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Otto Hwaletz. *Die Ö¶sterreichische Montanindustrie im 19. und 20. Jahrhundert.* Vienna: BÖ¶hlau Verlag, 2001. 379 pp. EUR 71.70 (paper), ISBN 978-3-205-99086-4.

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A Surfeit of Numbers on the History of Austrian Iron-Making

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Iron and steel production have long played an important role in Austrian economic development. In consequence, the industry's history is covered by a substantial number of, scholarly and popular, writings. Hlawetz has added to this literature by exploiting rich, and previously underutilized, data bases in order to provide a detailed statistical portrayal of the evolution of a portion of one of the Austrian economy's key sectors. The presentation is divided into three main sections. The first covers coal mining, iron-ore mining and the production of pig iron, with heavy emphasis on the years 1875-1917 as well as the First Republic. The second section deals with the fortunes of the largest enterprise, the *Oesterreichische Alpine Montangesellschaft* (*Alpine*, for short) from its founding in 1882 to the *Anschluss*. In the much shorter, third section, the main findings are summarized and placed into the context of the economy's overall growth and cyclical behavior.

Well over half of the book's pages are taken up by graphs and tables. On my count, there are 238 (mostly time series) diagrams in Section I,followed by 59 pages of statistical tables. Section II comprises 143 diagrams and 13 pages of tables, and Section III, 51 diagrams, interspersed with some smaller tables. Clearly, what would be considered illustrative material in most historical accounts here makes up the main body of the work. Hwaletz deserves credit for the diligence with which he has collected and presented this mass of data; however, they also tend to overwhelm the reader, especially since the author's text frequently does no more than describe what the diagrams are meant to show. Therefore, it may be best to think of the book as a useful complement to more comprehensive, theory-based accounts of the industry's growth. These are matters to which I shall return below.

I stated at the outset that the work covers only a portion of the *Montanindustrie*, as that term is normally understood. In order to substantiate this claim, I must present a brief survey for readers unfamiliar with the evolution of the industry's technology [1]. The author focusses almost exclusively on the first steps in the production chain, the mining of basic input materials (iron ore, coal) and the manufacture of pig iron (*Roheisen*) in blast furnaces. The nineteenth century saw the gradual substitution of coke for charcoal in this process. Lignite (*Braunkohle*), of which the territory of what is now the Republic of Austria had relatively plentiful supplies, is unsuited to the making of coke. The study covers data on lignite mining in some detail, but this material is peripheral to the story of iron-making. Coking coal (*Steinkohle*) requirements could be met only through imports. The shift in technique also meant that many of the small iron works that relied on the surrounding forests to supply charcoal material were forced out of business. The author briefly touches on these matters in an international comparison of blast-furnace performance (p. 33), but he does not pursue their implications.

A second, much more important change, occured in the further processing of pig iron, which is, after all, only an intermediate input. Until well past the middle of the nineteenth century, most iron was converted directly into finished products. Only a proportion was turned into steel, mainly by means of the puddling process, which was small-scale and suffered from quality problems. This changed radically with the introduction of the Bessemer, Thomas and Siemens-Martin (open-hearth) processes. They made possible steel production on a much larger, more efficient scale, and with better metallurgical control.

As a result, the role of pig iron changed radically: instead of being turned into finished products, increasing amounts became inputs into the steel-making segment. The author's data on the output of the *Alpine*, one of the few places in which he deals explicitly with steel, reflect

this change (pp. 309-10). In 1882, the ratio of pig iron production to ingot (raw steel) production was roughly 2.2:1; by 1902, the ratio had dropped to 1.4:1; and in 1922 to 1.1:1. In the 1930s, the ratio dropped below 1:1, most likely suggesting an increased use of scrap as an input for steel-making. The result was, in any event, that iron became more and more of a purely intermediate input, and that an enterprise's ultimate performance depended progressively on its ability to turn out competitive steel-mill products. It is not at all clear, therefore, what the calculations that relate (total?) labor and capital inputs to pig iron output are intended to measure. The author expresses some puzzlement, for example, over the much sharper rise in the productivity of the ingot and rolling segments, especially from 1882 to 1917, as compared to aggregate productivity change (pp. 239-40). Given the above observations on the impact of major technical innovations, this hardly comes as a surprise.

Another consequence of these developments was that steel-making itself evolved into two distinct segments: on the one hand, the production of so-called commercial-grade steels (*Kommerzstaehle*), and on the other, of specialty or alloy steel (*Edelstahl*). In pre-World War II Austria, the *Alpine's* Donawitz works produced the bulk of the former, while smaller firms like Boehler and Schoeller-Bleckman concentrated on specialty steels. An additional effect of continuous advances in metallurgy and process control was that many steels originally considered specialty products could later be turned out on a commercial scale. Commercial-steel capacity was to be increased substantially after the Anschluss, by the construction of the *Hermann Goering-Werke* (renamed *VOeEST* after the war) in Linz. These, however, were not completed until the late 1940s and early 1950s.

This very cursory sketch would not be complete without mention of the Basic Oxygen Process (L-D Process), the Austrian innovation that revolutionized large-scale steel making. First introduced in the early 1950s in Linz and Donawitz (hence the Austrian designation, L-D), the process was soon adopted by enterprises across the globe. Similarly, Austrian works were among the pioneers in the introduction of the continuous casting (*Strangguss*) process, by which molten steel is turned directly into rolled products, thus obviating the ingot stage.

In my opinion, these matters deserve mention in a history of the Austrian industry, not only because they underscore some remarkable technological and structural developments behind the author's bare statistics, but also because they show that a small steel economy can achieve significance well beyond its global capacity and output shares.

This brings me to an additional observation: Thorough as the work's statistical explorations are in other respects, the author fails to deal in any detail with a further crucial aspect of the industry's development: its involvement in foreign trade. Exports and imports played an important role even before the Monarchy's demise. They assumed much greater significance for the First and Second Republics. The relevant data for the interwar period can be found in the publications of the *Statistisches Zentralamt.* [2] The first two decades of the post-World War II period were analyzed by Kleiner. [3] In the context of Hwaletz's concern with pig iron production, the following observations are relevant: domestic ores, which came almost exclusively from the famous Erzberg deposits, suffered from a low tenor (Fe content) of between 30 and 35 per cent. This made their mining and processing steadily less competitive. As a consequence, since World War II, the blast furnace segment has had to rely increasingly on imports of high-grade ores from sources like Brazil and Russia. Mining at the Erzberg was eventually shut down.

I trust that these remarks are not taken as a suggestion that Hwaletz should have written another book. Rather they point to the omission of factors that might have greatly strengthened the explanatory power of his account.

I turn now to a consideration of the statistical work as such. The major merit of Section I is its detailed description of regional developments in the Austro-Hungarian Monarchy. The author first shows that iron-making in Hungary lagged well behind Cisleithania and never amounted to more than a quarter of total output. He then divides Cisleithania into a "Northern Group" (Bohemia, Moravia, Silesia) and a "Southern Group" (essentially the territory of the present Republic). For virtually the whole period from 1875 to the end of the World War, Styria was the most important producer, in the later years accounting for over one-third of the Monarchy's output of pig iron. Bohemia and Moravia followed close behind. In the Southern Group, the decline to insignificance of Carinthia, which at one time produced as much as 16 per cent of the total, is noteworthy, as are the minimal, and shrinking, contributions of Tirol, Salzburg and Lower Austria. The process of regional concentration was no doubt hastened by the exhaustion of marginal ore deposits in these provinces, together with the decline of small-scale production triggered by the shift from charcoal to coke.

Total pig-iron production in Cisleithania more than

quadrupled in the four decades, 1834-1873, from 85,000 tons to 371,00 tons (p. 165). It then quintupled again in the following forty years, to 1,760,000 tons in 1912 (p. 166). During this latter period, output per blast furnace in operation rose from 2,890 tons annually to approximately 63,000 tons (p. 168). Output per employee increased from 35 tons/year to 297 tons. These latter numbers reflect remarkable progress in both technology and the scale of operations.

Production in the First Republic never reached the levels achieved in the analogous territory before World War I (p. 193). In the peak year, 1929, 459,000 tons of pig iron were turned out, as compared to 607,000 in 1913. The worldwide depression hit the industry hard, with output dropping to 88,000 tons in 1933. By 1937, the last full year of independence, it had recovered to 388,000 tons.

During World War II, the demands of the German armament economy pushed output to a 1943 peak of 961,000 tons. Postwar recovery was surprisingly rapid, thanks in good part to the completion of the Linz works, under the European Recovery Program. By 1951, it had reached over 1 million tons, and by the late 1960s it stood close to 2.5 million tons (p. 199). It is worth noting that these figures far exceeded the pig-iron capacities contemplated in the original reconstruction plans. The same was true for steel capacity. Combined with a number of structural problems and the declining competitiveness of Erzberg ores, these relatively large capacities meant that the government, formal owner of the (almost) fully nationalized iron and steel industry, was confronted by a repetitive series of *Stahlkrisen*.

These are the basic outlines of the story, in quantitative terms. What the author has done is to turn the interesting details of this story into the virtually impenetrable maze of diagrams to which I have referred at the outset. He presents absolute figures, converts these into numerous indexes and percentages, and then speculates about their meaning. Since the diagrams typically take up over half of each page, there really is not much room for extended discussion. Greater selectivity in deciding which of the time series reflect phenomena truly relevant to the telling of the story, and according them lengthier commentaries, would certainly have helped.

Many of the diagrams are bound to perplex the careful reader. A complete list of the various lapses would exceed the limitations of a review. Therefore, some random examples must suffice. Graphik 19 (p. 113), concerning Carinthian ore mining, is designated "Arbeiter je Betrieb in % von Zisleithanien." The time series starts at around 200, in the early 1870s, rises as high as 900 and eventually drops to around 100. Taken at face value, the label is obviously misleading. I suppose the chart is meant to compare the number of workers per Carinthian establishment with the average for all Cisleithanian establishments. But that is surely not what the legend states. In a similar vein, Graphik 11, "Anteile der Produktion von Roheisen an der im Gebiet der Republik Oesterreich 1911-1937" (p.230), purports to show the share of the *Alpine* in total Austrian pig iron production. According to the diagram, this share rose above 100 per cent in the early 1930s!

Occasionally, the author seems to misinterpret what his data show. Just one example: on p. 57, he discusses the implications of varying capacity utilization in Bohemia on the basis of Graphik 89, "Kapazitaetsauslastung in % Zisleithaniens". But this diagram shows capacity utilization as a percentage of Cisleithania – which, of course, relates it only to utilization in all regions. Even if capacity utilization in Bohemia were to fall in absolute terms, but less so than in Cisleithania as a whole, the diagram would show an increase in the percentage!

Let me mention one final example of the notorious difficulties in interpreting ratios and percentages. Comparing the performance of the Austrian and German industry, from 1911 to 1937, the author presents Graphik 137 (p. 85), "Produktivitaetsvergleich (je Arbeiter, Betriebswoche und betriebenem Hochofen)." Aside from the fact that this crowds a lot of data into one small diagram, the interpretation of any such comparisons must be tempered by the fact that Austrian blast-furnace capacity amounted to between four and six per cent of Germany's. But then comes the rub: although this is not stated anywhere, the annual figures for Austria are obviously obtained by taking the annual German ones as baselines (= 100). Since German productivity surely did not stay constant over this period, we are dealing with a moving target; what I take the diagram really to show is changes in Austrian productivity, relative to changes in Germany.

There is no point in extending the list of such problems. In my judgment, the author has diminished the value of his work by falling prey to what has been called "the computer's curse." Modern technology enables one, with minimal effort, to manipulate data and convert them into impressive-looking pictures, without attention to their informational substance.[4] "Milking" data bases and "letting the numbers speak for themselves" should not be substitutes for the traditional practice of constructing some tentative hypotheses or conjectures, which can then serve as a framework for selecting and

interpreting relevant data.

Despite all of these critical observations, I want to repeat what I stated at the outset: I regard Hwaletz's compendium of statistics, especially the tables of his source data, as a complement to other studies of the Austrian iron and steel industry; however, the absence of a list of diagrams and tables, as well as of an index, limits its usefulness to scholars even in this respect.

Notes:

[1]. Still one of the best, brief historical accounts of developments in the Austrian industry is Hans Malzacher, *Oesterreichs Eisen in Vergangenheit und Zukunft* (Linz: Wirtschaftswissenschaftliche Gesellschaft fuer Oberoesterreich, 1951).

[2]. Oesterreichisches Statistisches Zentralamt, *Der Aussenhandel Oesterreichs in der Zeit zwischen den beiden Weltkriegen* (Beitraege zur oesterreichischen Statistik 1946.1, Vienna 1946).

[3]. Otmar Kleiner, *Oesterreichs Eisen- und Stahlindustrie und ihre Aussenhandelsverflechtung* (Wiener geographische Schriften 31/32, Vienna: Hirt, 1969).

[4]. A very useful guide for the avoidance of this methodological trap is Edward R. Tufte, *The Visual Display of Quantitative Information* (Cheshire, Conn.: Graphics Press, 1983).

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