

Viennese Chairs: A Case Study for Modern Industrialization

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We examine the Austro-Hungarian bentwood furniture industry as a case study for modern industrialization during the second half of the nineteenth century. We establish that, through the implementation of innovative production methods and aggressive and insightful marketing strategies, this industry constitutes an important example of the modern industrial enterprise. Furthermore, we find evidence of cooperative behavior in the industry, making it an interesting case study in the history of industrial organization.

The advent of the modern industrial enterprise in the last quarter of the nineteenth century is attributed by Alfred Chandler to three sets of inter-related investments: an investment in large-scale production facilities; an investment in a national and international marketing and distributing network; and an investment in management.¹ These types of investments mainly took place in a few capital-intensive industries, such as chemicals, metals, oil, and machinery. In labor-intensive industries such as furniture, textiles, apparel, specialized instruments, and machinery, Chandler claims that large integrated firms possessed few competitive advantages, and manufacturers had little incentive to make the three-pronged investment in production, distribution, and management. This article presents an important exception to Chandler's argument: the Austro-Hungarian bentwood furniture industry of the second half of the nineteenth century.

We establish that this industry, through the implementation of innovative production methods based on the interchangeability of parts and aggressive and insightful marketing strategies targeted at a world-wide market, constitutes an important, and so far ignored, example of the modern industrial enterprise. In fact, judging from the methods and scale of production, we argue that bentwood furniture marks the first mass production in the history of furniture manufacturing. Our study thus calls into question the commonly held belief that mass production did not occur in the furniture sector, as well as the reasons put forth to explain this failure, namely the nature of the material and consumer tastes.

The Journal of Economic History, Vol. 59, No. 1 (March 1999). © The Economic History Association. All rights reserved. ISSN 0022-0507.

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We are grateful to Lou Cain and especially Joel Mokyr for their encouragement and advice. We also thank two anonymous referees for their very helpful comments.

¹ Chandler, *Scale*.

Furthermore, we find that the industry is characterized by strong patterns of cooperation among its firms, as demonstrated by their price-fixing behavior and the information sharing on new production technologies and product designs. In fact, firms were quick to copy the new products of their rivals, and even offered them under the same product name in their catalogues. As a result, their chairs, which constituted the bulk of industry production, came to be known simply as “Viennese chairs.”

Finally, our study has implications for evaluating the economic performance of the Habsburg Empire, as it demonstrates at a microeconomic level that modern industrialization was well under way in the monarchy during the second half of the nineteenth century.

MODERN INDUSTRIALIZATION IN THE HABSBURG EMPIRE

Containing a large portion of today’s Central and Eastern Europe, the Habsburg Empire constituted a major political power during the nineteenth century and until its dissolution in 1919. The economic performance of the Empire traditionally has been viewed as mediocre and problematic, lagging significantly in terms of growth compared to its Western European contemporaries, while it displayed sharp, and growing, disparities in economic development among its different regions.

During the latter part of the century, the Habsburg Empire experienced a number of major socioeconomic changes that sharply reduced natural and institutional barriers to the free flow of goods, capital, and people: the abolition of serfdom, following the revolution of 1848; the elimination of internal tariffs and the formation of a customs union within the Empire; the Dual Settlement of 1867, which gave Hungary substantial autonomy in its internal affairs; the reorganization of the Empire’s monetary system, and the creation of a central money market in Vienna, with the emergence of large “universal” banks; and the building of an extended railroad system, whose length increased eightfold during the period 1860 to 1900, reaching a population density comparable to that of Germany, France, and England.² By the last decades of the nineteenth century, these changes enabled the Empire to begin catching up to other European countries and fostered a narrowing of regional disparities within the multinational state.³ These changes were also essential preconditions for the growth of the bentwood industry and the worldwide expansion of its market.

² Komlos, *Habsburg Empire*.

³ See Good, “Economic Lag” and “Proxy Data.”

THE BENTWOOD FURNITURE INDUSTRY

The early stages of the industry are dominated by the figure of the German-born Michael Thonet.⁴ Trained in the high European tradition of cabinet making, he began his experiments with bent wood in the 1830s, based initially on the use of laminated veneers. In 1842 Thonet, following Prince Metternich's advice, relocated in Vienna where several examples of his furniture were shown to the Emperor. As a result, the Austrian court granted him the right (patent) "to bend any type of wood, even the most brittle, into the desired forms and curves by chemical and mechanical means."⁵

In 1853 Michael Thonet signed over the business, then employing 42 workers, to his five sons, who became the co-owners of *Gebrüder Thonet* (Thonet Brothers), although he remained in charge of management and procurement. On 10 July 1856 the firm obtained its main patent (Imperial and Royal Privilege No 25.295) "for the production of chairs and table legs made of bent wood, the bending of which is accomplished by the use of steam or boiling liquids." In the same year Thonet built its first factory in Koritchan, in the heart of the Moravian mountains. In the following years four more factories were built, in nearby Bistritz, in Gross-Ugrocz (Hungary), in Hallenkau, and in nearby Wsetin (Moravia), and two more outside the Austro-Hungarian borders, one at Nowo-Radomsk in Polish Russia, and one at Frankenberg, Germany. During the next decades the firm continued to grow, and by 1913 the annual production had reached almost 1.9 million furniture pieces, produced by 7,000 workers, with a value of approximately 10 million kronen.

On 10 December 1869 Thonet Brothers relinquished their patent from 1856, following a lawsuit by the company Jacob and Josef Kohn that claimed the annulment of the above patent. With the formal termination of the 1856 patent, a wave of competitors, both from Austria and abroad, entered the market. The most important among them was the firm of Jacob and Josef Kohn.

The Kohn family firm was originally founded in 1850 as a producer of lumber in Wsetin, Moravia.⁶ The company built its first furniture factories toward the end of 1869, and production of bentwood furniture began in 1870. During the following years the company grew steadily and large factories were erected in Teschen (Silesia), Krakow (Poland), Warsaw, and Gross-Poremba (Galicia), while five other smaller works were operating in Moravia and Silesia. By 1876 the firm employed three to four thousand workers producing about 500,000 pieces of furniture per year. Additional

⁴ Thonet lived from 1796 to 1871. Information about the company comes from Exner, *Michael Thonet*. Data sources on Thonet's production and sales in our disposal are described in the Appendix.

⁵ Kaiserlich und Königlich Privileg (Imperial and Royal Privilege) No 28.877/1.158. These privileges were granted through the *Kaiserlich-Königlich allgemeine Hofkammer*, the Ministry of Finance with a department for trade and industry. The system of privileges was superseded by the patent law of 1897.

⁶ Information about Kohn is from Eckstein, *Erste Österreichische Actien-Gesellschaft*. Additional data sources on the company are described in the Appendix.

factories were later built in Nowo-Radomsk and in Hallenkau. By 1904 the total number of employees had grown to 6,300 and daily production had risen to 5,500 pieces of furniture.

Apart from Thonet and Kohn, a number of small bentwood firms were also established within the Austro-Hungarian borders as well as abroad, in particular Germany. Wilhelm Exner and Georg Lauboeck (1893) record 52 manufacturers of bentwood furniture, out of which 26 were located in the Habsburg Empire, 9 in Russia, 7 in Germany, 4 in France, 3 in Italy, 2 in Belgium, and one in Rumania. Increased competition during the beginning of the twentieth century forced 11 of the smaller Austro-Hungarian companies to merge in 1907 into Mundus, Joint-Stock Company of the United Austrian Bentwood Furniture Factories, which became the third largest bentwood company.⁷

The declaration of World War I in the summer of 1914 dealt a serious blow to the industry. With the conclusion of the war in 1918, the companies began to rebuild. The 1920s saw a revival of bentwood furniture, spurred by the increased demand for inexpensive furniture during the economically depressed years following World War I and by a renewed enthusiasm for the traditional nineteenth century bentwood furniture by avant-garde artists, such as Le Corbusier. Thonet, Kohn, and Mundus, which merged in 1922, continued to produce traditional bentwood furniture until the outbreak of World War II. In 1940 the company moved to the United States, where it continues to operate under the name Thonet Industries, producing commercial furniture. Most interestingly, modern bentwood furniture production is based on exactly the same methods used more than a century ago.⁸

METHODS AND ORGANIZATION OF PRODUCTION

From the beginning, the bentwood industry aimed at producing furniture with uniform and interchangeable parts through the use of specialized machines, a production system commonly referred to as the "American system of manufacturing." As has been indubitably established by David Hounshell, this principle was by no means widespread during most of the nineteenth century, found principally in the national armories at Springfield and Harpers Ferry.

The American system of manufacturing was certainly not found in the American furniture industry. As late as 1920 an engineer for a Grand Rapids furniture manufacturer was complaining that "most managers . . . overlook the possibility of reducing the variety of parts to be manufactured through standardization of design, interchangeability of parts, and greater limitation of line [which] would not only directly reduce manufacturing costs, but

⁷ *Compass*, 1907.

⁸ Article in *Woodworking and Furniture Digest*, pp. 44-48.

would also tend toward the development of automatic machinery, better utilization of raw product, economies in handling parts in process of manufacture, etc.”⁹ Despite the wide variety of woodworking machinery used in American industries, which astonished English observers in the 1850s, “the American furniture industry did not adopt the production technology that proved so successful in such areas of metalworking as firearms, sewing machines, bicycles and automobiles. There was no Henry Ford of the furniture industry.”¹⁰ However, the story of the Austro-Hungarian bentwood furniture industry of the nineteenth century suggests otherwise.

The extraordinary scale of production achieved by the larger firms in the industry, Thonet and Kohn, was attained precisely through the implementation of the principle of interchangeable parts produced by special-purpose machinery. Michael Thonet’s invention of making furniture from bent wood was the key factor for the transition from traditional crafts making to modern production of machine-made furniture with interchangeable components.

Long before the appearance of bentwood furniture, the bending of wood had been used in the production of barrels and wagon wheels and in the building of ships. Michael Thonet’s innovation was to apply this idea to furniture and to design a process that allowed him to produce furniture in quantity and cheaply.¹¹ The process of bending a solid material into a structural form economized on material and labor time, reducing the number of parts needed for a single piece of furniture. On the other hand, the technique of bending wood based on the use of steam itself pointed toward mechanization, requiring but minimal skills while increasingly relying on specialized machines. Already in the 1850s, special bending machines were introduced in order to produce the desired shapes for the various furniture components. Special-purpose machines and tools were also invented for the wood-cutting and sawing operations. For the steaming and drying of the wooden rods, special steam retorts and air pipes were built.¹²

The use of special bending forms made of cast iron clearly demonstrates the uniformity of the furniture parts produced (backs, legs, seat rings), which may be further confirmed by visual inspection of the firms’ sales catalogues and of surviving furniture. A noteworthy feature is that interchangeability characterized not only the parts of any specific furniture model, but also the

⁹ Hounshell, *American System*, p. 145.

¹⁰ *Ibid.*, p. 150.

¹¹ Thonet’s unique idea was to apply metal strips in the bending process. Through the application of steam, the bending capability of wood can be increased. When exposed to steam, the wood’s oil and resin partially dissolve, loosening the matrix of the grain, which may then be shifted in the bending process. The major problem of bending wood is the danger of splitting it. Thonet solved this problem by securing a flat metal strip along the straight length of the wood with screw clamps. As the wood was bent, the metal strip was snug against the outer convex surface preventing it from stretching.

¹² Detailed information on the bending process may be found in Exner, *Beiträge und Studien*; and in Exner and Lauboeck, *Das Biegen*.

parts among a large number of different furniture models—for example, the majority of chairs would share the same legs or seat frames—as well as among different furniture types—for example, among chairs and armchairs. Furthermore, the mere fact that most furniture pieces were packed disassembled in large quantities and with no distinguishing features is a clear indication that interchangeability was an integral aspect of the production process, sought and achieved from the very beginnings of the industry in the 1850s.¹³

Production efficiency was further enhanced by the implementation of two other principles: one-good based production lines and product standardization. From the early stages of the industry dominated by the firm of Michael Thonet, production was based on, though not limited to, one particular furniture piece, “Chair No. 14.” In 1875, for example, “Chair No. 14” constituted two-thirds of Thonet’s total production. Furthermore, the different chair models produced in this period, which constituted more than three-quarters of Thonet’s total output, shared the same basic structural components.

Product standardization is another cost-minimizing device. It is manifested in the bentwood companies’ sales catalogues, published in intervals of five to ten years. From the very first catalogue, published by Thonet in 1859, furniture models are numbered. The use of a numbering system is an indication of the firm’s efforts toward rationalizing the production and distribution processes. Furthermore, it demonstrates the firm’s intention to maintain the same line of production through the years, minimizing the changes in already existing models. Thus, for example, the design and catalogue number of “Chair No. 14” remained unchanged for fifty years.

A common characteristic of the bentwood industry’s larger firms is that they were vertically integrated, in control of all the steps of the production and distribution processes. For example, Thonet, initially a downstream firm producing furniture with materials purchased from and supplied by other firms, successfully expanded into the upstream market. As early as 1860 Thonet owned forests and saw mills, as well as railroad tracks for the transportation of wood from the forests to the factories. In addition to the six furniture factories operating in 1881, Thonet owned other specialized factories: a machine factory that made the specially designed machines and tools used in the production of bentwood parts; a factory for the production of screws; and a limestone factory producing building materials for the factories.¹⁴ Finished products were distributed to firm-owned warehouses and retail shops all over the world. On the other hand, Kohn was initially an upstream firm, producing lumber and matches, and later a downstream firm as a manufacturer of furniture, while it also operated a number of wholesale and retail stores worldwide.

¹³ Thonet sales catalogue, 1859.

¹⁴ Exner and Lauboeck, *Das Biegen*.

Vertical integration is a cost-minimizing organization of economic activity, which may arise as a solution to the “double-marginalization problem,” occurring when a downstream firm (for example, a furniture manufacturer) buys its inputs from an upstream firm (for example, a forest or sawmill owner). One can show that, under vertical integration, the firm’s total profits are higher and consumers are better off, because the final good’s price is lower. Of course, the firms in our case were not monopolists, but the same result holds when the firms have sufficient market power.

Smaller bentwood companies were typically not integrated. A possible reason is that they were constrained in their capacities, especially financially.¹⁵ Instead, the smaller firms would specialize in particular products (for example chairs) or markets.

Mass Production in Furniture

The common belief, epitomized by Hounshell’s claim that “there was no Henry Ford in the furniture industry,” is that mass production did not occur in the history of furniture manufacturing. Yet, the production methods implemented by the Austro-Hungarian bentwood industry allowed those firms, especially the larger ones, to operate at such a large scale that we are led to claim that mass production did occur in furniture in the nineteenth century at least in Central Europe.

Already in the 1870s Thonet and Kohn were employing approximately 4,000 workers each, turning out almost one million furniture pieces a year. At the same time, the largest British firm, Jackson and Graham, was employing about 600 workers, while in Chicago, which was emerging as a predominant furniture supplier in the United States (along with Grand Rapids and New York), the largest enterprise, A. H. Andrews and Co., was employing 500 workers in its four factories.¹⁶ In 1913 Thonet’s production was almost two million pieces, produced by 7,000 workers. In contrast, well into the twentieth century, “the American furniture manufacturers continued to operate relatively small factories employing [on average] around 150 workers, annually turning out 5,000 to 50,000 pieces.”¹⁷

The enormous size of output of the Austro-Hungarian bentwood furniture manufacturers is comparable only to Singer’s production of wooden sewing machine cabinets. During the first two decades of the twentieth century, Singer’s factory at South Bend, Indiana, was producing about two million cabinets a year with a labor force of 3,000 workers. However, the South Bend plant

¹⁵ Indeed, the large universal banks seemed to have favored the financially stronger enterprises. Rudolph, *Banking*, p. 106.

¹⁶ See Aslin, *Nineteenth-Century English Furniture*; and Darling, *Chicago Furniture*.

¹⁷ Hounshell, *American System*, p. 12.

was an exception among American factories. In the period between 1870 and 1920, “no furniture maker ever matched South Bend’s output (certainly not in numbers and probably not in dollar value) or the scale of employment.”¹⁸

The similarities between the Austrian bentwood furniture production and Singer’s cabinet production is not limited to numbers. Strikingly enough, it was only through the development of a process for making cabinet covers from *bent* layers of cheap wood (nyssa or gumwood), that Singer was able to reach such an extraordinary scale of production. However, there is an important distinction between Singer and the Austrian bentwood makers. Singer’s product enjoyed a ready-made worldwide market. People would buy only a Singer cabinet when they purchased a Singer sewing machine.

Singer’s extraordinary, by contemporary American furniture-manufacturing standards, production scale of wooden cabinets raises the question why mass production failed to occur in the rest of the American woodworking industry. A typical explanation for this failure, offered by Alfred Chandler among others, was that the nature of the material, namely wood, prevented the implementation of heat-using methods. In *The Visible Hand*, Chandler argues that, although most American woodworking industries had substituted machines for hand labor by the Civil War, the wooden nature of the material implied that throughput could only be increased thereafter by adding more men and machines without an increase in productivity. However, as pointed out by David Hounshell, the case of Singer’s manufacturing of wooden sewing machine cabinets in huge factories and on a large scale, already by the mid-1880s, calls this “nature of the material” argument into question. Instead, Hounshell puts forth the nature of the furniture market, namely consumers’ preferences and their desire for fashion, style, and novelty. “Products could not be standardized and product lines could not be maintained long enough to justify the construction of special-purpose machinery and other efficient production techniques.”

The case of the bentwood furniture industry, however, tends to invalidate Hounshell’s argument as well. The explanation seems to lie in two demand-related factors: first, the appearance of a rapidly growing market for commercial furniture, a result of the industrialization of the Western World, which provided an outlet for standardized low-priced furniture; second, the lasting aesthetic appeal of bentwood furniture, shared first by the aristocracy and subsequently by the middle classes, as well as by the elite of avant-garde artists. Efficient production methods allowed the bentwood companies to satisfy the first type of demand, while by the implementation of the “flexible mass production” principle, that is, by the introduction of frequent but superficial changes in furniture design, they were able to follow rapidly changing consumer tastes. The bentwood companies not only followed the prevailing

¹⁸ Ibid., p. 144.

fashion, but also initiated it, as for example when they started producing architect-designed furniture around the turn of the century. These ideas are explored in the next section, where we also examine the marketing strategies implemented by the bentwood industry.

MARKETING STRATEGIES AND DEMAND

By first captivating the interest of the aristocracy as a *curio*, notably of Prince Metternich himself, and decorating famous palaces in Vienna and Budapest, bentwood furniture quickly became accepted by the middle class, first in its public and later in its private sphere. The rise and establishment of the middle class as a major economic force during the nineteenth century created new consumer needs both inside and outside the home. The bentwood industry was the first to realize the economic potential of the new furniture markets, in particular that for commercial furniture. It responded with large-scale production of low-priced, standardized, yet good quality and aesthetically appealing furniture.

The qualities of commercial bentwood furniture are exemplified in the industry's best-seller, "Chair No. 14," called the "first consumer chair" in Thonet's 1904 sales catalogue. Designed in the 1850s by Michael Thonet, "Chair No. 14" was as simple as a chair could be. Devoid of any decoration, it was minimal in its use of material: only five pieces of bent wood, ten screws and two washers were used in its construction. Its design was ideal for mass production, its low price was ideal for mass consumption. For 55 years the price of an individual "Chair No. 14" was three gulden (or six kronen), while a dozen cost only 24 gulden, yielding a price of two gulden for each chair.¹⁹ Its light weight and the fact that it could be assembled simply using a screwdriver made it suitable for mass exportation. The different components of three dozens of "Chair No. 14" would be packed disassembled in a box of 36 cubic feet, to be put together easily at their destination. It became the most popular commercial chair of the nineteenth century—perhaps of the last two centuries—having sold an estimated 50 million by 1914. Thonet Brothers alone had sold 11,254,355 pieces by the outbreak of World War I.

While "Chair No. 14" and its fellow Viennese chairs came to furnish thousands of cafés, restaurants and offices worldwide, toward the end of the century a new family of commercial bentwood furniture was born, specially designed for the needs of particular types of public establishments, such as hospitals, churches, schools, and theaters. In 1899 the Austrian bentwood

¹⁹ Documented in an 1862 Thonet advertisement (in the Viennese newspaper *Kikeriki-Anzeiger*), and in Thonet's catalogues of 1870, 1895, 1904, and 1911. In Vienna of 1870 two gulden could buy 3.5 kilos of meat, or 16 liters of milk, or 6 dozens of eggs, or 3 kilos of sugar, or 6 bottles of wine. In 1911 it was equivalent to 2 kilos of meat, 12 liters of milk, 3 dozens of eggs, 4 kilos of sugar, or 6 bottles of wine (from *Geschichte und Ergebnisse*, pp. 676–79).

companies led by Kohn revolutionized the furniture industry once more by introducing an entirely novel line of mass-produced, and thus cheap, furniture designed by famous architects and leaders of the Viennese *Kunstreform* (Art Reform) movement, such as Otto Wagner, Joseph Hoffmann, Adolph Loos, Marcel Kammerer, and Koloman Moser.²⁰

Innovative product design was complemented by aggressive marketing. An important feature of the industry's marketing strategies was the publication of multilingual sales catalogues, which were distributed in retail stores all over the world and from which a buyer could choose and order any specific item.

Starting in 1859 Thonet published a broad sheet-catalogue that featured 26 furniture models, a number that increased to 1400 by 1911. From the first catalogue, the items were numbered. By 1866 individual prices were also listed, and by 1888 a short description of each model was offered, including its dimensions and its weight. The text accompanying the catalogues came to include a short history of the firm and its latest technical achievements, the prizes and distinctions awarded in international events, a list of the firm's showrooms worldwide, instructions for maintenance, ordering, packing and assembling, as well as an exhaustive description of extra offerings, all carefully described and priced, aiming to improve the durability, comfort, practicality, or the aesthetic effect of the furniture, creating the possibility of nearly custom-made pieces.

Advertising was another important means for product promotion. Bentwood furniture advertisements appear already in the 1850s in European newspapers and periodicals. In addition, the bentwood companies would consistently participate in the magnificent nineteenth century international exhibitions, starting from the very first one in 1851 at the Crystal Palace in London, drawing the attention of critics and typically winning important distinctions and medals.

The promotional efforts of the bentwood companies were accompanied by the early establishment of an extensive international distribution network by the leading firms, that included firm-owned showrooms, retail and wholesale stores, company-employed traveling salesmen, and independent retailers. By 1862 Thonet Brothers had branches in Paris, London, and Budapest, by 1866 in Berlin, Hamburg, Rotterdam, and Brno, and by 1872 in New York. The number of Thonet showrooms and wholesale stores increased continuously. The 1904 sales catalogue lists 24, including all major cities of the world.

Similarly, Kohn pursued an aggressive marketing policy. According to Eckstein, "as far back as 1872, they were represented in the Far East by a Cologne firm, . . . [and] in that same year they consigned a cargo of bentwood furniture to Hongkong. The whole of South and Central America,

²⁰ Architect-designed furniture was not a novel practice in the industry. Already in the 1870s large British firms employed architects at very high wages to design luxury furniture pieces. Aslin, *Nineteenth-Century English Furniture*.

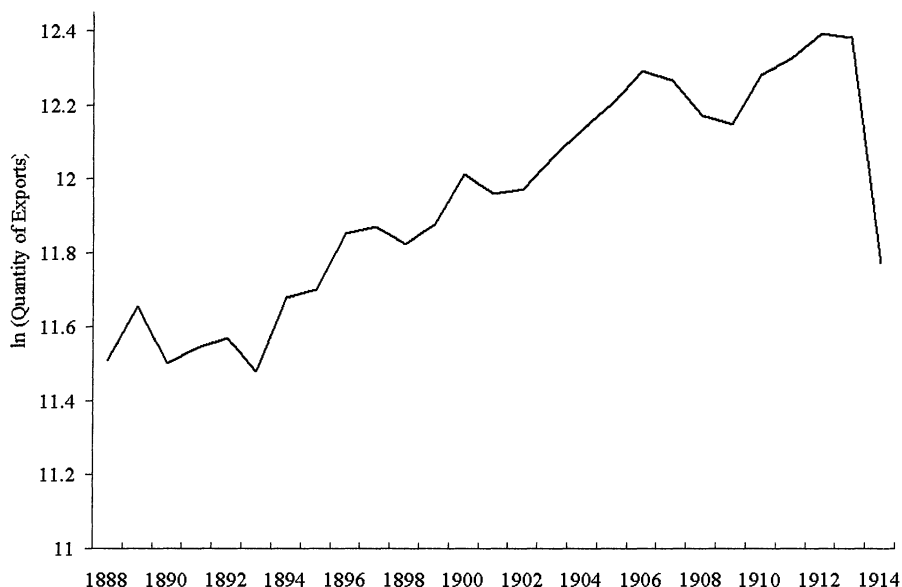


FIGURE 1
EXPORT QUANTITIES

Note: Quantity is in 100 kilograms.

Source: *Statistik des auswärtigen Handels des Vertragszollgebietes der beiden Staaten der Österreichisch-Ungarischen Monarchie.*

Australia, the West Indies, the Polynesian Islands, and the coast towns of China and Japan were regularly visited by Jacob and Josef Kohn's travelers.²¹ Warehouses of the firm could be found "all over the world: in Antwerp, Barcelona, Berlin, Brussels, Budapest, Cologne, Hamburg, Kiev, London, Madrid, Milan, Marseilles, Moscow, Naples, New York, Nuremberg, Paris, St. Petersburg, [and so on]."

The importance of foreign trade cannot be overemphasized. Indeed, exports constituted the majority of total bentwood furniture sales. The historical records on the share of exports in total sales for the industry's leaders, Thonet and Kohn, indicate that about three-quarters to four-fifths of their output was absorbed in the international market. The available national export data reveal that the share of bentwood furniture in the value of total exports of the Habsburg Empire more than tripled within a quarter of a century, from a 0.44 percent in 1890 to 1.48 percent in 1913.²² Furthermore, its share in the value of total furniture exports from the Empire steadily increased, from 60 percent in 1888, to almost 97 percent in 1900, suggesting the increasing importance of

²¹ Eckstein, *Erste Österreichische Actien-Gesellschaft*, p. 9.

²² See the Appendix for their description and location.

TABLE 1
SHARES OF DIFFERENT CONTINENTS IN THE VALUE OF TOTAL BENTWOOD EXPORTS

Year	Europe	America	Asia	Africa	Australia
1891	86.80	5.95	3.72	1.95	0.99
1892	85.67	6.25	2.88	3.34	1.86
1893	82.19	7.87	4.27	5.12	0.55
1894	73.56	14.72	5.81	4.74	1.17
1895	73.05	14.83	4.96	5.53	1.63
1896	76.67	12.31	4.00	5.25	1.77
1897	76.30	10.57	3.19	7.66	2.28
1898	78.56	10.16	4.24	5.89	1.15
1900	77.94	10.95	4.14	5.62	1.35
1901	78.01	10.52	4.00	5.44	2.03
1902	76.71	10.73	5.38	6.22	0.96
1904	78.46	9.10	4.34	7.06	1.04
1907	76.66	12.30	4.23	5.96	0.85
1908	79.76	10.80	3.58	4.77	1.09
1910	77.18	9.06	7.41	6.04	0.31
1911	75.93	6.90	6.75	10.12	0.30

Note: Shares for Europe include the seaports of Hamburg, Bremen, Fiume, and Trieste.

Source: *Statistik des auswärtigen Handels des Vertragszollgebietes der beiden Staaten der Österreichisch-Ungarischen Monarchie*.

the bentwood sector in the general Austro-Hungarian furniture industry. The data also reveal that the average export price (total revenue by total quantity) of bentwood furniture was considerably lower (two to three times), as compared to the price of the other furniture.

Figure 1 depicts the quantity of total bentwood exports between 1888 and 1914. Notice the dramatic drop in 1914. The estimated annual growth rate between 1888 and 1913 was 3.8 percent. Table 1 shows the evolution of shares of the different continents in the value of bentwood furniture exports. Clearly, Europe was the largest market, followed by the Americas and surprisingly Africa, especially Egypt and Capetown. Outside of Europe, the most important market was South America. Table 2 presents the shares of the different European countries. With a share of one-third until the turn of the century, Germany constitutes the largest market in Europe as well as worldwide.

Similarly, we cannot overstress the role of the revolution both in ground and sea transportation—in particular of the expansion of the international railroad network—that took place during the nineteenth century. The bentwood industry very early realized the advantages of railroads. Not only did they build their own lines to connect forests and saw mills with the furniture plants, they also succeeded in obtaining special tariffs for furniture wagon loads, initially for 5,000 and later for 10,000 and 20,000 kilos.²³

²³ Eckstein, *Erste Österreichische Actien-Gesellschaft*, pp. 9–10.

TABLE 2
SHARES OF DIFFERENT EUROPEAN REGIONS IN THE VALUE OF TOTAL BENTWOOD EXPORTS

	1891	1892	1893	1894	1895	1896	1897	1898	1900	1901	1902	1904	1907	1908	1910	1911
Free ports	34.5	30.5	30.4	13.8	19.2	22.8	15.6	17.5	13.6	33.9	30.8	28.2	36.9	35.9	35.5	36.6
Germany	22.1	26.7	26.7	26.7	24.1	24.7	32.2	33.7	37.6	19.0	18.1	19.2	15.3	15.9	14.7	13.9
France	8.2	6.8	6.6	9.2	7.9	6.8	6.5	6.4	7.8	6.8	8.9	9.5	6.5	7.4	7.0	6.2
England	4.7	3.5	3.6	6.2	6.1	7.1	7.4	6.8	6.8	6.6	5.6	5.9	4.2	3.4	2.5	3.0
Lowlands	5.7	5.4	5.4	5.6	4.9	4.9	4.9	5.4	4.6	5.1	5.8	6.2	6.4	7.2	6.1	5.5
Italy	3.7	4.0	3.9	3.9	4.6	4.5	3.9	4.4	3.7	3.3	3.8	5.8	4.6	6.6	7.5	6.9
Balkans	2.2	2.8	2.9	3.9	3.1	2.5	3.0	2.1	0.9	0.9	1.5	2.1	1.0	1.4	2.3	2.6
Russia	1.1	1.0	0.9	0.7	0.9	1.2	1.0	1.0	0.8	0.8	0.8	0.1	0.7	1.0	1.0	0.9
Iberia	4.3	3.7	1.4	2.7	1.7	1.6	1.3	0.5	1.3	1.1	0.9	0.6	0.2	0.1	0.1	0.0
Scandinavia	0.3	1.3	0.4	0.8	0.6	0.5	0.5	0.7	0.8	0.5	0.5	0.8	0.8	0.8	0.5	0.3

Notes: Regions are composed as follows: Free ports are Hamburg, Trieste, Bremen, and Fiume; Germany includes Switzerland; England includes British colonies in the Mediterranean; Lowlands includes Holland and Belgium; Balkans includes Greece, Rumania, Serbia, Bulgaria, and Montenegro; Iberia includes Spain and Portugal; Scandinavia includes Denmark, Sweden, and Norway.

Source: *Statistic des auswärtigen Handels des Vösterreichisch-Ungarischen Monarchie.*

The Role of Demand

The success of bentwood furniture may be attributed to the invention itself and the ensuing technological innovations, the methods and organization of production, and the marketing strategies employed by the companies. As we will argue in this section, demand also played an important role in determining both the scale and the methods of production. The increase in demand for good-quality and low-priced furniture in the post-Industrial Revolution era was a necessary (although clearly not sufficient) condition for the occurrence of mass production in the bentwood industry. However, we argue that increases in demand for inexpensive furniture during the nineteenth century also may have led to efficiency increases in production, that is, outward shifts in supply. Indeed, it is straightforward to establish that, in the presence of growth externalities, increasing returns to scale, and learning-by-doing effects, shifts in demand will cause shifts in supply.

The nineteenth century saw a vast increase in the demand for consumer goods such as clothes, furniture, and household wares, associated with population growth and increased incomes. In fact, based on the high rate of growth in durables stocks, Harold Vatter argues that “a consumer durables revolution, characterized by the provision for the first time of durables by the enterprise sector that replaced handwork and homemade equipment, may well have occurred in the mid-nineteenth century.”²⁴ Moreover, this period is characterized by “modifications of established durables by the elimination of ornamentation, reduction in weight, model simplification, strictly functional design, and associated development of the inexpensive model,” changes that are most accurately reflected in bentwood furniture production.²⁵ In addition, the growing commercialization and industrialization of the Western World, along with the increased mobility of the population created a large, and until the second half of the nineteenth century unexploited, market for commercial furniture. Furthermore, toward the end of the century, the increased social and economic stratification of the population, with the emergence of well-off middle classes, led to a boom in the demand of affordable, yet good-quality and fashionable household furniture. All these types of demand were exploited by the bentwood furniture industry.

The market expansion for low-priced and durable furniture was met by an increase in the scale of operation of the bentwood firms, the standard movement across the supply curve, but we argue that it may have also spurred technological innovation, that is a shift of the supply curve. For example, the replacement of glue with screws and bolts for the fitting of the furniture parts—an important if not necessary factor for the shipment of furniture in

²⁴ Vatter, “Has there been a Twentieth-Century Consumer Durables Revolution?” p. 16.

²⁵ *Ibid.*, p. 9.

disassembled form which economized on transportation costs—and the replacement of laminated veneers with bent solid pieces of wood, was largely due to the increase in demand from South America following the Crystal Palace Exhibition of 1851.²⁶ Another example is the replacement in the beginning of the 1880s of cane seats with the more durable thermoplastic veneer seats as a result of the demand for more durable public furniture.

Finally, and perhaps most importantly, there is evidence of technological spillovers and thus of growth externalities within the industry, facilitated by the geographically close location of the bentwood factories. As we argue in the next section, the absence of lawsuits about patent rights between the industry's leaders and the free copying of product designs and techniques suggest that the bentwood companies actively pursued cooperation in research and development.

STRATEGIC BEHAVIOR IN THE BENTWOOD INDUSTRY

Collective Invention and Locational Concentration

An important feature of the bentwood industry was the free flow of information on new production techniques as well as product designs, an essential precondition of what Robert Allen has called “collective invention.”²⁷ Indeed, new technical advancements and product designs were exploited not only by the firm that invented them, but also by competitors. The standardization of bentwood products, documented in the companies' sales catalogues, had two main effects. First, it reduced the costs of product design and experimentation at the level of individual firms. Second, it boosted demand by creating a brand name for bentwood furniture, thus lowering search costs for consumers.

Despite the fact that certain techniques and products were patented, property rights were not enforced, in particular between the industry's leaders. According to Julius Eckstein, “Thonet Brothers without any agreement or understanding with Jacob and Joseph Kohn appropriated for years, while it was still running, their patent for the fourfold direct fastening of the back with the seat, although the incontestability of this patent had been proved up to the hilt and put beyond all doubt by numerous actions for breach of patent brought by Jacob and Joseph Kohn against other firms.”²⁸ Thus Kohn, even though it pursued its patent rights against other firms, did permit its main rival in the industry the use of a patented technique. It is difficult to believe that this happened without at least an implicit agreement between the two

²⁶ Exner, *Michael Thonet*.

²⁷ Allen, “Collective Invention.”

²⁸ Eckstein, *Erste Österreichische Actien-Gesellschaft*, pp. 8–9.

firms. Eckstein's claim that there was no such arrangement should be understood in the light of his task as Kohn's historian, to glorify the company and stress its leading position in the industry. On the other hand, patent rights seem to have been pursued against smaller, and typically foreign, firms. An example of the latter practice is the legal dispute between Thonet and the firm Gardner of New York about the compressed-veneer seats, in which Thonet was able to document that it was the first to apply this technique.²⁹

The literature on research cartels establishes that cooperative research behavior achieves higher levels of consumer and producer surplus than non-cooperative research behavior.³⁰ In a competitive environment, research that generates technological spillovers to rival firms is less actively pursued, as firms may free ride on rivals' research. In addition, the enforcement of patent laws prevents the spreading of new techniques, which creates delays in the adoption of new production techniques and thereby slows down the technological progress of the industry. In a cooperative environment, on the other hand, these factors are internalized, enabling growth externalities across firms. A research cartel makes full use of technological spillovers and permits members the use of patented techniques. Taking these factors into account suggests that the returns to research and experimentation are assessed more efficiently under cooperation than under competition.

In the case of the bentwood industry, it was hard or even impossible to keep information on new techniques and products secret. In many instances the products themselves embodied much technical information which could be reproduced easily, while detailed information on the bending technique and bending tools and machines was published in the engineering literature as early as 1873.³¹ Furthermore, bentwood furniture production methods were not highly sophisticated. Even an unskilled worker probably could have described them relatively accurately and in detail. Such workers could have been easily lured by competitors, and their mobility among firms was enhanced by the close geographical location of many firms' factories. It also was not unusual for skilled workers to leave their employers and start their own businesses, as was the case with Alexander Fischel.³²

The locational concentration of the industry in the Habsburg Empire and nearby Central European states was a crucial factor for the occurrence of "collective invention," and needs to be explained. Furthermore, the locational factor sheds new light on the question why bentwood furniture pro-

²⁹ *Die industrielle Verwerthung*, p. 29.

³⁰ Kamien et al., "Research Joint Ventures."

³¹ Exner, *Beiträge*.

³² According to Jaromíra Simoníková (in *D. G. Fischel Söhne*), Alexander Fischel, after learning the bentwood business at Thonet's factory in Koritchan, opened up his own company, the firm D.G. Fischel and Sons, in Niemes (northern Bohemia) in 1870. By the end of the century the firm was producing almost half a million furniture pieces a year.

duction did not flourish in other countries, and in particular not in the United States. As with many other industries, the initial location of the industry with Michael Thonet's relocation from Germany to Vienna is best characterized as a historical accident.³³ On the other hand, the evolution and expansion of the industry with the location of the main industry leaders in a small geographic area is a phenomenon common to a number of industries. Krugman identifies three main reasons for localization, some of which we have mentioned before.³⁴ First, the concentration of a number of firms in the same geographic space, an industrial center, creates a pooled market for workers with special skills, benefitting both workers and firms. Second, an industrial center allows provision of nontraded inputs specific to an industry in greater variety and at lower cost. Finally, because information flows more easily locally than over greater distances, an industrial center facilitates technological spillovers. All these factors played an important role in the development of the Austro-Hungarian bentwood industry and may have made a relocation to other countries, especially distant ones, difficult. We should probably emphasize the second reason. Bentwood furniture production relied crucially on the use of specialized bending machines which were also required in large quantities as each furniture component had to remain bent, aided by these machines, for a significant amount of time in order to acquire the desired shape. The establishment of plants for the production of these industry-specific inputs probably required a large sunk cost, the recovery of which in turn required the existence of a large enough scale of production for bentwood furniture. Furthermore, these bending machines, made of iron, were heavy and thus costly to export to great distances.

Price Fixing, Entry, and Price Wars

The apparent cooperative behavior of the Austrian bentwood firms was not limited to research and development. In this section we present evidence on collusive pricing practices, and summarize the interaction of the industry's leaders, which characterizes the evolution of the industry.

With the termination of Thonet's patent in 1869, its monopoly position ended and a wave of firms entered the industry. Thonet's market share gradually declined and soon dropped below 50 percent. Entrants typically remained relatively small in scale. The only exception was Kohn, which entered with a production scale similar to Thonet.

There is no evidence that Thonet fought entrants with aggressive pricing policies. Indeed, the firm's catalogues indicate that most of the individual items' nominal prices did not change during the transition from monopoly

³³ Krugman, *Geography*.

³⁴ *Ibid.*, p. 36.

to oligopoly. Moreover, Thonet's catalogue prices remained constant for the next thirty years, a period characterized by a constant and even falling general price level.³⁵ A possible explanation for the constancy of Thonet's nominal prices may be price-fixing behavior in the industry, which agrees well with the regulative practices that distinguished the political and economic organization of Central European countries. Furthermore, there are many instances of cartel formations in the Empire during the nineteenth and especially the twentieth century.³⁶ The conjecture of collusion in the bentwood industry is substantiated by contemporary publications reporting a number of incidences of the breakdown and reestablishment of price agreements after the turn of the century.

During the nineteenth century there is evidence on cooperative pricing in newly entered export markets or in regions hit by a depression. In these cases reduced prices were offered in order to increase the share of bentwood furniture in the furniture market. Industry publications indicate that during the 1890s recession in the United States, Spain, and Portugal, the bentwood companies reacted with very low prices in order to keep their share in the furniture market.³⁷ This claim is also reflected in the Austro-Hungarian export prices. Figure 2 depicts the real average export prices for the United States and Germany.³⁸ Notice the drop of about 10 percent between 1894 and 1897. At the same time the export quantities for the United States surged, with an increase of about 64 percent per year between 1894 and 1897, on average. In contrast, during that period the export prices toward Germany were increasing (Figure 2) while export quantities increased by 7 percent, on average.³⁹

Potential entrants may, thus, have been attracted by inflated profits due to price fixing. Indeed, a number of additional bentwood companies entered the market between 1870 and 1900 and the total number of firms in the industry reached about 100 in 1900.⁴⁰

At the beginning of the twentieth century the apparent price stability broke down. Between 1901 and 1906 a price war took place which is documented in contemporary publications.⁴¹ Figure 3 shows the evolution of average export prices (in both nominal and real terms) for the period 1895 to 1913. Notice the decline of approximately 15 percent between 1901 and

³⁵ *Geschichte und Ergebnisse*, pp. 676–79.

³⁶ Good, *Economic Rise*, pp. 218–36.

³⁷ *Bericht*, pp. 123–24.

³⁸ For the transformation of our data in real terms, we used the *Index der Verbraucherpreise 1800–1914* (from *Geschichte und Ergebnisse*, pp. 676–79), a general price index for the Empire constructed by the Austrian Central Statistical Office, which uses 1914 as base year.

³⁹ This point must be viewed with caution, since lower average price may reflect a different composition of sales, for example the less expensive items, before and after the recession.

⁴⁰ Ostergard, *Bent Wood*, pp. 333–41.

⁴¹ “[J. J. Kohn] were certainly not prepared to carry on the fight with their rivals with the weapon of reduced prices . . .” In Eckstein, *Erste Österreichische Actien-Gesellschaft*, p. 9.

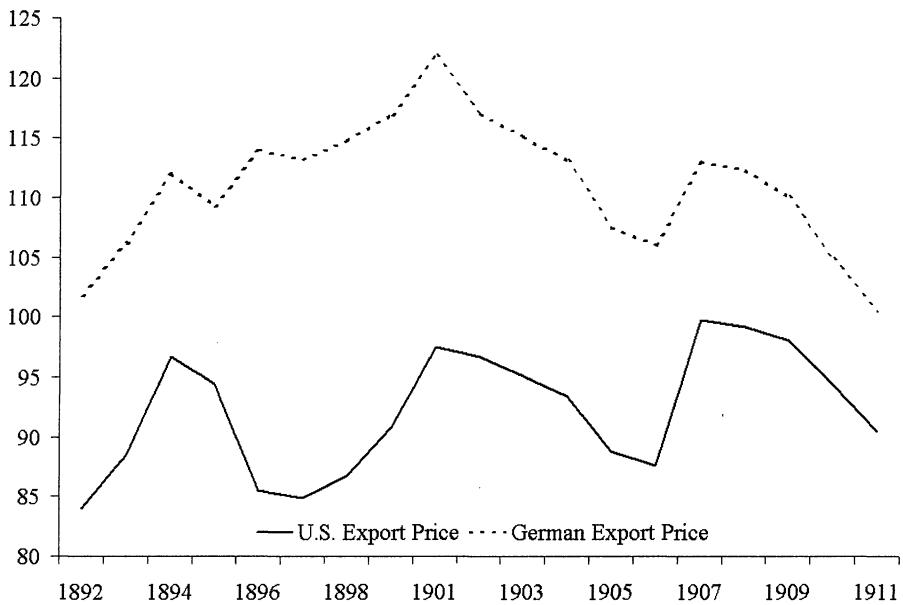


FIGURE 2
INDEX OF REAL EXPORT PRICES: GERMANY AND UNITED STATES

Note: For a description of the data transformation in real terms, see note 38.

Source: *Statistik des auswärtigen Handels des Vertragszollgebietes der beiden Staaten der Österreichisch-Ungarischen Monarchie*.

1906 in the real price. The export prices toward different countries reveal the same pattern (see Figure 2).

There are at least two possible explanations for the occurrence of a price war. First, the incumbent firms, dissatisfied with the erosion of their market shares, may decide to fight entrants. Second, as the theory of Green and Porter predicts, negative demand shocks may trigger a price war.⁴² There is no evidence for the first hypothesis. In fact, Thonet's records indicate that the company did not take an aggressive position in this first price war. Its average real price for chairs in 1905 was only 2 percent below the level of 1899. Similarly, Kohn's financial reports indicate that during the year 1904 the company kept its prices fixed although these levels were undercut by competitors.⁴³ There is, however, evidence for the second hypothesis. During the first years of the twentieth century the Habsburg Empire experienced economic stagnation, which may have caused a decrease in the domestic demand for bentwood furniture.⁴⁴ Furthermore, in 1901 exports toward Germany dropped by 60

⁴² Green and Porter, "Noncooperative Collusion."

⁴³ Financial report for J. J. Kohn in 1904, in *Compass* 1906, p. 608.

⁴⁴ Good, *Economic Rise*, p. 180.

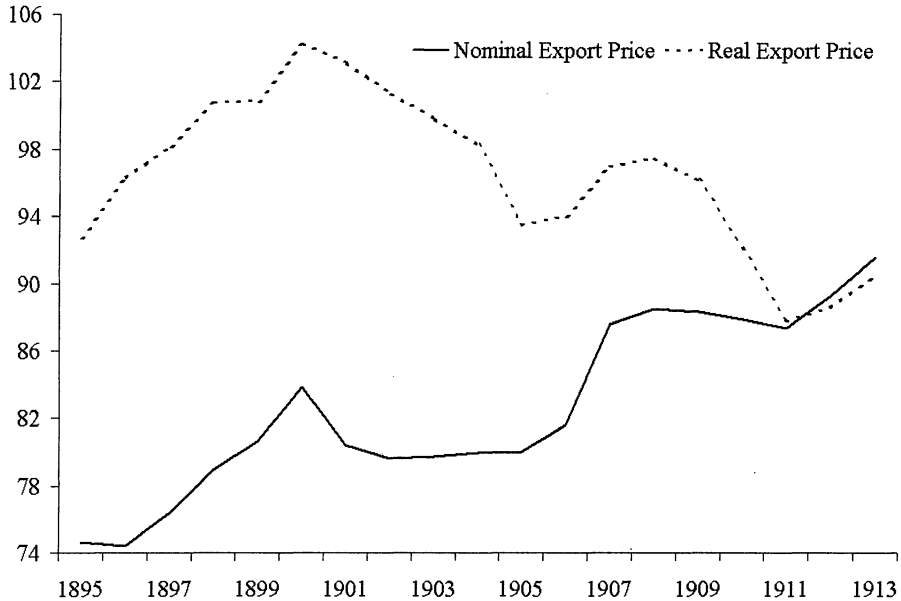


FIGURE 3
INDEX OF EXPORT PRICES

Note: For a description of the data transformation in real terms see note 38.

Source: *Statistik des auswärtigen Handels des Vertragszollgebietes der beiden Staaten der Österreichisch-Ungarischen Monarchie*.

percent, indicating a significant negative demand shock.⁴⁵ Companies, only observing their own sales, may have interpreted these demand reductions as the result of cheating on the price agreement by competitors, and in reaction lowered their own prices, triggering a general price war.

Around 1904 bentwood furniture sales recovered and a period of substantial growth started. Yet, this recovery of sales was not accompanied by the recovery of prices. Prices remained at low levels until about 1906, evident in Figure 3.⁴⁶ The price competition resulted in a shakeout in the industry over the next five years. Many firms were forced into bankruptcy or merged with other firms, as was the case of Mundus, in order to survive.

⁴⁵ The drop in demand from Germany may have been due to an increase in the tariff on bentwood furniture. Graham Dry (in Ostergard, *Bent Wood*, pp. 86–87) reports that in 1900 German bentwood manufacturers, who were becoming increasingly active in the industry, petitioned for a raise in the tariff on Austrian furniture imports. As a result the German government doubled the tariff. Although some of these demand reductions may have been expected, the large magnitudes of these reductions probably exceeded all expectations. In addition, there are theories (see for example Bagwell and Staiger, “Collusion”) predicting that cartel break downs are more likely during recessions than during booms.

⁴⁶ *Compass*, 1906, p. 608.

In 1907 the bentwood companies made an attempt to fix prices once again. On 24 and 25 May 1907 there was “a meeting of ‘all’ Austrian, German, Hungarian and Swiss bentwood furniture companies in Dresden, Germany, where the firms agreed on a joint regulation of prices, and specifically to follow the pricing strategies of Thonet Brothers and J. J. Kohn.”⁴⁷ Between May 1907 and June 1909, the newly constituted price cartel achieved price increases, as indicated by the approximately 10 percent increase in the nominal average export price and a 3 percent increase in the real average export price (see Figure 3).

In 1909 the price cartel broke down again, and a second price war was fought. Thonet took a more aggressive position during this price war than during the first. Its real average price was 20 percent lower between 1905 and 1909. The company’s records also indicate that on 13 July 1909 Thonet issued a statement in the company’s internal correspondence that they would meet their competitors’ prices.⁴⁸ At the beginning of this price war Kohn was already in financial difficulties.⁴⁹ The company subsequently went bankrupt and merged with Mundus in 1914. After that price agreements were reestablished, initially for overseas markets and later also for Europe. In 1910 almost all Austro-Hungarian bentwood companies joined a price and condition cartel for overseas export markets.⁵⁰ In 1912 several bentwood companies again agreed to fix prices in Europe.⁵¹ The participants in the European agreement were Thonet, Fischel, Kohn, Mundus, and three German firms. Between 1912 and 1914 the cartel achieved substantial price increases.

Summarizing, we find that during the nineteenth century there was substantial entry into the bentwood industry. There is no evidence that the incumbent firms aimed at deterring or fighting entry into the industry with aggressive pricing policies. In contrast, prices remained fixed for extended periods of time. In the beginning of the twentieth century, however, collusive price agreements were successful only for short periods of time. Price wars occurred for extended periods of time. The price competition led to exit and restructuring in the industry prior to the outbreak of World War I.

CONCLUSIONS

The bentwood furniture industry of the Habsburg Empire stands out among the world furniture manufacturing sector of the second half of the nineteenth century. Early mechanization, product standardization, and inter-

⁴⁷ Letter of the Swiss bentwood furniture company, A. G. Moebelfabrik Horgen-Glarus in Horgen, 15 June 1907.

⁴⁸ *Thonet Anzeiger* (1909), internal correspondence of Thonet Brothers.

⁴⁹ *Compass*, 1909 and 1910.

⁵⁰ *Compass*, 1911 and 1914.

⁵¹ *Compass*, 1913.

changeability of parts led to mass production, the first to occur in the furniture industry. Innovative technologies and marketing policies enabled the bentwood companies to reach a world market, a remarkable achievement in the traditionally local furniture market of the nineteenth century.

The success of the large bentwood companies, Thonet and Kohn, may be explained by their investment in large-scale production facilities and an international distribution network that allowed them to successfully compete in the world furniture market. The size and extent of their operations indicate the presence of a managerial hierarchy for monitoring and directing the two main functional activities. This three-pronged investment in production, distribution, and management clearly identifies them as important examples of the modern industrial enterprise and as remarkable exceptions to the traditionally operating furniture sector of their time.

An important feature of the bentwood industry was the strong pattern of cooperation among the firms, both in research and development of new products and techniques and in their pricing behavior. For almost 40 years this cooperation may have created growth externalities and enabled the rapid growth of the industry, leading to its strong position in the world furniture market.

Finally, the successful story of the bentwood industry suggests important implications for the evaluation of the economic performance of the Habsburg Empire in the nineteenth century. The pioneering work of David Good and John Komlos established that the Empire was an economic unity with integrated markets and substantial interregional trade.⁵² The case of the bentwood furniture industry complements their findings at a microeconomic level. In this case the Habsburg Empire was not an imitator or follower of modern industrialized countries but actually a leader in technological and industrial advancement.

Appendix: Data Sources

Data on bentwood furniture exports from the Habsburg Empire are available for the years 1888 to 1914 in the volumes of the *Statistik des auswärtigen Handels des Vertragszollgebietes der beiden Staaten der Österreichisch-Ungarischen Monarchie* at the library of the Austrian *Statistische Zentralamt* (Central Statistical Office) in Vienna. These include 27 yearly observations on total quantity (in 100 kilograms) and value (in kronen) of bentwood furniture exports. In particular, for a number of years they contain individual observations per country of destination. We were thus able to construct a time series of average export prices for the world market, as well as for individual markets.

Data on Thonet were obtained from copies of original company records in the possession of Peter W. Ellenberg.⁵³ These provided us with yearly observations on output (number of furniture pieces produced), value of sales, quantity of materials used in the production process (cane, glue, screws), and number of workers and clerks, both for the company as a whole, and

⁵² See Good, *Economic Rise*; and Komlos, *Habsburg Empire and Economic Development*.

⁵³ Address: Innsbrucker Str. 87, 7800 Freiburg, Germany.

for five of its factories. In many cases we also have data on the composition of output in terms of different furniture types (for example chairs) and models (for example "Chair No. 14"). Unfortunately, there are many missing observations; none of the series are complete.

For the companies of J. J. Kohn and Mundus we obtained official accounting information from *Compass*, a yearly publication on all publicly held companies in the Habsburg Empire, available at the library of the *Handelskammer* in Vienna.

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