health⁵³. A federation was even formed against the free use of Saccharin in food products. Strengthened by this, Belgian bottom-fermenting brewers started lobbying to prohibit the use of Saccharin. The Belgian government had ears for them and banned Saccharin from the brewing industry in 1923⁵⁴. This led to a lot of commotion among the smaller brewers and the Consortium of Belgian brewers of top-fermentation reacted fiercely to this law. According to them, Saccharin was harmless and the prohibition was only meant harm them. They saw this prohibition as a major cause of the crisis of the top-fermenting breweries stating that 700 small breweries had to close because this law⁵⁵. This was manifestly exaggerated, but it was true this law meant a drag on the already troubled top-fermenting breweries. Finally in 1928 a bill was designed to change the law and make an exception to breweries, which eventually passed. This could have eased the problems of the small top-fermenting breweries somewhat, but it is clear the crisis remained.

Another juridical battle that was fought by the top-fermenting brewers and their Consortium was about the imposition of a progressive tax law⁵⁶. With this law they wanted the government to protect their smaller breweries by levying a relatively

⁵³ MERTENS, A., 'Où en sommes nous? L'évolution économique et technique de la brasserie belge' *Bulletin trimestriel de l'Association des anciens élèves de l'Ecole supérieure de brasserie de l'université de Louvain*, 26-3 (1926), p.159.

⁵⁴ HET BROUWERSBLAD, 36 (1928), p. 334.

⁵⁵ HET BROUWERSBLAD, 36 (1928), p. 334

⁵⁶ HET BROUWERSBLAD, 35 (1927), p. 1170.

higher tariff on larger production units. This way the smaller top-fermenting breweries enjoyed a tax advantage against their larger counterparts. This law did not change the tide either for the smaller breweries but it would have its impact on the way the increase in scale in the brewing industry occurred.

The law or governmental protection could not save the small breweries; hence other, technological paths were followed as well to improve the quality and the stability of top-fermentation beer. They were mostly inspired by the technical developments in the bottom-fermentation sector. Some concerned the use of better primary materials or the employment of scientifically improved measuring instruments⁵⁷.

But no doubt the most significant evolution was the introduction of artificial chilling in the top-fermenting brewery, also copying bottom-fermentation techniques⁵⁸. This way, top-fermenting brewers could make beer of a more stable quality, especially in summer, which was very difficult before. There were a few companies that delivered cooling installations designed for the Belgian top-fermentation breweries, but the most important was the firm *Kendall*⁵⁹. This firm, based in Lille, in Northern France had an ingenious system to apply the cooling method to top-fermentation, which it tried to sell by means of big advertising campaigns in the professional magazines. In these campaigns they clearly articulated the threat that faced the top-fermenting brewers, and of course recommended their system as the solution. But besides their system that ameliorated the quality and stability of the top-fermentation beer, they also dispensed advice on how to run a brewing facility independently and efficiently in the modern society. They even offered their experience on advertising and commercial activities to help the smaller breweries to establish real brands to accompany their new special beer and to compete with the large bottom-fermenting breweries⁶⁰. In this way the firm portrayed itself as the big defender of the traditional top-fermenting breweries while at the same time putting its finger on the sore spot of those smaller brewers.

But despite its ingenious system and its extensive promotion campaigns, Kendall was not as successful as it had hoped. This was probably because of the large fixed costs that were brought about for the smaller breweries by the investment in their machines. These costs were too high for the small, top-fermenting breweries and were the main reason in the first place why they continued to use top-fermentation. Only the larger top-fermenting breweries could afford this expensive machinery. So

⁵⁷ MERTENS, A., 'Où en sommes nous? L'évolution économique et technique de la brasserie belge' *Bulletin trimestriel de l'Association des anciens élèves de l'Ecole supérieure de brasserie de l'université de Louvain*, 26-3 (1926), p.167-173.

⁵⁸ VERHELST, L., 'Fermentation haute et fermentation basse.', *Bulletin trimestriel de l'Association des anciens élèves de l'Ecole supérieure de brasserie de l'université de Louvain*, 24-2 (1924), p.68.

⁵⁹ HET BROUWERSBLAD, 34 (1926), p. 260, 312.

⁶⁰ HET BROUWERSBLAD, 35 (1927), p. 1720.

this development actually contributed to the broader evolution to large-scale breweries producing beers that were of a more stable quality but also more homogeneous and exchangeable.

Hence, the crisis for the smaller top-fermenting breweries remained throughout the Interwar Years, notwithstanding the fact that the sector as a whole performed soundly and weathered the crisis of the 1930s remarkably well⁶¹.

Therefore to contemporary authors the reasons for the concentration in the brewing sector and the decline of the smaller breweries were clear. The small breweries disappeared or diminished in importance while the large ones increased and expanded their activities because the industry evolved at a rapid pace towards industrial production in the shape of bottom-fermentation⁶². Quickly increasing concentration resulted this way.

7. SUTTON AND CONCENTRATION IN THE BELGIAN BREWING SECTOR IN THE INTERWAR YEARS

The traditional economic literature gives a rather similar explanation for the concentration in the brewing sector that took place in most developed countries at different times and pace in the course of the twentieth century⁶³. Most authors emphasize the importance of steadily rising fixed costs in the production process. To recover these costs they have to be split among a higher production. This means that average costs will fall for a long time, when production rises, leading to considerable economies of scale. This leads to an upward trending of the *minimum efficient scale* of production (M.E.S.). When this happens in a market where demand is stable or declining the natural outcome is increasing concentration. Due to the lower average costs, bigger companies could set lower prices than smaller companies. To compete those smaller firms have to invest in large-scale production. The recuperation of those larger investment costs has to come through the obtainment of a bigger market share. When smaller firms are unable to make these large investments or won't get a larger market share after the investment, they exit the industry, thus leaving their

⁶¹ VAN CRIEKINGE, H., 'Les industries alimentaires belges et le tabac en 1936' *Bulletin trimestriel de l'Association des anciens élèves de l'Ecole supérieure de brasserie de l'université de Louvain*, 37-2 (1937), p.97.

⁶² HET BROUWERSBLAD, 33 (1925), p. 314.

⁶³ HOROWITZ, I.; HOROWITZ, A.R.; 'Firms in a Declining Market: The Brewing Case' *The Journal of Industrial Economics*, 13-2 (1965), p.129-153.; BROUWER, M., 'The European Beer industry; Concentration and competition' in: DE JONG, H.W.(ed.), *The Structure of European Industry*, The Hague, 1981, p.39-57.

former share to one of the bigger companies. This leads in a competitive environment to more concentration.

If one translates this theory to the Belgian brewing sector in the Interwar Years many parallels can be drawn. Due to the switch to bottom-fermentation and the following adoption of a new technology, fixed costs rose a lot. The Lager process needed artificial cooling not only during fermentation, but also throughout a long storage period, which was very expensive. Because of this long storage period a lot of storeroom was necessary. Bottom-fermentation took longer, so to maintain the same yearly production volume larger tubs were needed. Top-fermenting breweries that tried to compete had to raise their fixed costs as well. They also needed new equipment such as cooling systems to improve the quality of their beers. All breweries had to invest in new systems and material for transportation. Moreover they required more power machinery and better laboratory techniques to control the brewing process. Due to growing home consumption in the Interwar Years many breweries were compelled to invest in bottleries. Beer for home consumption was mostly sold in bottles whereas for bars and pubs delivery depended on draughts.

According to the theory, this rise in fixed costs caused by the transition to industrial bottom-fermentation brewing would then have forced smaller breweries to exit and made larger breweries capture a bigger market share.

Some other additional sources for the concentration were cited as well. Advertising was seen as an exogenous cost with increasing returns to scale, contributing to increasing concentration⁶⁴. For the Belgian brewing sector in particular growing advertising costs and image-competition were seen as factors adding to growing concentration and at the same time giving the deathblow to most top-fermenting breweries⁶⁵.

These theories contain without any doubt a lot of truth. But they don't offer a complete explanation. The rise in fixed costs and the subsequent shift in the M.E.S. certainly led to important economies of scale in production. But this rise in setup costs cannot account for all of the increase in concentration. Transport costs remaining high in absolute terms and the progressive tax system putting large production plants at a disadvantage, impeded the economies of scale to take full effect. Because of this, when mergers or acquisitions took place in the brewing industry in the Interwar Years or the decennia after WWII often different production

⁶⁴ GREER, D., 'Product Differentiation and Concentration in the Brewing Industry', *The Journal of Industrial Economics*, 19-3 (1971), p. 206.; PELES, Y., 'Economies of scale in advertising beer and cigarettes', *The Journal of Business*, 44-1 (1971), p. 32.

⁶⁵ JANSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987, p.215-216.

plants were kept, implying that economies of scale in production were not always the deciding factor for this move.

There are indeed also increasing returns to scale to advertising in the beer market, but the effects of advertising can go beyond the simple increasing returns to scale if we involve strategic behaviour of firms into the analysis.

John Sutton was the first who really anchored the previous explanations about the causes of concentration in one structure and extended the analysis when necessary.

To substantiate his theory on sunk costs and market structure Sutton involved a study on the history of the American brewing industry in his work as an example of a case where endogenous and exogenous costs interacted⁶⁶.

Since the ending of the Prohibition the American brewing industry also knew several phases of concentration, essentially evolving to a very concentrated structure. When in 1933 Prohibition finally was suspended many of the breweries that operated before in a fragmented structure⁶⁷ never reopened. In the mean time, technological developments in the brewing industry had the effect of raising setup costs. This alone could make concentration trend modestly higher. But this exogenous shock was not fully independent of other endogenously established factors. These exogenous changes stimulated, by raising the level of setup costs, concomitant increases in the endogenously chosen advertising outlays of the breweries. This accentuated and strengthened the tendency towards higher concentration. They both play a part in the same unified mechanism⁶⁸ where an increase in setup costs leads to an increase in advertising intensity. The lower bound to equilibrium concentration, or the level where concentration will never sink beneath, varies with the amount of setup costs.

When setup costs became high they favoured large-scale production. As a result concentration increased. But at the same time, because of this tendency to large-scale production and of some societal changes, capturing rival's market shares through advertising became more profitable for the American breweries. The brewing sector essentially developed into a high-alpha industry. There were successive phases where firms engaged in costly forms of advertising escalation. Breweries tried to establish or strengthen their brands with the purpose of raising the perceived quality of their beers and thus increasing their market share at the expense of their rivals.

⁶⁶ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 285-304.

⁶⁷ STACK, M., 'Local and regional brewers in America's brewing industry, 1865-1920' *Business History review*, 74-3 (2000), p. 435-463.

⁶⁸ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 22-23.

So in the American experience the initial onset of concentration could be traced to an increase in setup costs boosting economies of scale but a central role in the change of market structure was played by this escalation in advertising.

Considering the fact that a rise in setup costs and the importance of advertising were already cited by authors as a cause of concentration in the Belgian brewing industry, it will be interesting to examine whether the picture Sutton painted of the American brewing industry also holds for the Belgian sector.

To qualify for this story, the Belgian brewing industry should have evolved to a high- alpha industry.

First of all in Belgium during the first decennia of the twentieth century there was also a shock of exogenous sunk costs in the fashion of a transition to bottom-fermentation, as has been extensively argued in the previous sections of the paper. The beginning of this effect can be spotted by the short rupture that WWI formed in the development of the Belgian brewing industry. Many breweries did not restart their businesses at the end of the war, as happened with lots of American breweries after the end of the Prohibition. In the United States these rising exogenous costs made the escalation of endogenous sunk costs possible.

As mentioned before, the value of alpha, or the extent to which a fragmented industry can be destabilised by a firm escalating its endogenous sunk costs, furthermore depends on two factors.

The first is the effectiveness by which the real or perceived quality of a product can be raised. In this case it boils down to the characteristics of advertising. When the efficiency of advertising increases or the cost of it decreases, this factor will have the effect of augmenting alpha. Beer was a typical product where producers were prone to invest in loyal customers by means of advertising because of the short shelf-life of the product. When sunk costs increased during the Interwar Years this became a characteristic of even higher importance.

In the food industry the big progression of advertising and branded articles during the Interwar Years can be attributed to new ways of communication between producers and consumers. Besides the regular retail outlets, such as pubs and stores for the beer market, other intermediaries were now more willing to incorporate advertising into their normal practice. These growing media became a powerful instrument for advertising campaigns. Ever more magazines and newspapers of all kinds started to accept advertising as a way to reduce the price for their customers⁶⁹.

⁶⁹ VAN OTTERLOO, A.H., 'Prelude op de consumptiemaatschappij in voor-en tegenspoed 1920-1960' in: LINTSEN, H.W. (ed.), *Geschiedenis van de techniek in Nederland. De wording van een moderne samenleving, 1800-1890.*, Zutphen, 1993, p. 269.

This improved the way to reach potential consumers exponentially. Where before customers had to be informed by travelling salesmen or by placards on pubs or in the streets, which only reached a small public, now large masses could be contacted at once through an advertisement in one of the important magazines or newspapers. However, this was a fixed cost, invariable of production volume, thus warranting large-scale production. This way the effectiveness of advertising increased enormously and accordingly the attractiveness of escalation strategies grew, augmenting alpha.

The second factor determining alpha is linked to the homogeneity of the market. A more homogenous market enables firms to easily capture market share of their rivals. It can be argued that the Belgian beer market became more homogenous in the Interwar Years. After large-scale introduction of lager-type beers after WWI their share of the market grew rapidly. There are no entirely reliable data about the relative market shares of top-fermenting and bottom-fermenting beers but contemporary estimates assess the share of lager beers at 15% of the market at the end of WWI which rose swiftly to 55% in 1928. Hereafter growth of its share slowed down and stabilized until the end of WWII⁷⁰. Eventually, after WWII a share of 70% for lager beer was reached. This share of lager beers during the Interwar Years consisted mostly of some quite uniform and exchangeable beers. The large proportion of those bottom-fermenting beers contrasted strongly with the highly segmented market before WWI, dominated by many diverse types of top-fermenting beer. Besides, because of the technological developments in reaction to the bottom-fermentation beer, most top-fermentation beers became more uniform and homogenous as well. In this manner the introduction of lager beers made an important contribution to the homogenisation of the Belgian beer market.

Another thing impacting the homogeneity of the market is the reduction of transport costs in the Interwar Years. The road network was extended and improved to enable the use of motorised vehicles. More roads in the rural areas were macadamised⁷¹. The widespread use of motorised vehicles revolutionised transport, notably in the brewing sector, where transport costs had always been an important issue. Transport by pick-up trucks or lorries instead of horse and cart became the rule, where before WWI this was reserved only for the very largest breweries⁷². Additionally, the longer shelf life of the lager beers and the modernised top-fermentation beers facilitated transport over longer distances. Because of this, the Belgian market developed from a

⁷⁰ CORBIAU, J.; VAN CAUWENBERGHE, P., 'Développement de la brasserie belge depuis son début jusqu'à nos jours' in: *Centenaire de l'Association des Ingénieurs sortis de l'Ecole de Liège. Congres. Section Alimentation*, p.8. and BROUWERSBLAD, 38 (1929), p 834.

⁷¹ GREGOIRE, J.M., *Autosnelwegen in België: ontstaan en verwezenlijking*, Brussel, 1985.

⁷² HET BROUWERSBLAD, 38 (1929), p. 834.

highly segmented market into a more unified national market where many breweries entered into each others spheres of influence.

All of this basically had the effect of making the Belgian beer market more homogenous during the Interwar Years. These factors also affected alpha, making escalation strategies more profitable.

The increase in effectiveness of advertising and the market becoming more homogenous through the lager beer and the decrease in transport costs augmented alpha, turning the Belgian brewing industry into a high-alpha industry.

The jump of exogenous sunk costs in the shape of the sudden rising M.E.S. due to the introduction of bottom-fermentation beer could provide the final incentive spurring the Belgian breweries to a competitive escalation of sunk costs. The American experience supplies an example as to where this escalation can lead to.

This evolution of the Belgian brewing industry to a high-alpha industry would imply a rupture with the traditional pattern, otherwise the stability condition would be violated. This means that one smart agent is needed to fill the profitable opportunities that the new developments had constituted. In this case, at least one of the Belgian brewers should in time see the new advantages a big advertising campaign could yield, thus triggering an escalation of endogenous sunk costs.

During the Interwar Years there was indeed among brewing circles a growing interest for the benefits that could be realised through the proper use of new advertising instruments. Professional magazines encouraged this interest, influenced by developments in the neighbouring countries, such as France or the Netherlands, where the importance of advertising was recognized before⁷³. Big events were seized upon by breweries to promote their beer and brand names were announced in large advertisements in the important newspapers. Another reason why professional organisations encouraged the use of advertising was because they asserted that societal changes favoured a trend towards home consumption instead of drinking beer in pubs or bars. Hence breweries had to make sure that consumers took their beer home. However this tendency should not be exaggerated. For example, Schroeven (1994) uses estimates about the share of home consumption of Belgian beer of 10% in the 1920s and 15% in the 1930s⁷⁴.

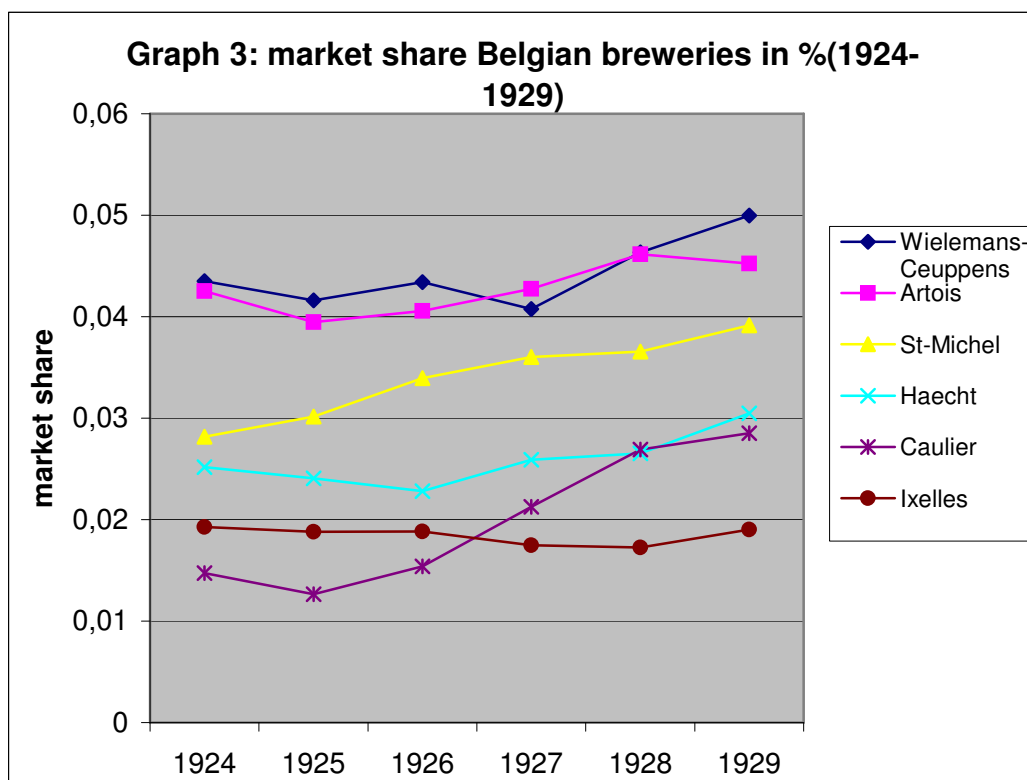
As the theory predicted, eventually one of the Belgian brewers exploited this new opportunity. The brewery *Caulier* was originally one of the second tier breweries but

⁷³ HET BROUWERSBLAD, 34 (1926), p. 652.

⁷⁴ SCHROEVEN, C., *Consumer expenditure in interwar Belgium 1920-1939: The reconstruction of a database.*, Leuven, 1994, p.93.

evolved in short time to one of the leading firms in the Belgian brewing industry. They were the first to fully incorporate modern advertising into their business strategy around the mid 1920s. Starting as a medium-size brewery, they adopted the modern style of advertising from the large foreign breweries and spent large amounts of money to promote their new Pilsen-beer, branded *Perle 28*. They mainly used modern witty cartoon-like advertisements in the big Belgian newspapers to support their new beer. This succeeded wonderfully, and *Perle 28* quickly became the most popular Belgian beer. This success prompted other large Belgian breweries to follow their example. The second largest Belgian brewer, *Artois*, responded hastily in 1926 by introducing its own important brand; *Stella*. *Stella* was originally meant as a Christmas special, but being a big hit, *Artois* decided to keep this beer as primary brand and backed it by considerable advertising expenses. A bit later, other Belgian brewers followed their suit as well, such as the brewery *Alken* with their brand *Cristal* in 1928 or the biggest Belgian brewer, *Wielemans-Ceuppens* with *Wiel's*. The idea of modern branding and advertising clearly broke through during the 1920s in the Belgian brewing industry. Towards the beginning of the 1930s these expenses for publicity became a real burden for the breweries. The industry expenses for advertising rose up to 30.000.000BEF, comparable to all the costs for packaging such as bottling or draughts and more than half of all the transport costs⁷⁵.

⁷⁵ PEUMANS, H., 'de Evolutie der Belgische Brouwindustrie', *Economische Tijdingen van de Kredietbank*, 3 (1938), p.92.



(Source: Het brouwersblad⁷⁶)

Table 1: Market shares Belgian breweries

	1925	1926	1927	1928	1929
Wielemans-Ceuppens	4,16%	4,34%	4,08%	4,64%	5,00%
Artois	3,95%	4,06%	4,27%	4,62%	4,53%
St-Michel	3,02%	3,40%	3,60%	3,66%	3,92%
Haecht	2,41%	2,28%	2,59%	2,66%	3,05%
Ixelles	1,88%	1,88%	1,75%	1,73%	1,90%
Chevalier Marin	1,46%	1,74%	1,92%	1,94%	2,03%
Caulier	1,27%	1,54%	2,13%	2,69%	2,85%
Chasse Royale	1,37%	1,52%	1,65%	1,95%	1,89%

(Source: Het brouwersblad)

Graphically some of the effects of the escalations can be noted. This graph shows the market shares of the major Belgian breweries. The Belgian market was the relevant market for the analysis, with the shares of import and export being very low throughout the whole of the interwar years. Export constituted at most 0.3% of total

⁷⁶ These data are constructed by means of reports of primary materials for the Excise Authority by the main Belgian breweries. These data were for some time publicised by *Het Brouwersblad*, but their publication was quickly halted due to complaints of smaller breweries, who saw those publications as a form of free advertisement for the large breweries.

production and import accounted for no more than 1.9% of total consumption during those years. These are the maximal numbers for the interwar years which makes it safe largely to neglect the influence of foreign countries on Belgian production and consumption of beer. The importance of the home market made that Belgian brewers did not show much interest for export⁷⁷. Besides, some of the potentially important foreign markets, such as Germany, adopted a very protectionist stance towards foreign beers.

In spite of the limited period for which those market shares could be reconstructed we can still notice that the market share of the brewery Caulier was quickly rising since the mid 1920s. Its market share nearly doubled in six years time, evolving from the tenth largest brewery to the fifth of the country. Most of the other important breweries had rising market shares as well. C4, a commonly used measurement of concentration in economics, which adds up the market shares of the four largest firms in the sector, grew with 20% from 0.139 to 0.164 in these same years. It should be noted that these market shares remained rather low in absolute terms because the Belgian beer market was in a process of evolving from an almost completely fragmented structure and transport costs were still an important issue. Still, in the interwar years the number of active breweries diminished at a rapid pace. The number declined with 47% between 1919 and 1939 (Graph 1).

The growing importance of the biggest breweries and the continuous decrease of the total number of active breweries provide a clear picture of the industrial concentration that took place in the Belgian brewing sector. Most of the concentration arose from internal growth of the larger and medium sized firms. Acquisitions and mergers were only a small influence on concentration. The institution of an important new law in 1927 which facilitated these mergers and acquisitions⁷⁸ could only have had a marginal impact on concentration in the brewing sector since at that time only 10 % of the closures in the brewery sector were attributed to these mergers and acquisitions⁷⁹. There were of course a few important mergers as exceptions to the rule. Already in 1919 a corporation, *N.V. Krüger*, was formed between 24 brewers in the region of Eeklo, pooling their capital in one new brewery, which enabled them to start producing bottom-fermenting beers⁸⁰. The same happened in Ghent, where 20

⁷⁷ SWARTELE, A., 'Boire et brasser' *Bulletin de l'Association des anciens étudiants en brasserie de l'Université de Louvain*, 54-3 (1958), p. 94.

⁷⁸ This law made mergers and acquisitions easier because it replaced most of the existing laws concerning these activities. The law furthermore exempted taxes on the surplus capital by liquidation of companies in case of mergers. BAUDHUIN, F., *Histoire économique de la Belgique 1914-1939: Grandeurs et misères d'un quart de siècle*, Brussel, 1944, p. 182.

⁷⁹ HET BROUWERSBLAD, 36 (1928), p. 334.

⁸⁰ PATROONS, *Alles over Belgisch bier.*, Antwerpen, 1984, p. 16.

brewers united themselves in one big brewery, *Belgica*. In 1928 this firm merged again, this time with the Bruges based brewery, *L'Aigle*, to become one of the leading Belgian breweries⁸¹.

But, most of the time smaller breweries that were not competitive anymore retreated from business in one way or another. Sutton predicts that often when firms are not able to compete in the escalation of sunk costs, they retreat to some kind of low advertising niche market, mostly at the bottom-end of the market, such as low cost production for retail-outlets. Something comparable happened in the Belgian brewing sector. Many of the small top-fermenting breweries that didn't have enough resources to launch their own lager brand sought different ways to keep their customers. The big breweries capitalised on this trend by what the firm Kendall called a 'Sirene's call' in their advertisements⁸². They offered their big lager brands to the smaller breweries at a discount so that they were able to sell these brands to their clients. Many smaller breweries made use of this offer and sold those premium lager-beers next to their own top-fermenting beers. But breweries applying this strategy soon faced another problem. Their clients demanded ever more of the lager-brands and less of their own top-fermentation beers. In this manner the importance of their own production decreased continuously. These firms gradually became more dependant on selling the brands of the bigger breweries and evolved in time almost completely to retail outlets for the brands of the bigger breweries, serving as beverage wholesale stores. In this way they remained more or less in the sector and their exit out of the real production of beer went in a more natural way.

Only the biggest breweries could afford this escalation of advertising outlays. Smaller and medium-size breweries saw their shares decline in favour of those big breweries and they reverted to a traditional means of defending their territory. This mechanism concerned an elaborate sales strategy, by which on different ways outlets for their production could be secured.

There were three related ways to conduct this strategy⁸³. In the first way, a brewery could simply buy or establish its own chain of bars and pubs which gave the brewer a fixed outlet for his production. To the disadvantage of this strategy can be said that it involved high opportunity costs. The strategy absorbed a lot of capital which the brewery could not invest in other things. It was a very expensive way of securing sales.

⁸¹ HET BROUWERSBLAD, 36 (1928), p. 331.

⁸² HET BROUWERSBLAD, 37 (1929), p.1404.

⁸³ JANSSEN, A.C.M., *Bier in Nederland en België: een geografie van de smaak.*, Utrecht, 1987, p.44-47.

A second form of tying the customers consisted of granting long-term credit to pubs. Because of the good conditions that were offered the client would be inclined to stay with his purveyor. This system was cheaper than owning your own outlets but it was also less certain.

The third system holds the middle position between the former ways. The brewery engaged in a contract, a so called *pub contract*, with the pubs which committed them to obtain their beers only by this brewery in return for credit or other kinds of economic or financial benefits. This ensured an outlet to the production while at the same time hampering competitors by prohibiting the pub to offer competing products of other breweries.

This system of tying sales outlets was long embedded in the beer market, because of the peculiar attributes of the product. The short shelf-life of top-fermentation beer forced these brewers to look for safe and quick outlets for their production. Securing their outlets became ever more important when the market shares of these top-fermentation brewers came under pressure due to the successes of the big breweries in marketing their new lager beers. These different ways of tying outlets became the prime weapon of most medium-sized breweries in their struggle to keep their market share.

But this strategy could yield considerable advantages for bottom-fermentation breweries as well. Although longer than top-fermentation beers, the shelf-life of their products was not unlimited either. When their product was kept in tanks its shelf-life went from two up until six months. But when the beer was bottled or put in draughts it lasted only three or four weeks⁸⁴. And, because of the economies of scale it was very advantageous to use the whole capacity of the installations, for which an outlet had to be ensured. Moreover to make sure not to get behind in the race against the smaller top-fermenting breweries, lager breweries also had to participate in the scramble for outlets.

In this manner, the strategy of tying distribution networks was self-reinforcing. In the beginning of the 1930s this scramble intensified⁸⁵. Started as a defence mechanism against the larger breweries, this strategy quickly became an instrument in hands of the big breweries, and was amplified by the effects of the economic crisis. This crisis eventually had some effects on consumption. The declining consumption made the tying of outlets for production even more important because of the threat of underutilisation of capacity.

⁸⁴ PEUMANS, H., 'de Evolutie der Belgische Brouwindustrie', *Economische Tijdingen van de Kredietbank*, 3 (1938), p. 113.

⁸⁵ VAN CRIEKINGE, H., 'Les industries diverses en 1934' *Bulletin de L'Institut des Sciences Economiques de L'Université de Louvain*, 6-2 (1935), p. 191.

The fixing of the distribution networks had indeed the effect the smaller breweries had hoped. Market shares were basically frozen by the possession of production outlets. This muted further escalation of endogenous sunk costs through advertising expenditures.

But soon these tying agreements became a serious financial burden on the breweries as well⁸⁶. Owning pubs or granting credit or other facilities to production outlets was very expensive and demanded a lot of the company's capital. This entailed a lot of problems, especially for the smaller breweries. Capital that was fixed in distribution could not be used to improve the equipment of the breweries and the quality of their products. Besides, this scramble demanded more and more capital of the small breweries which they could not produce. They were unable to compete with the bigger breweries in offering conditions to the pubs, or buying them. This forced some of the smaller businesses to exit the industry, and thus even more concentration ensued. The primary way to gain market share on competitors was by in one way or another, taking over their distribution networks. To achieve this, mergers and acquisitions became gradually more important. After WWII this strategy soared. Especially in the 1960s acquisitions were a major issue in the Belgian beer industry. The brewery Artois was the principal actor in this process, becoming by far the largest Belgian brewery through these takeovers.

This process differed substantially from what happened in the United States. There, the escalation of sunk costs was not muted to a large extent by tying production outlets to the breweries. This was probably because in the United States there was no tradition of and some legal obstructions after the ending of Prohibition against tying distribution networks in the beer market⁸⁷. Furthermore, the share of home consumption in total beer consumption was considerably higher there.

There are some parallels with the situation of the beer market in the United Kingdom as Sutton describes it⁸⁸. There the tying system was probably even more elaborated than in Belgium. The scramble for outlets had already started in the last decade of the nineteenth century, after which a period a relative stability followed. Typical of the English market was the long domination of the improved top-fermenting *ale* style of beers. The rise of lager beers, well after WWII, was characterised by an increase in advertising outlays, in particular in the lager segment.

⁸⁶ PEUMANS, H., 'de Evolutie der Belgische Brouwindustrie', *Economische Tijdingen van de Kredietbank*, 3 (1938), p. 113-114.

⁸⁷ ADAMS, W.J., 'Beer in Germany and the United States', *Journal of economic perspectives*, 20-1 (2006), p. 198.

⁸⁸ SUTTON, J., *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*, Cambridge, 1991, p. 515-521.

For a long time the British beer industry remained quite fragmented⁸⁹. Industrial dynamics were more constrained than in the Belgian case. First of all the number of pubs and bars was limited by the government by means of permit restrictions, a system which was not present in Belgium. This freezes the structure of the industry once the outlets are divided among the breweries, unless important mergers or takeovers take place. But the British authorities had a more hostile view towards mergers than the Belgian government. Because of this the tying of outlets in the United Kingdom had the effect of preserving fragmentation instead of contributing to concentration.

The situation as described in Belgium held the first decennia after WWII. The system of tying outlets to breweries remained roughly the same throughout the 1950s and 1960s. In contrast to some other countries, no restrictions were imposed on the practice of buying pubs or granting credit by breweries. This preserved the rivalry between the important breweries and led to the establishment of lots of inapt merchants. In 1961 80% of the 80000 pubs or bars were tied by means of some delivery contract to a brewery⁹⁰. This situation ignited, certainly in the 1960s an important merger wave since growth was most easily realised by taking over a rival's distribution network. At the end of the 1960s and in the 1970s this situation changed. Belgian brewers were more and more engaged in the internationalisation of the beer market. New foreign markets opened and in that frame it made little sense for a brewery to fix most of its capital in tying a regional distribution network. Ties with retail outlets did not disappear but they changed from character and loosened somewhat, which also lowered the costs for most breweries. This was combined with new developments in mass-communication, such as the breakthrough of television. As predicted by Sutton's theory, this eventually led to a new phase of escalation of endogenous sunk costs and rising advertising outlays during that period⁹¹.

8. CONCLUSION

The Belgian brewing industry struggled in the interwar years with an industrial structure inherited from the nineteenth century which was not fit for the new technological and commercial developments. This resulted in a long phase of

⁸⁹ JOHNSON, G.; THOMAS, H., 'The industry context of strategy, structure and performance: the UK brewing industry' *Strategic Management Journal*, 8-4 (1987), p. 344.

⁹⁰ HOELEN, H., *De economische problematiek van de biermarkt, in het bijzonder in Nederland*, Amsterdam, 1961, P. 466-467.

⁹¹ WILLEMS, D., *Toepassing van de Sutton-methode voor bedrijfstakanalyse, sector: bierindustrie, onuitgegeven licentiaatsverhandeling*, Leuven, 1994.

continuous concentration starting at the end of WW I. One of the key catalysts for industrial change in the beer industry everywhere, was the introduction of the bottom-fermentation process in brewing. This process originated in Plzen in the middle of nineteenth century and stems from the use of a different kind of yeast. It required a new, more expensive and more complicated way of brewing. This transformed brewing from an artisanal to an industrial process. This new lager beer had a longer shelf-life, was more homogenous in taste and was a better looking, clear brew. Because of those qualities, it became immediately a very popular beer, and with some delay, it was adopted in the whole developed world. In Belgium this shift happened relatively late. Although the first lager beers were produced in Belgium in the last decennia of the nineteenth century, it took until the interwar years to see a significant change in the preferences of the consumers and the domestic production. When that finally happened it led to a structural revolution in the Belgian brewing industry. The Belgian beer market was up until then dominated by a large variance of traditional top-fermentation beers. But the share of lager beers increased dramatically in the interwar years. This started a rivalry between the big bottom-fermenting breweries and the mostly smaller, top-fermenting breweries. The top-fermenting breweries were at a disadvantage and when legal or governmental protection didn't sort the proper effect, they were prompted to make important technological changes as well, making their production process also more capital intensive.

In this manner the switch to bottom-fermentation gave a first impetus to concentration in the Belgian brewing industry. Rising setup costs and economies of scale were a cause of concentration. But this was not the sole explanation for concentration.

Sutton sees the brewing industry as an example of a high-alpha industry where an increase in exogenous sunk costs can be the trigger to an escalation of endogenous sunk costs, resulting in concentration. The rise in exogenous sunk costs by the shift to bottom-fermentation, or the improvements made in top-fermentation in reaction to this shift, could be the trigger for escalation of endogenous sunk costs in Belgium.

But for this picture to hold it is necessary to see first if the Belgian brewing industry could be considered as a high-alpha industry during the interwar years.

New ways of communication between producers and consumers in the interwar years increased the effectiveness of advertising considerably. More and more magazines and newspapers started to accept advertisements as a new source of income. Quickly many companies in Belgium exploited this opportunity.

The homogeneity of the market increased as well. The main factors contributing to this were the rapid spread of the more homogenous lager beers, the decreasing

variability of the top-fermenting beers, which made beer a less differentiated product and the reduction of transport costs.

These evolutions had the effect of transforming the Belgian brewing industry into a high-alpha industry. As predicted by the theory it became profitable for some companies to break the existing configuration in the industry by adopting a strategy of escalating endogenous sunk costs. The brewery Caulier was the first to start this escalation with big advertising campaigns to promote their brand, rising quickly from a medium sized brewer to one of the leading breweries of the country. Soon its lead was followed by most of the other important Belgian breweries, which all came with their first real beer brands, backed by considerable amounts of advertising. Smaller firms could not make those investments and had to exit the industry or became beverage wholesale stores for the products of the bigger breweries.

But, as Sutton already acknowledged the situation can be complicated thoroughly by historical and institutional factors, which also have to be taken into account. The eventual outcome will be strongly affected by those factors.

These other aspects were also important to explain the industrial dynamics in the Belgian brewing industry. The practice of tying retail outlets to breweries was a longstanding tradition in the Belgian beer market. At first these techniques consisted mostly of breweries buying their own chain of pubs or granting long-term credits, but in the interwar years pub contracts were increasingly used. These agreements were intensified in the interwar years mostly as a defence mechanism against the actions of the big lager-brewing companies. They were successful in muting the escalation of sunk costs of the big breweries by diminishing the effectiveness of advertising. But because of the high financial requirements, this strategy soon became a burden for the smaller breweries as well, and contributed at its turn to more concentration. To further accentuate the importance of institutions and historical events, we can mention the British case, where the same strategy of tying outlets had the opposite effect of keeping the industry fragmented.

So Sutton's theory is certainly an interesting tool for historical analysis and its framework can provide a partial explanation for the concentration in the Belgian brewing industry. As predicted in the theory, at some points of the industry history phases of escalation of sunk costs take place in the brewing industry. Parts of the interwar years, and later on the period starting at the 1970s are an example of this. But, to give a specific explanation for industrial and geographical unique cases many historical and institutional should be embedded into the theoretical framework. This is in no way a refutation of the theory as it did not claim to provide more than a

underlying pattern that is subject to other determinants effecting eventual outcome. It is instead an example of how economics and history interact, with economics supplying the theoretical structure while history furnishes the facts to make the theory suitable for a complicated reality.

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