THE ECONOMIC DEVELOPMENT OF AUSTRIA-HUNGARY'S MACHINE-BUILDING INDUSTRY, 1870-1913

Max-Stephan Schulze

A thesis submitted for the degree of
Doctor of Philosophy

The London School of Economics & Political Science
University of London

Abstract

This thesis examines the economic development of industrial engineering in Austria-Hungary between 1870 and 1913.

The pattern of sectoral change in Austria's machine-building industry is investigated in Chapter Two. New output estimates indicate that mechanical engineering took a course quite different from that suggested in recent historiography. Austria's capital goods sector was subject to prolonged stagnation during the "Great Depression" of the 1870s and 1880s. But during the subsequent two decades mechanical engineering made a large and rising contribution to overall industrial growth.

Chapter Three is concerned with the rise of industrial machine-building in Hungary. Based on new output estimates, the chapter traces the phases and origins of a process which accounted for a markedly faster expansion of mechanical engineering than in the Western half of the Habsburg Empire.

Chapter Four provides an analysis of the financial and investment behaviour of major machine-building firms. The growth of companies, the pattern of their investment, the volume and forms of finance varied significantly between firms and over time. The main factors accounting for differential rates of company growth were the diverging development of demand in the various machine-building branches, the impact of the business cycles in Austria and Hungary, and individual firms' preparedness to pursue external expansion.

The structure, volume, and direction of the Habsburg Monarchy's trade in machinery are examined in Chapter Five. The study of import tariffs and input price diffentials yields results which suggest that, after the turn of the century, the competitive position of Austro-Hungarian engineering was impeded by an inept tariff policy.

The thesis argues that the course of industrial engineering lends strong support to the notion of a "Great Depression" in Austria. Once the depression had been overcome, however, the machine-building industry became one of the two main sectoral sources of growth in industry - despite the effects of an unfavourable tariff policy. Machinery output in Hungary grew at a faster rate than in Austria. Yet its impact on total manufacturing growth was somewhat smaller than in Austria since Hungarian industry as a whole also expanded more rapidly.

Acknowlegements

During my research, I was generously supported by many individuals and institutions. I am particularly grateful to the staff of the Hungarian National Archives in Budapest and the library of the Chamber of Commerce and Trade in Vienna who have been exceedingly patient and kind in dealing with my many requests. I should also like to thank the Austrian National Archives, the Creditanstalt-Bankverein, Voith GmbH, and J.M. Voith AG for access to their records. As a recipient of an Alfred Zauberman Award, an Eileen Power Memorial Studentship and a Michael Postan Award I am grateful for the financial support provided by the London School of Economics.

Professor Iván Berend and Dr Károly Halmos provided invaluable help in the initial stages of the project, offering leads to much of the archival and published material in Hungary. Dr Jochen Liese and Dr Werner Filek-Wittinghausen kindly offered advice on data sources in Austria. I would like to thank them all.

My colleagues and friends at the London School of Economics' Department of Economic History and elsewhere made the writing of the thesis a pleasant and rewarding experience. I would especially like to thank Professor Alan Milward who supervised this project from its beginnings to its completion. I have benefitted greatly from his advice and criticisms. Dr Bob Humphreys deserves special credit for his patience in reading the manuscript. His comments were much appreciated. I am grateful to Dudley Baines who continuously encouraged and supported my graduate work.

My greatest debt, however, is to my family. I owe much to Charlotte, my wife, for her encouragement, advice and good humour. I am grateful for my parents' unfailing trust and generous support. This thesis is dedicated to them.

Contents

List of Figures

List of Tables

List of Abbreviations

AG	Aktiengesellschaft = joint-stock company
AVwA	Österreichisches Staatsarchiv - Allgemeines Verwaltungsarchiv, Vienna
BH	Business History
BHR	Business History Review
CAA	Archiv der Creditanstalt-Bankverein, Vienna
EHR	Economic History Review
fl	Gulden = florins
HK	Handels- und Gewerbekammer
HKB	Bibliothek der Kammer der gewerblichen Wirtschaft für Wien, Vienna
JEEH	Journal of European Economic History
JEH	Journal of Economic History
K	Kronen = Austro-Hungarian crowns
kg	kilograms
M	Mark = German mark
MOL	Magyar Országos Levéltár, Budapest
MSE	Magyar Statisztikai Évkönyv
NHIV	Nachrichten über Industrie, Handel und Verkehr
ÖSH	Österreichisches Statistisches Handbuch
ÖStat	Österreichische Statistik
ÖZBH	Österreichische Zeitschrift für Berg- und Hüttenwesen
RT	részvénytársaság = joint-stock company
SJB	Statistisches Jahrbuch
VSP	J.M. Voith AG, Turbinenbau, St. Pölten/Austria
VWA	Werksarchiv, Voith Gmbh, Heidenheim/Germany

I

INTRODUCTION

The process of industrialization, its timing and pace are the themes which dominate much of recent research and writing in Habsburg economic history[1]. As a quantitative study of the economic development of industrial machine-building in late nineteenth century Austria-Hungary[2], this thesis aims at contributing to the understanding of some of the *sectoral* aspects of industrialization and economic growth.

In fairly general terms, industrialization can be viewed as a process of absolutely and relatively increasing

---

[1] A brief account of the "research boom in Habsburg economic history" is given in the introduction to Good, D.F., *The Economic Rise of the Habsburg Empire, 1750-1914* (Berkeley, Calif., 1984), pp.7-10. Recent monographs in the field include Rudolph, R.L., *Banking and Industrialization in Austria-Hungary: the Role of Banks in the Industrialization of the Czech Crownlands, 1873 - 1914* (Cambridge, 1976); Komlos, J., *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century*, (Princeton, 1983), and *Stature, Nutrition, and Economic Development in the Eighteenth Century Habsburg Monarchy: The 'Austrian' Model of the Industrial Revolution* (Princeton, 1989). Most recently David Good examined Alexander Gerschenkron's work in the light of Austria-Hungary's industrialization experience; see his "Austria-Hungary", *Patterns of European Industrialization. The Nineteenth Century*, eds. R. Sylla and G. Toniolo (London, 1991), pp.218-247.

[2] Austria-Hungary and the Habsburg Empire are used interchangeably with reference to the territory controlled by the Habsburgs until the end of World War I. The *Ausgleich* of 1867 established the so-called Dual Monarchy. The Empire was split into two relatively autonomous parts with one capital in Vienna and the other in Budapest: Austria (Cisleithania) and Hungary (Transleithania). Most scholars use these rather than the more cumbersome, official names.

utilization of capital; the share of the two other factors of production, labour and land, is decreasing over time[3]. The machine-building industry is, then, a key sector for its "output constitutes replacement of or additions to the economy's stock of physical capital"[4]. Indeed, recently presented evidence suggests not only a close long-run association between machinery investment and productivity growth at the macro level, but also the likely direction of causality: to a large extent, the argument runs, output per worker rose in the past *because* of high rates of investment in machinery[5]. Viewed in this light, rising expenditure on capital goods appears not as a mere concomitant of economic expansion but as a strategic factor accounting for growth.

However, surprisingly little attention has been focused so far on Austria-Hungary's capital goods sector. On the eve of World War I, Austria-Hungary's machine-building industry ranked amongst the leading producers of the world in terms of total output and employment, surpassed only by the United States, Britain, and Germany[6]. But studies

---

[3] Reitschuler, S., *Die Stellung der Maschinenindustrie im Prozeß der Industrialisierung* (Cologne and Opladen, 1963), p.31.

[4] Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), p.143.

[5] De Long, J.B., "Productivity Growth and Machinery Investment: A Long-Run Look, 1870-1980", *JEH* 52 (1992) No.2, pp.307-324.

[6] Verein Deutscher Maschinenbau-Anstalten, *Denkschrift über die Maschinenindustrie der Welt. Bestimmt für das Kommittee B des vorbereitenden Ausschusses der internationalen Wirtschaftskonferenz des Völkerbundes* (Berlin, 1926), pp.22, 26. Russia is ranked fourth and Austria-Hungary fifth in terms of engineering employment and production. But the data reproduced in this source clearly refer only to Austria proper; they correspond exactly to figures provided in other sources. If output and employment in Hungarian machine-building are added to the respective figures for Austria, then the combined total is well above the level of Russian output, but still slightly below

comparable in scope to those of Saul and Floud for Britain[7] or the work of Barth, Schröter, and Becker on the German machine-building industry[8] have not been produced for engineering in the Habsburg Empire[9]. The aim of this thesis is to close at least part of this apparent gap in the literature. Its focus is on the economic development of mechanical engineering[10]. Electrical engineering was

---

Russia's level of employment. It seems particularly surprising that France should have had a smaller machine-building sector than Austria-Hungary. But the figures reproduced in the *Denkschrift* are implicitly confirmed by Lévy-Leboyer and Lescure who point out that in 1913 French production of machinery represented only 6 per cent of the combined output of Britain and Germany and less than 5 per cent of that of the United States; Lévy-Leboyer, M., and Lescure, M., "France", *Patterns of European Industrialization*, eds. Sylla and Toniolo, p.157. These percentages match with the data reproduced in the *Denkschrift*.

[7] Saul, S.B., "The Market and the Development of the Mechanical Engineering Industries in Britain, 1890-1914", *EHR* 2nd ser. XX (1967) No.1, pp.111-130, and "The Machine-Tool Industry in Britain to 1914", *BH* 10 (1968) No.1, pp.22-43; Floud, R.C., *The British Machine-Tool Industry 1850-1914* (Cambridge, 1976).

[8] Barth, E., *Entwicklungslininen der deutschen Maschinenbauindustrie von 1870 bis 1914* (Berlin, 1973); Schröter, A., "Die Entstehung der deutschen Maschinenbauindustrie in der ersten Hälfte des 19. Jahrhunderts", A. Schröter and W. Becker, *Die deutsche Maschinenbauindustrie in der industriellen Revolution* (Berlin, 1962), pp.11-133; and, in the same volume, Becker, W., "Die Entwicklung der deutschen Maschinenbauindustrie von 1850 bis 1870", pp.135-285.

[9] An exception is Arnost Klíma's "The Beginnings of the Machine-Building Industry in the Czech Lands in the First Half of the 19th Century", *JEEH* 4 (1975) No.1, pp.49-78.

[10] Occasional reference is also made to closely related engineering branches, especially the production of railway cars which was often carried out by firms otherwise active in mechanical engineering. Because of the heterogeneity of the engineering sector's output there was no uniform usage or definition of the term *machine-building* at the time. However, reflecting this heterogeneity, the organizational structure of the German machine-builders' association can serve to illustrate the scope of what throughout the thesis will be referred to as mechanical engineering. The

already perceived by contemporaries as a new, separate branch distinctly different from classical machine-building; it is, therefore, left aside in this study[11]. The same holds for motor car manufacturing which as an industry emerged only towards the end of the period under review[12].

The course of analysis is organized in five chapters. Chapter II outlines sectoral change in Austria's machine-building industry. New output estimates are employed to determine the phases of expansion and contraction in Austrian machinery production and to assess the industry's

---

association was organized in thirteen divisons relating to major product groups (each of them composed of several sub-groups):

I machine tools
II textile machines
III agricultural machines and implements
IV locomotives
V power machines
VI working machinery
VII plant equipment and machinery for iron and steel works and rolling mills
VIII mechanical conveyors (cranes, lifts, elevators, etc.) and scales
IX machinery for the paper-making and graphical industries
X machinery for the food processing and chemical industries
XI dressing/separation and crushing machines
XII special machines and machinery parts
XIII apparatus

Verein Deutscher Maschinenbau-Anstalten, *Denkschrift über die Maschinenindustrie*, p.63. This grouping is in accordance with the contemporary description of the sector by Fischer, H., "Die Maschinenindustrie in Österreich", *Die Groß-Industrie Österreichs*, vol.I (Vienna, 1908), pp.99-105.

[11] Kareis, J., "Elektrotechnik", *Entwicklung von Industrie und Gewerbe in Österreich in den Jahren 1848 - 1888*, eds. Commission der Jubiläums-Gewerbe-Ausstellung, (Vienna, 1888), pp.274-305; Zickler, C., "Die elektrotechnische Industrie", *Die Groß-Industrie Österreichs*, vol.III (Vienna, 1898), pp.175-190.

[12] Matis, H. and Bachinger, K., "Österreichs industrielle Entwicklung", *Die Habsburger Monarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.184-185.

performance during and after the Great Depression of the 1870s and 1880s. The value of output, the number and size of engineering firms, the workforce employed, the regional allocation of the industry, the pattern of product specialization, sectoral productivity, and the respective changes over time are the problems focused on.

Chapter III examines, in a similar fashion, the emergence and expansion of industrial machine-building in Hungary. Again, new output estimates are used to trace the industry's advancement in the late nineteenth century.

The fourth chapter complements the previous discussion of overall sectoral development with a less aggregate analysis of the financial and investment behaviour of machine-building firms in Austria and Hungary. It outlines the processes of internal and external company growth which were associated with changes in the demand for capital and in the provision of funds. Annual balance-sheet data derived from a sample of eight leading engineering joint-stock companies are used to examine these changes over time and the diverging experience of individual firms.

In Chapter V, the economic development of Austria-Hungary's machine-building industry is placed in its international context. This chapter is concerned with the structure, volume, and direction of the Habsburg Monarchy's trade in machinery and the associated intertemporal changes. The competitive position of Austro-Hungarian machine-building is examined in the light of input price differentials and the tariff structure.

In the concluding chapter of this thesis, the results derived in the previous chapters are put into a broader perspective. It is concerned with the machine-building industry's relevance for economic growth and the process of industrialization in late nineeteenth century Austria-Hungary.

II

THE MACHINE-BUILDING INDUSTRY IN AUSTRIA: AN OUTLINE OF SECTORAL DEVELOPMENT

1. Phases of Expansion and Contraction

In 1870, Austria's machine-building industry produced machinery worth approximately 90 million crowns. By 1912, the gross value of the industry's annual output had reached a level of almost 650 million crowns in current prices[1]. The four and a half decades between the Austro-Hungarian Compromise of 1867 and the outbreak of World War I, clearly, were a time of rapid expansion in mechanical engineering. Over the period as a whole the machine-building industry grew faster than most other branches of industry (Tables II.1 and II.2)[2]. But, irrespectively, the new estimates presented here suggest that output in Austrian machine-building expanded at a rate well below the level previously assumed. This holds for the whole period 1870 to 1913 as well as for shorter intervals therein. It will be shown below that growth in industrial engineering was volatile and often discontinuous. Phases of vigorous growth in production alternated with periods of stagnation

---

[1] For the new estimates of Austrian machine-building output, the methods employed and the data used in their derivation and a critique of earlier attempts to approximate production see Appendix A. Estimates of machinery output in both current and constant (1913) prices are reproduced in Appendix A, Table A.13, columns (1) and (2).

[2] For a sectoral breakdown of Austria's manufacturing production see Komlos, J., *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century* (Princeton, 1983), Appendix E, Table E.6.

and even absolute contraction[3].

Table II.1

COMPOUND RATES OF GROWTH OF MACHINERY PRODUCTION IN CONSTANT 1913 PRICES (PER CENT PER ANNUM)

1870-1913	4.49	1890-1900	6.65
1870-1880	1.86	1900-1913	4.05
1880-1890	5.60		

Peak-to-peak measures:

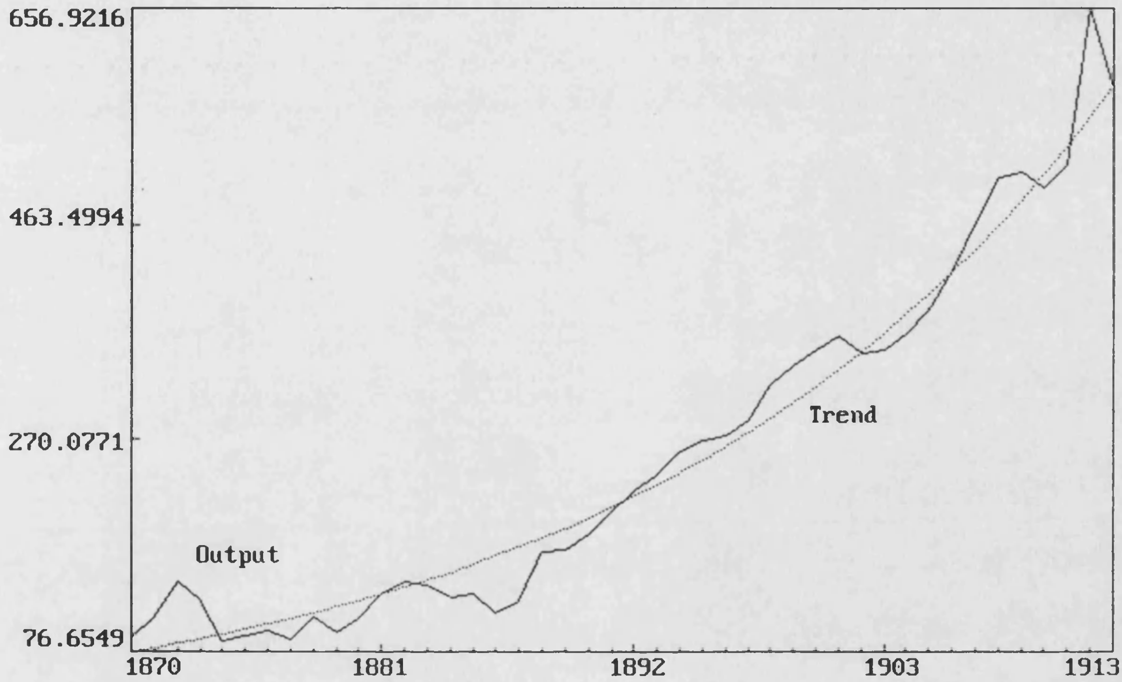
1872-1912	3.94	1872-1894*	2.83
1872-1882	-0.02	1894-1912*	5.32
1882-1894*	5.26		
1894-1901*	4.98		
1901-1912	5.53		

* No output peak in 1894 but strong positive deviation from trend.

Source: Appendix A, Table A.13, column (2).

[3] Apart from expansion over a specific decade (e.g. 1870-1880), output growth was generally measured from the peak of one business cycle to the peak of the subsequent cycle. Thus the rate of growth of potential output was obtained. The advantage of this measure lies in that it does not disguise possibly important turning points as moving averages often do. A difficulty with peak-to-peak measurement, however, is the implicit assumption of full factor utilization at the peaks. If at one of the peaks capacity was not fully utilized, the growth rate would be underestimated for that cycle and overestimated during the subsequent cycle. See, for example, Komlos, *Customs Union*, note to Table 4.19, p.145, and Solomou, S., *Phases of Economic Growth, 1850-1973* (Cambridge, 1990), p.17.

Figure II.1: Output in Austrian Machine-Building (Mill. Crowns; 1913 Prices)



Source: Appendix A, Table A.13, column (2).

Table II.2

COMPOUND RATES OF GROWTH IN AUSTRIAN INDUSTRY
(PER CENT PER ANNUM)

	M	MM	MMC
1871-1912	2.36	2.56	2.36
1871-1884	1.80	2.10	1.86
1884-1895	2.51	2.77	2.32
1895-1902	1.77	1.94	2.08
1902-1912	3.37	3.38	3.24
1871-1895	2.13	2.41	2.07
1895-1912	2.68	2.78	2.76

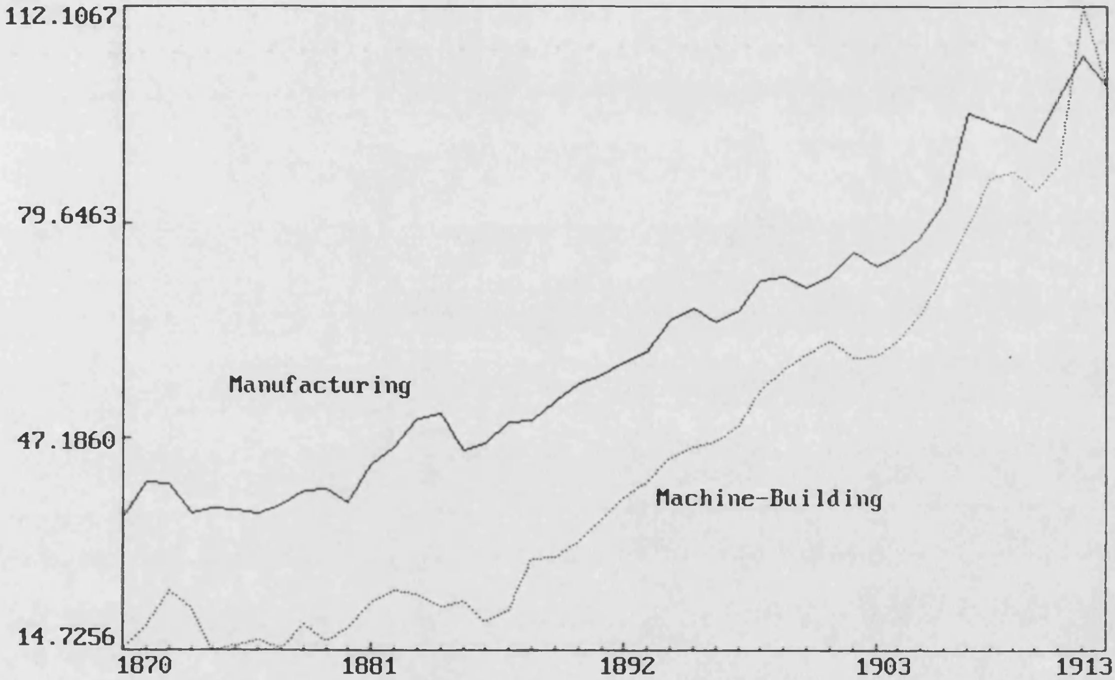
Key: M = manufacturing
MM = manufacturing, mining
MMC = manufacturing, mining, construction

Source: Komlos, *Customs Union*, Appendix E, Table E.4.

Figure II.2 shows that for most of the period to 1913 the indices of machine-building output and total manufacturing production follow a similar path. As one might expect, a rise of industrial output in the long run was associated with expanding demand for industrial equipment. Both domestic production as well as imports of machinery from abroad grew in response to industrial and agricultural needs for capital goods[4]. Nevertheless, some significant differences in both the pace and the pattern of development are striking (see also Tables II.1 and II.2). While manufacturing output rose by approximately 2.4 per cent between 1871 and 1912, production of machinery expanded by about 3.9 per cent on annual average. Though industrial engineering expanded faster than most other manufacturing sectors, it was at the same time the sector most exposed to cyclical output fluctuations: deviations from the trend of production were clearly more pronounced in machine-building than in other sections of the manufacturing industry for

[4] See Appendix D, Tables D.1 and D.2 on the development of the Habsburg Empire's and Austria's imports and exports of machinery.

Figure II.2: Indices of Austrian Industrial Output (1913=100; 1913 Prices)



Sources: App. A, Table A.13, col.(2); Komlos, Customs Union, App. E, Table E.4.

which comparable output estimates are available; this holds especially for the 1870s and 1880s (Figure II.3)[5]. Pigou observed that shipbuilding and engineering were the industries with the largest amplitudes in (cyclical) fluctuations in late nineteenth century Britain[6]. The explanation forwarded for the particular cyclical responsiveness of the capital goods sector - or as Pigou termed it "the instrumental industries" - includes several elements.

Machinery is not used up in a single act of production but continues to function in future. Consequently, there is always a stock of capital goods already produced alongside the output of machinery in the current period. Suppose actual or expected demand in machinery-using consumers' goods industries, for example, rises: "If, then, it is decided to increase the production of, say, cotton goods by 20 per cent in conditions such that, in order to do this, the supply of cotton machinery has to be increased by 10 per cent, the 10 per cent increase in the *supply* of cotton machinery will involve a very much larger increase, perhaps an increase of 80 per cent or 100 per cent, in the *new production*, including, of course, that part of the new production ... which is needed for replacements and repairs, of that machinery"[7]. This relationship between the demand for machinery, the existing stocks of capital goods and their supply in the current period provides an explanation of why, in general, a given expansion in the production of consumers' goods is likely to involve an even faster percentage increase in machinery production. Yet the extra output of machinery in years of high demand implies

---

[5] Trend was computed as a log-linear function using ordinary least sqares estimation.

[6] Pigou, A.C., *Industrial Fluctuations* (London, 2nd ed., 1929), p.13. Pigou used employment rather than output data as sufficient statistics on the latter were not available; ibid., pp.10-11.

[7] Ibid., p.108.

an enlarged stock of capital goods at the disposal of machinery users in later years. If demand contracts in a downswing and returns to pre-upswing levels, it is confronted with this larger capital-stock which had been built up in times of rising demand. As a result, the lower level of demand will now give rise to smaller demand for new machinery than it used to before the upswing. Machinery purchases may be confined to replacements only. "Thus the upward fluctuation of industrial activity above the normal carries with it a subsequent downward fluctuation below the normal when the stimulus is removed and not merely a subsequent return to the normal"[8].

The data in Tables II.1 and II.2 and the plots in Figures II.2 and II.3 indicate that machine-building was hit more severely by the impact of the post-1873 depression than the manufacturing sector as a whole. While total manufacturing output fell by 0.32 per cent on annual average between 1871 and 1879[9], engineering production virtually collapsed and shrunk at an annual rate of more than 4 per cent (1872-1878). For most branches of Austrian manufacturing, signs of recovery began to show in the late 1870s. Pre-depression levels of output were generally achieved during the early 1880s[10]. In the capital goods sector, however, recovery came much later. Output fluctuated at levels below the long-run trend until the early 1890s (Figure II.3). Much of the rise in output during the 1880s should thus be interpreted as recovery growth rather than genuine expansion (Table II.1). Only towards the very end of the decade was there any sustained advance above pre-crash levels of production.

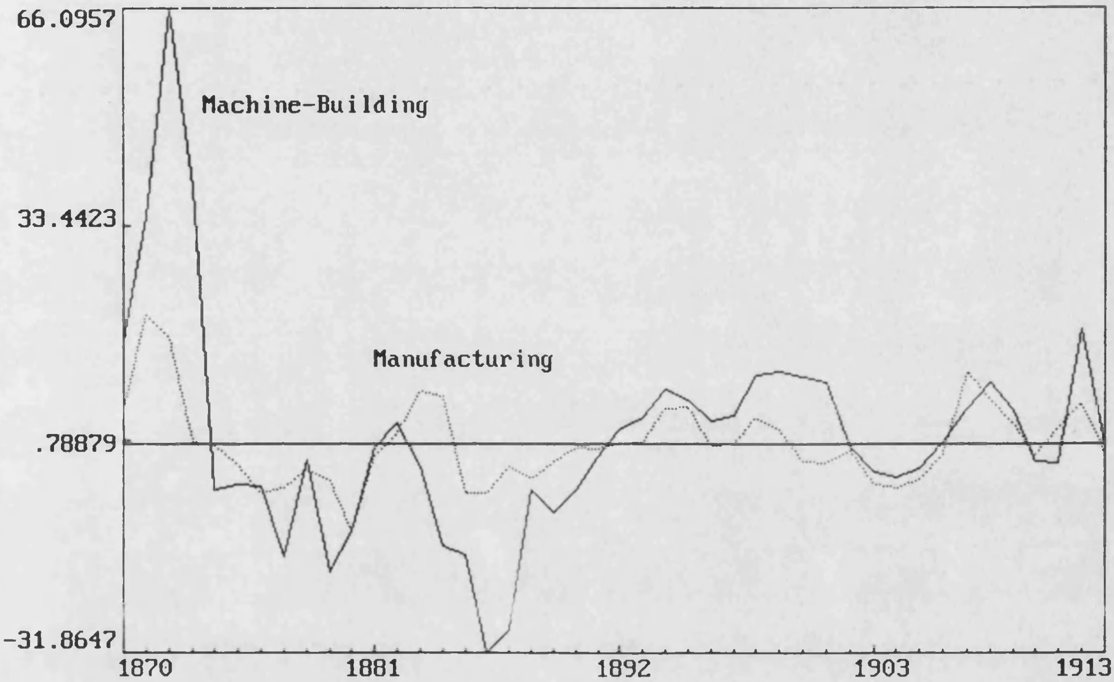
---

[8] Ibid., p.109.

[9] Komlos, *Customs Union*, Appendix E, Table E.4.

[10] Ibid.

Figure II.3: Deviations from Trend of Production (Per Cent of Trend)



Sources: App. A, Table A.13, col.(2); Komlos, Customs Union, App. E, Table E.4.

Based on the evidence on output growth and fluctuations presented so far, expansion in Austrian machine-building can be perceived as a sequence of five major phases:

1. rapid expansion up to 1872;
2. years of severe depression between 1873 and 1880;
3. a period of slow improvement through the 1880s;
4. full recovery by 1888 and rapid growth to the turn of the century;
5. a decade of further expansion interrupted by two brief recessions in 1902-1903 and 1910.

This pattern is distinctly different from that implied in Richard Rudolph's output calculations for Austrian machine-building[11]. According to his estimates, the industry grew significantly faster between 1870 and 1913 than the new output estimates used here indicate. His figures suggest, moreover, that there was no significant downturn in engineering activity during the 1870s and 1880s (Table II.3)[12]. This index has been widely used - most notably in the context of the debate on the "Great Depression" in Austria. But it conveys a course of development which is at odds with both the quantitative and the qualitative evidence available. The next section is, therefore, concerned with a re-assesssment of the machine-building industry's situation in the 1870s and 1880s. It precedes the discussion of the sources of engineering growth during

---

[11] Rudolph, R., "The Pattern of Austrian Industrial Growth from the Eighteenth to the Early Twentieth Century", *Austrian History Yearbook* XI (1975), Table 2; and *Banking and Industrialization in Austria-Hungary. The Role of Banks in the Industrialization of the Czech Crownlands, 1873-1914* (Cambridge, 1976), Table A.3, p.207. For a critical discussion of the data and methods used by Rudolph see Appendix A, section I.

[12] Rudolph's index shows a fall in output for 1881 to 1883. But this decline is merely the result of a sharp increase in rail production directly reducing iron and steel consumption in machine-building. The compensating increases in wrought iron output and iron and steel imports are not accounted for in his estimation procedure; Rudolph, *Banking and Industrialization*, Tables A.3, A.18 and A.19, pp.207-224. See also Appendix A, section I.

the last two decades before the First World War, which follows in the third section.

Table II.3

RUDOLPH ESTIMATES OF GROWTH IN AUSTRIAN MACHINE-BUILDING (PER CENT PER ANNUM)

1870-1913	8.00	1890-1900	9.30
1870-1880	3.50	1900-1913	5.30
1880-1890	15.30		
Peak-to-peak measures:			
1885-1896*	10.79	1900-1912	6.29
1896-1900*	8.94		

* No output peak in 1896 but strong positive deviation from trend.

Source: Rudolph, "Pattern of Industrial Growth", Table 2; and *Banking and Industrialization*, Table A.3, p.207.

2. Machine-Building and the "Great Depression" in Austria

In a 1974 article and in his 1984 book, David Good critically examined the notion of a "Great Depression" in Austria between 1873 and 1896[13]. This notion is particularly associated with the work of Eduard März and Herbert Matis. Drawing on Schumpeter's and Kondratieff's concepts of development, März and Matis argue that Austrian economic growth between 1848 and 1913 was characterized by a long-wave pattern with trend breaks in 1873 and 1896[14].

---

[13] Good, D.F., "Stagnation and 'Take-Off' in Austria, 1873-1913", *EHR* 2nd ser. XXVII (1974) No.1, pp.72-87, and *The Economic Rise of the Habsburg Empire, 1750-1914* (Berkeley, Calif., 1984), pp.164-185.

[14] März, E., "Zur Genesis der Schumpeterschen Theorie der wirtschaftlichen Entwicklung", *On Political Economy and Econometrics*, Essays in Honour of Oskar Lange (Warsaw, 1965), pp.370-380, and *Österreichische Industrie- und Bankpolitik in der Zeit Franz Josephs I.* (Vienna, 1968); Matis, H., *Österreichs Wirtschaft 1848-1913: Konjunkturelle Dynamik und gesellschaftlicher Wandel im Zeitalter Franz Josephs I.* (Berlin, 1972).

They distinguish three discrete periods: an expansionary phase from 1848 to 1873 dominated by railway construction; a second period, containing the great depression in the aftermath of the 1873 Viennese stock market crash, lasted until 1896; it was characterized by price deflation and slow growth in real output; and finally, a phase of rapid growth between 1896 and 1913 supported by the rise of new industries and re-armament[15]. Good disagrees with the view that Austria's economic growth slowed down after the 1873 crash. He argues, with reference to the results of his own research and the work of Nachum Gross and Richard Rudolph, that the economy's performance between 1873 and 1896 did not diverge significantly from its growth record during the subsequent business cycles[16]. "The picture which emerges ... confirms the conclusion ... that the entire period 1873-1913 was one of steady, uninterrupted growth in the Austrian economy with no break in the secular trend"[17]. This assessment of the pattern of growth was challenged by John Komlos[18]. He accepts the traditional hypothesis of a slowdown in Austria's economy after 1873 and maintains that much of the evidence cited in support of the revisionist

---

[15] März' summarized his view of Austrian economic development in the nineteenth century in "Die wirtschaftliche Entwicklung der Donaumonarchie im 19.Jahrhundert", *Wirtschaft und Gesellschaft* (1985), pp.367-392. See also Kernbauer, H., and März, E., "Das Wirtschaftswachstum in Deutschland und Österreich von der Mitte des 19. Jahrhunderts bis zum Ersten Weltkrieg - Eine vergleichende Darstellung", *Historische Konjunkturforschung*, eds. W.H. Schröder and R. Spree (Stuttgart, 1981), pp.47-59.

[16] Good, *Economic Rise*, p.172. Cf. Gross, N.T., "Industrialization in Austria in the Nineteenth Century" (unpublished doctoral thesis, University of California, Berkeley, 1966), pp.61-66, and Rudolph, *Banking and Industrialization*, pp.12-13.

[17] Good, "Stagnation", p.83.

[18] Komlos, J., "Is the Depression in Austria after 1873 a 'Myth'?", *EHR* 2nd ser. XXXI (1978) No.2, pp.287-289; Good's reply, "The Great Depression and Austrian Growth after 1873", is published in the same issue, pp.290-294.

view is based on heavily biased data and procedures of output adjustment that disguise significant cyclical turning points[19]. This is not the place to review the discussion on the "Great Depression" in more detail[20]. It suffices to outline the main positions in this ongoing debate as a background against which to project the machine-building industry's performance after 1873.

In a comment on the early 1880s Rudolph remarks: "The machine-building industry was now developing a strong footing in the economy, and its major output during the boom consisted of equipment for the mining and sugar industries, as well as numerous steam engines and boilers"[21]. Good, examining the process of recovery in the late 1870s and early 1880s, finds that "the expansion was led by the same industries that prospered in the 1867-1873 period. Growth in the machine-building sector was vigorous due to mechanization in the sugar and textile industries and to the diffusion of steam engines and boilers throughout Austrian industry"[22]. Kernbauer and März, too,

---

[19] See the comment on the state of research on Austrian industrial growth in Komlos, *Customs Union*, pp.238-254. Good has shown that smoothing Komlos' annual index of industrial production by use of five-year-moving averages - as a means of removing the more extreme fluctuations in the annual data - yields results broadly in support of his thesis; see Good, *Economic Rise*, pp.173-176. Komlos, preferring peak-to-peak measurement of growth, criticizes the loss of information involved in such data smoothing; Komlos, J., Review of D.F. Good, The Economic Rise of the Habsburg Empire, 1750-1914. *JEEH* 18 (1989) No.2, pp.452-455.

[20] On this debate see also Mosser, A., *Die Industrieaktiengesellschaft in Österreich 1880-1913: Versuch einer historischen Bilanz- und Betriebsanalyse* (Vienna, 1980), pp.171-194, and his review of D.F. Good, The Economic Rise of the Habsburg Empire, 1750-1914. *Mitteilungen des österreichischen Staatsarchivs* 40 (1987), pp.455-457.

[21] Rudolph, *Banking and Industrialization*, p.28.

[22] Good, *Economic Rise*, p.165.

conclude that rapid expansion in the metal-working and machine-building industries dominated the cycle in the early 1880s[23]. As has been shown above, the new estimates of Austrian machine-building output presented here do not confirm this view. On the contrary, they suggest a steep downturn in production from the 1872 peak, followed by a period of prolonged stagnation in industrial engineering. Between 1874 and 1891, machinery output only once (1882) reached or surpassed its trend level (Figure II.1). Much of the rise in output during the 1880s can thus be interpreted as recovery growth rather than genuine expansion (Table II.1). Full recovery of production in terms of a return to trend levels and advances above its pre-crash volume was not achieved before the end of the decade.

It will be argued below that the poor growth record of Austrian engineering between 1873 and the mid-1880s can be explained by the disappearance of those forces that accounted for the industry's rapid expansion in the preceding boom of 1867 to 1872.
This boom unfolded in the climate of political and institutional stability following the 1867 Dual Settlement between Austria and Hungary. The economic upsurge was fuelled primarily by an expansion in the money supply and the Hungarian "miracle harvest" of 1867/68[24]. New paper money was issued by the government to finance the Prussian and Italian wars. The record harvests came at a time of poor harvests elsewhere in Europe. Consequently, grain exports from Austria-Hungary were stimulated in response to particularly high foreign demand. The uspswing in agriculture facilitated a cumulative increase in activity throughout the economy. Agricultural incomes rose as prices for both grain and land began to climb and, as a result, demand for consumer goods grew. The sharp growth in freight

[23] Kernbauer and März, "Wirtschaftswachstum", p.53.

[24] See Matis, *Österreichs Wirtschaft*, pp.153-161.

traffic intensity associated with buoyant cereal exports initiated an unprecedented expansion of the railway network. "Even those railway lines hitherto unprofitable now yielded substantial returns, a virtual 'railway boom' of almost American dimensions began with the length of track and rolling stock expanding"[25]. Austria's railway network grew from 5,273 kilometres in 1869 to 10,331 kilometres in 1875. Never before and never thereafter were more new tracks laid in one year than in each of the years 1871 and 1872 (Figure II.4). Similarly, Hungary's railways system were enlarged at quite the same rate[26]. With rising demand for rails, engines and rolling stock the railways provided a major stimulus for the producer goods and capital goods industries[27]. Austria's pig iron production rose from 182,670 tons in 1867 to more than 320,000 tons in 1873; and steel output grew by 43 per cent per annum[28]. But the boom years of 1867 to 1873 were associated with rising output not only in producer goods industries and agriculture, but also, in response to generally rising incomes, with rapid growth in manufacturing of consumer goods such as sugar, beer and textiles[29]. New productive capacity in industry was installed and large joint-stock operations played an increasingly important role: a total of 463 industrial establishments were either newly founded or converted into joint-stock enterprises between 1866 and 1873. 116 sugar factories came into being, 61 construction corporations were founded, 45 mining companies were set up, 43 new breweries and 28 textile factories entered the

---

[25] *Ibid.*, p.158.

[26] Matlekovits, A. v., *Das Königreich Ungarn*, vol. II (Leipzig, 1900), pp.661-663.

[27] Cf. Matis, *Österreichs Wirtschaft*, *pp*.186-191.

[28] For sources see Appendix A, Table A.7.

[29] See Komlos, *Customs Union*, Appendix E, Table E.6, on the development of output in the various manufacturing branches.

market as joint-stock companies[30]. To put the scale of founding activity in these years into perspective: between 1851 and 1865 only 21 new industrial joint-stock companies were set up, whereas for 1874 to 1890 new formations of industrial joint-stock companies amounted to 77[31].
Faced with rising demand for railway related output and growing orders of equipment from an expanding industrial sector, the domestic machine-building industry was well placed to benefit from the Gründerzeit boom[32]. "In 1872 the demand for machinery of all kinds rose to such an extent that the most important establishments had to turn down orders - despite the increase in workforce and auxiliary equipment, the expansion of workshops, and recourse to working at night, during Sundays and bank holidays"[33]. The demands on engineering capacity necessitated expansion of the existing productive apparatus and induced some of Austria's most important machine-building companies to incorporate[34].

---

[30] Somary, F., *Die Aktiengesellschaften in Österreich* (Vienna, 1902), p.9.

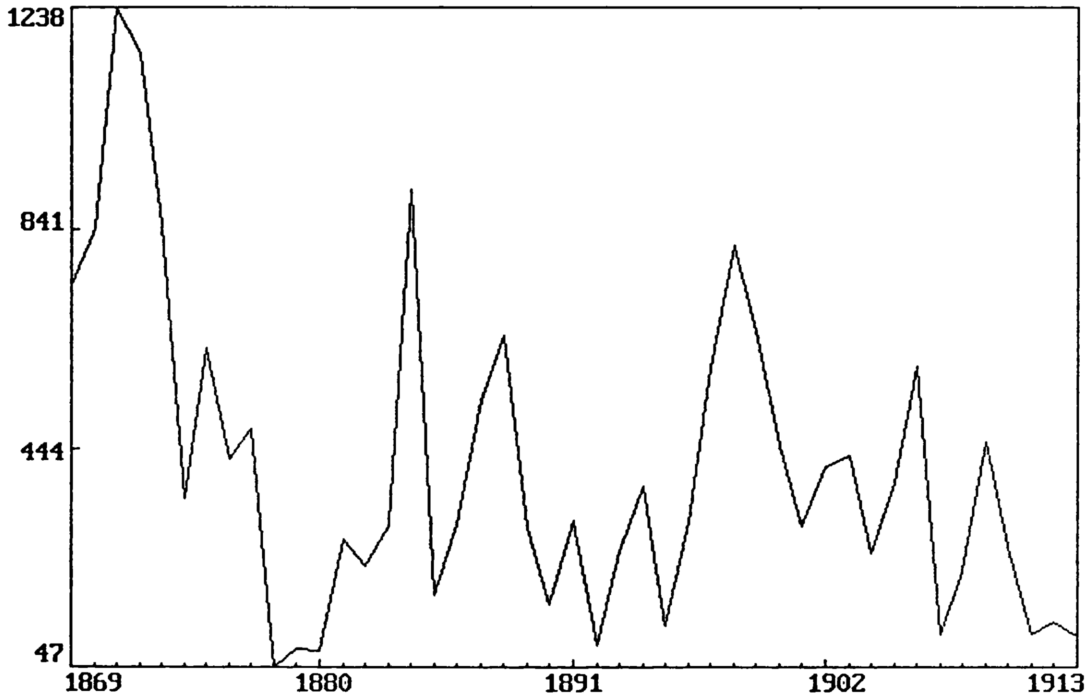
[31] Ibid., pp.38-39.

[32] According to Komlos' index of industrial production (mining, manufacturing, construction) industrial output rose by almost 8.6 per cent on annual average from 1867 to 1872; Komlos, *Customs Union*, Appendix E, Table E.4.

[33] Handels- und Gewerbekammer Wien, *Bericht über die Verkehrsverhältnisse während des Jahres 1872-1874* (hereafter *HK-Bericht Wien*), p.134.

[34] For example: Maschinen- und Waggonbaufabrik AG Simmering (1869); Wiener Lokomotivfabrik AG (1869); Prager Maschinenbau AG, vorm. Ruston, Bromovsky & Ringhoffer (1869); Erste böhmisch-mährische Maschinenfabrik in Prag (1871); Erste Brünner Maschinenfabrik AG (1872); Maschinenbau AG, vorm. Breitfeld, Daněk & Co., Prague (1872). See Somary, *Aktiengesellschaften*, p.49.

Figure II.4: Annual Additions to Austrian Railway Network (Kilometres)



Source: See Appendix A, Table A.10.

The impact of railway construction on engineering is well illustrated by the case of Vienna's locomotive industry - around 1870 probably the most important single branch of Austrian machine-building. In 1870, prior to the peak of the railway boom, the value of locomotive and tender production of Austria's three producers of locomotives - the k.k. priv. österreichische Staatsbahn (Vienna) and the two factories of G.Sigl in Vienna and Wiener Neustadt - accounted for approximately 18 per cent of the country's total machine-building output[35]. Up to 1873 output of railway engines rose rapidly. But once pre-1873 orders from domestic and foreign customers were completed in 1874, and partly still in 1875, the factories began to run out of work[36]. Neither the few state owned nor the privately run railway companies required new machinery - and the supply to foreign markets was a shortlived interlude allowing for only partial compensation[37]. The collapse of the private railways after the 1873 crash led to a virtual cessation of new railway construction in Austria (Figure II.4)[38]. In Hungary, further expansion of the network came to a standstill[39]. The fall in related demand for engines and rolling stock caused the Viennese manufacturers' output and employment to drop dramatically. Production of locomotives fell from an annual average of 334 in 1870-1874 to 118 in 1875-1880. The example of the 'Actiengesellschaft der

---

[35] Handelsministerium, "Statistik der österreichischen Industrie 1870", *NIHV*, vol.3 (1874), No.2, pp.116, 145. See also Appendix A, Table A.6.

[36] *HK-Bericht Vienna 1875*, p.41.

[37] Ibid.. See also Appendix D, Table D.9.

[38] A brief discussion of the disintegration of the private railway companies after 1873 which eventually led to the re-establishment of state-owned railway lines in Austria is to be found in Bachinger, K., "Das Verkehrswesen", *Die Habsburgermonarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp. 292-303.

[39] Cf. Chapter III, section 3, Table III.9.

Locomotivfabrik, vormals G.Sigl' (Wiener Neustadt) is indicative: the number of people employed in the workshops of this company - the biggest and most important producer of railway engines - rose from 2,460 in 1872 to its peak of 2,826 in 1874. Output of locomotives and tenders peaked already in 1873 but due to previous foreign orders there was work left to be finished in 1874 and 1875, partly compensating for diminished domestic orders. Of the 172 locomotives produced in 1872 only 8 were exported; in 1873, when production reached 179 engines, already 78 of these were sent abroad; the export share came to its maximum in 1874 and 1875 when 150 and 117 locomotives out of a production of 168 and 134, respectively, were delivered to foreign countries. But by 1876 this source for employment had dried up: in the first half of the year only 21 locomotives were produced and deliveries of tenders - which were at 129 in 1875 - decreased to a mere 17. The value of output plummeted from 3,829,450 florins to 992,369 florins in 1876. Both the number of employed workers as well as working hours fell as a consequence of contracting demand. By 1876 only 650 people had kept their jobs at the 'Locomotivfabrik' in Wiener Neustadt, and a considerable number of these were being employed for only two or three days per week[40]. However, as shown in Table II.4, these conditions of insufficient demand and low employment were not confined to one establishment but affected all major producers of railway equipment for most of the 1870s and 1880s[41]. Though turnover and employment improved again during the early 1880s in response to a new railway programme, the peak levels of employment in Vienna's

---

[40] *HK-Bericht Wien 1875*, p.42.

[41] G.Sigl's machine-building firm in Vienna never fully recoverd - with employment fluctuating between 200 and 400 workers - and was eventually closed in 1887. The company at Hernals - a producer mainly of railway cars founded in 1869 - went into liquidation in 1876. See Mathis, F., *Big Business in Österreich. Österreichs Unternehmen in Kurzdarstellungen*, Vienna 1987, pp.144, 284.

railway engineering industry of the early 1870s were never repeated.

Table II.4

EMPLOYMENT IN VIENNESE ENGINEERING COMPANIES (NUMBERS OF WORKERS)

	SVI	SWN	STEG	FLO	SIM	HER	Total
1872	1,436	2,460	1,338	748	1,186	720	7,880
1873	1,286	2,639	1,294	833	870	883	7,805
1874	1,139	2,826	1,006	633	523	240	6,367
1875	760	2,041	486	410	521	257	4,475
1876	420	654	420	345	394	191	2,424
1877	374	1,021	485	332	464	267	2,943
1878	307	1,177	713	588	557	458	3,800
1879	200	676	548	220	570	178	2,392
1880	188	590	500	482	502	262	2.524
1881	205	1,900	622	862	700	401	4,690
1882	273	2,172	950	1,105	800	710	6,010
1883	322	2,323	940	1,035	1,026	870	6,516
1884	290	1,887	815	952	950	765	5,659
1885	243	1,774	719	875	1,034	917	5,562
1886	226	1,222	581	419	711	454	3,613
1887	-	957	704	332	932	406	3,331
1888	-	1,239	999	596	1,006	-	3,840
1889	-	1,559	1,174	684	1,060	-	4,477
1890	-	1,407	1,041	624	1,118	-	4,190

Key:
- SVI = G. Sigl, Vienna
- SWN = Actien-Gesellschaft der Locomotivfabrik, vorm. G.Sigl, Wiener Neustadt
- STEG = Maschinenfabrik der priv. österr.-ungar. Staatseisenbahn-Gesellschaft, Vienna
- FLO = Wiener Locomotivfabriks-AG, Floridsdorf
- SIM = Maschinen- und Waggonfabriks-AG, vorm. H.D. Schmid, Simmering
- HER = Hernalser Maschinen- und Waggon-Fabrik von C. v.Milde & Co.

Sources: *HK-Bericht Wien 1872-1874*, p.136; *1877*, p.63; *1879*, p.62; *1881*, p.52; *1883*, p.73; *1885*, p.75; *1886*, p.78; *1887*, p.73; *1889*, p.85; *1891*, p.87.

Throughout the late nineteenth century, railway construction in Austria was carried out sporadically . But the related erratic changes in demand for locomotives and rolling stock never exercised such pressure as in the 1870s, because the relative importance of railway related machine-building within the engineering industry as a whole declined during the later periods. In the early 1870s locomotive engineering was at the centre of Austrian machine-building. Hence a downturn in this branch had an immediate effect on overall machine-building output. The sharp decline in total engineering production, however, suggests that contraction hit virtually all branches of the industry.

The consumer goods industries whose expansion in the boom years provided a stimulus for machinery production were now also in crisis. While the dominant Bohemian sugar industry recovered relatively fast with pre-crash levels of production realized again in 1878/79[42], other light industries remained in agony. The output of beer dropped by almost 17 per cent between 1873 and 1880 and did not make up for the difference until 1887[43]. Similarly, the development of the woollen textiles industry meant that little relief was to be expected from that side either[44].
The index of Austrian manufacturing output fell by 11 per cent between 1872 and 1873. The 1871 peak was reached again as late as 1881[45]. But for the machine-building industry, whose output had risen much faster in the pre-crash expansion than that of other manufacturing branches, 1873 marked the beginning of a downturn more severe than that in Austrian industry as a whole. In the 1874 trough, output was 40 per cent below the 1872 level. Although the pre-crash peak was briefly realized again in 1882, production in mechanical engineering fell below this mark in the following years to 1887. This renewed downturn was related to the world sugar crisis. Austrian output of sugar fell by

---

[42] Brousek, K.M., *Die Großindustrie Böhmens 1848-1918* (Munich, 1987), pp.90-91.

[43] Komlos, *Customs Union*, Appendix E, Table E.6.

[44] Ibid.

[45] Ibid., Table E.4.

almost 40 per cent between 1885 and 1886[46]. In turn, demand for plant equipment contracted and caused a rapid fall in production of those engineering branches that worked largely for the sugar industry, notably in Bohemia and Moravia[47].

The rapid growth in machinery output in the pre-1873 boom years implied an enlarged stock of capital goods in the economy in later years. As aggregate demand contracted after 1873, with sales and output of industrial goods falling and only gradually returning to pre-crash levels, it was confronted with this larger capital stock. Machinery purchases during the mid-1870s to mid-1880s were thus largely confined to replacements only. At a time when railroad construction ceased to be a driving force behind the expansion of machine-building the industrial sector could not fill the gap. Low rates of manufacturing growth meant little net investment in capital goods and, consequently, demand for steam engines and plant equipment recovered only slowly[48].

3. Growth and Productivity: 1890 to 1913

Full recovery in Austrian machine-building was finally achieved by the late 1880s in the wake of accelerating growth in the industrial economy. Domestic demand for machinery was rising as manufacturers began exceeding the limitations of mere replacement investment by installing new capacity[49]. Favourable harvests in Russia, Hungary and Roumania, the primary export markets for Austrian

---

[46] Ibid., Table E.6.

[47] *HK-Bericht Wien 1884*, pp.81-82; *1885*, pp.80-81; *1886*, pp.82-83; Handels- und Gewerbekammer Brünn, *Bericht der Handels- und Gewerbekammer in Brünn* (hereafter *HK-Bericht Brünn*) *1884*, p.17.

[48] *HK-Bericht Wien 1885*, pp.75-82.

[49] *HK-Bericht Wien 1888*, p.78.

agricultural machinery, provided a further stimulus[50]. Though interrupted by two recessions in 1902-1903 and 1910, the ensuing long-run upswing in Austria's mechanical engineering industry lasted until the eve of World War I. Clearly, the process of expansion was sustained by a general rise in demand for capital goods from a growing domestic industrial sector. But the marked trend acceleration in Austrian machinery production we observe for the post-1890 period was also related to the emergence of new, additional sources of growth. These accounted for a pace of advancement strikingly different from that of other industries[51]. The main factors which contributed to pushing output levels above the longer run trend during most years between 1890 and 1913 were the development and application of new technologies, a rise in agriculture's machinery requirements, and a favourable development of machinery trade between the mid-1880s and the turn of the century. Moreover, in the years immediately preceding World War I, Austria-Hungary pursued an expansive re-armament programme[52]. Some of the output growth in the machine-building industry was most probably related to the effects of increased military orders and the associated expansion of armaments and ship-building concerns like the Skoda works in Pilsen/Plzeň and the Stabilimento Tecnico Triestino, especially from 1910[53].

Mechanical engineering directly benefitted from the rapid growth in electricity generation and usage which set in during the 1880s. Austria's first central power stations

---

[50] Ibid., pp.85-87.

[51] Cf. the discussion below, section 5.

[52] Cf. Paulinyi, A., "Die Industriepolitik in Ungarn und in Österreich und das Problem der ökonomischen Integration (1889-1914)", *Zeitschrift für Wirtschafts- und Sozialwissenschaften* (1977) No.2, pp.139-141.

[53] März, E., *Österreichische Bankpolitik in der Zeit der großen Wende 1913-1923* (Vienna, 1981), pp.27, 30-31.

were built in this period[54]. Demand for water turbines and steam engines, as sources of moving power for generators, rose in response to the growing number of privately and publicly owned power plants which supplied electricity for communications, industry, and private households[55]. Between 1907 and 1913, the number of power plants in Austria rose from 446 to 854; their output of electricity increased annually by more than 18 per cent on average. About 57 per cent of generating energy was provided by steam engines, 38 per cent by water power and the remaining 5 per cent by internal combustion engines[56]. Moravia employed almost a third of all Austrian workers primarily engaged in steam technology and so was the country's leading region in manufacturing of steam engines and boilers[57]. Output data

---

[54] Matis, H. and Bachinger, K., "Österreichs industrielle Entwicklung", *Die Habsburger Monarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1978), p.185.

[55] Cf. *HK-Bericht Brünn 1890*, p.54. The records of Austria's two leading producers of water turbines, the Leobersdorfer Maschinenfabriks-AG and the Voith works in St. Pölten, indicate an extremely wide range of customers for their products, including small-scale rural flour mills requiring less than 10 horse-power per unit and large central hydro-electric power stations with turbine installations of up to 8,000 horse-power per unit.
J.M. Voith AG, Turbinenbau, St. Pölten/Austria (hereafter VSP): (1) Verzeichnis der von der Leobersdorfer Maschinenfabriks-AG gelieferten Turbinen; (2) Leobersdorfer Maschinenfabriks-AG, Wasserturbinen, Lieferungen seit dem Jahre 1900. Werksarchiv Voith GmbH, Heidenheim/Germany (hereafter VWA): Verzeichnis der von der Firma J.M. Voith für Österreich-Ungarn gelieferten Turbinenanlagen (1870 to 1912).

[56] K.k. österreichisches Handelsmuseum, *Materialien zur österreichischen Produktions- und Betriebsstatistik* (Vienna, 1916), p.12.

[57] The respective shares of Bohemia and Lower Austria were slightly lower; k.k. Statistisches Zentralkommission, "Ergebnisse der gewerblichen Betriebszählung vom 3. Juni 1902" (hereafter "Betriebszählung 1902"), *Österreichische Statistik* (hereafter *ÖStat*), vol. 75, 1. Heft, 2.Abtlg. (1907), Table II, pp.18-19; 3.Heft (1905), Table I, pp.4-5; 9.Heft (1906), Table I, p.11; 10.Heft (1905), Table I, p.8.

for Brno show that in the two decades around the turn of the century, electric power generating plants had become the second most important industrial customer of steam engine and steam turbine manufacturers; only the textile industries maintained larger orders[58].

The appearance of the internal combustion engine opened hitherto largely untapped sources of demand for power machines. Small workshops and factories, in particular, which by the turn of the century still employed the majority of workers in Austrian industry[59], made increasing use of gas, petrol, and - somewhat later - Diesel engines[60]. For these establishments, the internal combustion engine offered a credible alternative to costly steam power, since it was more efficient when operating intermittently or at less than full load, "conditions frequently found in small industry"[61].

A shift towards more capital intensive modes of production in agriculture provided a major and lasting stimulus to the growth of the machine-building sector. The large share of people employed in farming and the low degree of mechanization in Austrian agriculture implied ample scope for potential improvement during the late nineteenth century. In 1890, more than 62 per cent of the total labour force were still employed in agriculture and forestry. By 1910 this share had fallen to 53 per cent[62]. Yet in 1902, only a third of all agricultural operations in Cisleithania made use of any kind of machinery; the three most

---

[58] *HK-Bericht Brünn 1900*, pp.126-127; *1910*, pp.81-89.

[59] See the discussion below, section 4.

[60] Cf. *HK-Bericht Wien 1889*, pp.87-89; *1897*, pp.95-96; *1904*, pp.102-104; *1911*, p.83.

[61] Landes, D.S., *The Unbound Prometheus. Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge, 1969), p.280.

[62] Sandgruber, R., *Österreichische Agrarstatistik 1750-1918* (Munich, 1978), Table 51, p.114.

widespread implements, namely chaff-cutters, cleaning and sorting machinery, and threshing-machines, were employed respectively in only 28, 13, and 11 per cent of all operations[63]. The temporal coincidence of rapidly growing imports and expanding production indicates that there was a genuine rise in domestic demand for farm equipment after the turn of the century[64]. The sector invested heavily in labour saving technology and equipment which allowed more intensive cultivation of the soil. As Sandgruber points out, productivity growth in Austrian agriculture was indeed particularly fast in the post-1900 years when compared to the previous decades[65]. However, the trade statistics suggest that growth in Austrian output of agricultural machines was not only a function of rising domestic demand, but also of increases in machinery requirements elsewhere. Austrian exports of farming implements and machines rose rapidly, especially after the mid-1890s[66].

Finally, the effects of the course of Austria-Hungary's foreign trade in machinery as a whole from the late 1880s to the early 1900s should be considered. For several reasons which will be discussed in more detail in Chapter V below, the growth of imports was slower than that of domestic output and, despite considerable export growth, the degree of import penetration was temporarily falling. As a result, domestic manufacturers were left with a larger share of a growing machinery market. Austrian machine-building firms were thus in a better position to exploit any increases in demand than was the case during the 1880s.

---

[63] Ibid., Tables 52 and 53, pp.116-117.

[64] See Appendix A, Table A.12c, and Appendix D, Table D.10.

[65] Ibid., p.113 and Table 51, p.114, for data on yield-per-hectare and labour productivity.

[66] Appendix D, Table D.10. For a fuller discussion of Austria's and the Habsburg Empire's trade in agricultural machinery see Chapter V, section 2.

The growth of machine-building output went along with a rapid expansion of the labour force. Employment in mechanical engineering grew from about 33,000 workers in 1889 to more than 80,000 in 1911, an increase of about 4 per cent on annual average[67].

Table II.5

AVERAGE LABOUR FORCE IN MECHANICAL ENGINEERING

1889/1893	37,517	1904/1908	70,738
1894/1898	48,245	1909/1911	80,493
1899/1903	59,128		

Note: Averages based on annual data.

Sources: k.k. Ministerium des Innern, *Die Gebarung und die Ergebnisse der Unfallstatistik der Arbeiter-Unfall-Versicherungsanstalten 1889-1896* (Vienna, 1891-1898); *Ergbnisse der Unfallstatistik der fünfjährigen Beobachtungsperiode 1897-1901, 1902-1906, 1907-1911* (Vienna, 1904-1914); see Appendix A, Tables A.12a to A.12e, for detailed references.

According to the records of the Austrian workers' insurance system, much of the rise in engineering employment was accounted for by rapid growth in the manufacture of agricultural machinery. In 1891, fewer than 3,400 workers were employed in the production of farming machines and equipment; by the turn of the century the number had risen to 6,800 and in 1911, more than 13,000 people worked in this branch of mechanical engineering. In contrast, the relative importance of locomotive engineering was declining. The labour force in this branch of machine-building fluctuated strongly between a minimum of 2,457 workers (1892) and a maximum of 5,832 (1908), but average employment levels did not rise over time. As a result, the share of locomotive engineering in total machine-building

[67] See Table II.5 for sources.

employment gradually fell[68]. Similarly, while the share of agricultural machinery in total machine-building output rose from approximately 8 per cent in 1897/99 to almost 12 per cent in 1909/11, the production of locomotives decreased from 11 per cent to less than 7 per cent[69]. However, frequent re-classifications and the lack of sufficiently disaggregate data in the insurance statistics do not permit a detailed examination of the growth experience in the various branches of the industry[70]. The category of *general machine-building* includes all sections of mechanical engineering which are not explicitly specified in the statistics. This refers to the production of steam engines, other engines, machinery for the sugar, brewing, mining, and iron and steel industries, all types of working machines, and machine tools. The labour force employed in engineering branches subsumed under this extremely broad category accounted for 53 per cent of total machine-building employment in 1900 and 44 per cent in 1911[71]. Similar percentages apply to this section's share in total output in mechanical engineering. In brief, one half of the machine-building industry, probably including

---

[68] Ibid.

[69] See Appendix A, Tables A.12b, A.12c, and A.13, column (1). It should be noted, that the data for gross production in machine-building given in Appendix A, Tables A.12a to A.12e, are grouped according to the wage-sum/production ratios used to estimate output; this does not necessarily imply inclusion in the same branch of machine-building in the strict sense. Table A.12b, for example, comprises the output figures for branches as diverse as locomotive engineering, general machine-building, and the production of looms.

[70] Locomotive engineering and the production of agricultural machinery are the only two branches of mechanical engineering for which meaningful employment data are available for the early 1890s. Figures for the size of the labour force in other branches are either not provided at all, or refer to completely unspecified categories such as *large machine-building factories* or simply *machinery locksmiths and repair shops*.

[71] For sources see Table II.5.

some of its most important branches, is covered only with summary values for employment or output. Alternative employment data, based on a 1902 business census, are, therefore, presented in Table II.6[72]. The degree of branch differentiation is not higher than that provided by the insurance statistics, but at least we obtain some measure of the relative importance of steam engine production. Almost 20 per cent of all workers in Austrian mechanical engineering were employed in this section of the machine-building industry.

Table II.6

EMPLOYMENT DISTRIBUTION IN MECHANICAL ENGINEERING, 1902

	number of workers	per cent
(1) steam engines	12,198	19.9
(2) other engines	837	1.4
(3) agricultural machinery	10,062	16.4
(4) sewing machines	1,870	3.0
(5) milling machines	1,987	3.2
(6) other machines	34,441	56.1
(7) total	61,395	100.0

Source: Statistisches Zentralkommission, "Betriebszählung 1902", *ÖStat*, vol. 75, 1. Heft, 2.Abtlg. (1907), Table II, pp.18-19.

These employment figures suggest that, at the turn of the century, the production of steam engines and agricultural machinery were probably the most important sections of mechanical engineering in Austria. This finding is fully supported by the results of a factory survey in 1906, according to which the two branches together accounted for

[72] It should be noted that the 1902 business census aimed at a comprehensive record of all productive activity. Thus the number of employees in mechanical engineering as a whole and in its branches recorded in the census is somewhat higher than that reported in the *Unfallstatistik* for 1902.

30 per cent of the total labour force in mechanical engineering[73]. The structure of Austria's foreign trade, too, indicates that steam technology and agricultural machinery were the two main areas of engineering activity. Exports accounted for approximately 40 per cent of Austrian output of agricultural implements. If trade with Hungary is included, Austria maintained a positive balance of trade in agricultural machinery since the early 1880s, with a particularly fast expansion in exports to foreign countries after the turn of the century[74]. The same holds for Austria's trade in steam engines, at least from the early 1890s onwards[75].

A plausible explanation for this pattern of industrial specialization may be found in the size of the market. As Nathan Rosenberg has shown, the development of a country's capital goods sector is critically dependent on the ability to specialize production[76]. But the degree of specialization, i.e. the extent to which a firm or branch of an industry concentrates on the production of only a few more or less standardized types, is largely determined by the level of demand for these items. If total demand is restricted as a result of limited product market size, firms will be forced to maintain a relatively large product programme in order to fully employ their factors of production and are thus unable to realize economies of specialization. Austria, and Hungary to an even larger

---

[73] k.k. Handelsministerium, Arbeitsstatistisches Amt, *Die Arbeitszeit in den Fabriksbetrieben Österreichs* (hereafter *Fabrikszählung 1906*) (Vienna, 1907), Table IV, pp.264-268.

[74] Cf. Chapter V, section 2, Table V.4, and Appendix D, Table D.10.

[75] Appendix D, Table D.8, and Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1882-1913. Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1923), pp.304-305.

[76] Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), pp.141-150.

extent, was a country with a large agricultural sector relative to industry. One would therefore expect a relatively large part of machine-building to be geared towards catering for the machinery needs of agriculture. Similarly, power machines like steam engines were used in virtually all branches of industry. The actual and potential market for these machines was thus significantly larger than that for highly specialized machinery like, for example, machine-tools or spinning machines.

The production process in a firm or an industry can be examined at various levels and from different angles. One may, for example, study the methods of management, the training of the labour force, the rate of investment in capital equipment or other elements of industrial behaviour[77]. But often the sources available do not provide the information sufficient for a separate analysis of these components. This holds especially if, as in this study, an industrial sector as a whole rather than a single firm is the subject of interest. Changes in productivity, though, are a widely employed summary measure which serves to reflect the collective effects of these components on output. For all elements of the productive process together contribute to changes in the productivity of the factors of production. A concept which aims at measuring the changing efficiency in the use of all inputs is that of total factor productivity[78]. Here, however, we are confined to the measurement of changes in the productivity of labour inputs only, because the lack of adequate data does not permit the computation of changes in total factor productivity in

---

[77] Cf. Floud, R.D., *The British Machine Tool Industry, 1850-1914* (Cambridge, 1976), p.184.

[78] A comprehensive account of the concept of total factor productivity and its measurement is given in Matthews, R.C.O., Feinstein, C.H., and Odling-Smee, J.C., *British Economic Growth 1856-1973* (Oxford, 1982), pp.198-213, 589-598.

Austrian machine-building[79].

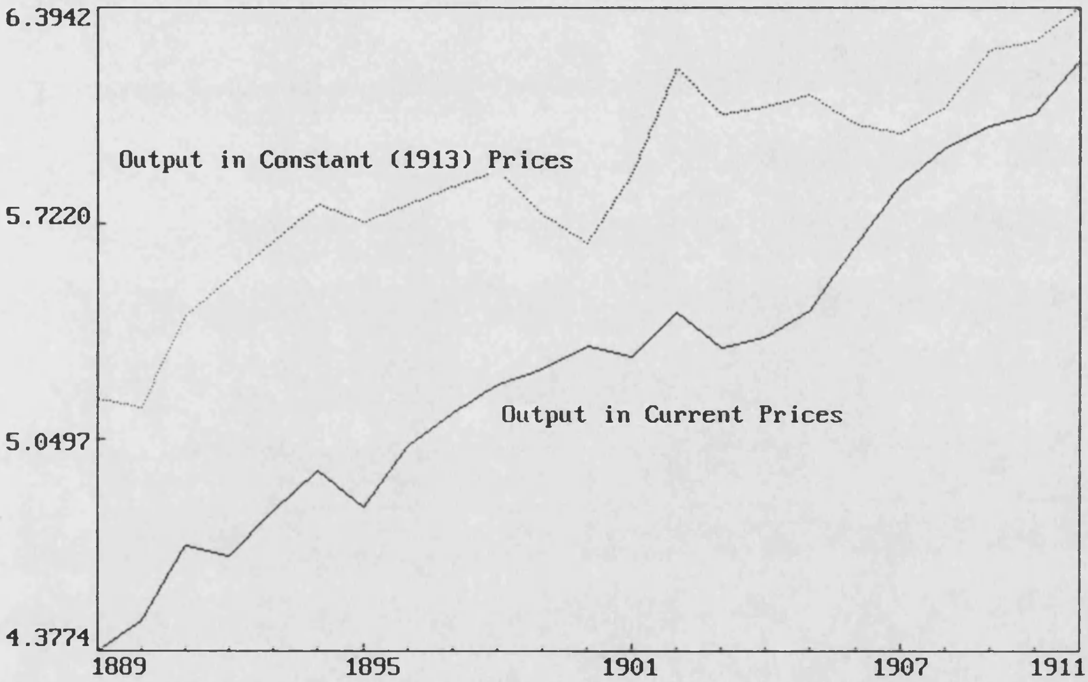
The labour input is measured in man-years. Unfortunately, no adjustments could be made for changes in the quality of labour and for variations in working hours[80]. The results obtained indicate that the rise in output was sustained not only by an absolute increase in employment but by a continuous upward trend in labour productivity (Figure II.5).

---

[79] The *direct* measurement of changes in total factor productivity by subtracting the rate of change of total factor inputs from the rate of change of output is not feasible because of the lack of sufficiently representative data on inputs of physical capital. An alternative method, which avoids some of the problems involved in the accurate measurement of inputs, is that employed by Roderick Floud who examined the change in total factor productivity in a British machine tool firm. He proceeds from a Cobb-Douglas production function which exhibits constant returns to scale. The so-called dual approach is used to transform the function in such way that output and inputs are measured in terms of their prices and not in physical units. Further transformation of the equation so obtained yields a linear function where the rate of growth in total factor productivity equals the sum of the weighted rates of growth of input prices minus the growth rate of the price of output. See Floud, *Machine Tool Industry*, pp.184-202. However, this approach, too, cannot be used to compute changes in total factor productivity in Austrian machine-building. Though material input prices and wage rates are available, and interest rates could be used as a proxy for the price of capital, an independent output price series is lacking. The computation of the average unit price per ton of iron and steel inputs as a proxy is not feasible since the input series has a slight upward bias over time. The resulting unit value series would be virtually meaningless. The price index used to deflate output had to be based on input prices and is thus of no help with this particular problem either. See the discussion in Appendix A.

[80] For 1891 to 1911, the employment data given in Ministerium des Innern, *Unfallstatistik*, refer to "full time employees". This is a standardized measure arrived at by dividing the total number of days worked by 300 which was regarded as the usual number of working days per annum for a person employed full time. Judged by the figures for 1891 to 1896, for which data on both categories are available, the annual average number of employees was only slightly higher than that of "full time employees". For 1889 and 1890, the annual average of the number of insured employees only is available.

Figure II.5: Output per Worker in Austrian Machine-Building (1000 Crowns)



Sources: See Appendix A, Tables A.12a to A.12e, A.13, columns (1) and (2).

Output per worker (in constant prices) in mechanical engineering displayed a trend rate of growth of approximately 0.8 per cent between 1889 and 1911[81]. The next section examines the question to what extent the growth in the labour force and the rise in labour productivity were accompanied by changes in the size structure of the industry and in the prevailing scale of production.

4. Plant Size and Location of Austrian Machine-Building

Table II.7 below presents data on plant size and employment in 1902 and 1906. A significant part of productive activity was carried out on a fairly small scale. About 15 per cent of the labour force in mechanical engineering were employed in workshops with 20 workers or fewer. Compared with Austrian industry as a whole, though, machine-building displayed a high degree of employment concentration in larger plants. More than half of all workers in Austrian industry were employed in workshops with fewer than 10 staff; establishments with more than 50 workers provided employment for only 34 per cent of the industrial labour force[82]. In mechanical engineering, though, three quarters of the work force were employed in factories with more than 50 workers. The smallest manufacturing units with fewer than 10 employees accounted for less than 10 per cent of total employment in machine-building[83].

---

[81] Trend in output per worker was computed as a log-linear function using ordinary least squares estimation. The years 1889 to 1911 delimit the period for which data on the size of the labour force are available.

[82] Good, *Economic Rise*, Table 32, p.194.

[83] In Table II.7, the data for 1902 in the "1 to 5", "6 to 10" and "11 to 20" size classes have been grouped together into one "1 to 20" class to conform to 1906 definitions for comparability.

Table II.7

PLANT SIZE AND EMPLOYMENT IN MACHINE-BUILDING

	1902		1906	
size class	establ.	workers	establ.	workers
1-20	2,091	8,983	80	1,223
21-50	201	6,514	221	7,353
51-100	121	8,514	124	8,985
101-300	84	13,757	109	18,204
301-1,000	33	17,557	38	18,813
>1,000	5	6,070	5	6,129
Total	2,535	61,395	577	60,707

Sources: (1) 1902: See Table II.6. (2) 1906: Handelsministerium, *Fabrikszählung 1906*, Table IV, pp.264-268.

Using the results of the 1902 census, Good differentiates four basic patterns of industrial concentration in Austria[84]. The first pattern is that in which large-scale enterprises, especially those employing more than 1,000, dominate their sector. Mining and the iron and steel industry, in particular, belong in this group.

A second pattern is formed by those industries which, despite a relatively high share of large-scale operations, were dominated neither by small-scale nor large-scale enterprises. Here, medium-scale operations were dominant with more than 50 per cent of employees attached to firms in the 11 to 300 staff category. Giant operations employing more than 1,000 workers were present, but their shares in total sectoral employment fell below those of their counterparts in the extractive and iron industries or in the industries of pronounced bipolarity. The sectors included in this group of predominantly intermediate sized operations are chemicals, construction, stone and glass, central power generation and graphics. Wood products,

[84] The following section relies on Good, *Economic Rise*, pp.196-198.

clothing and leather products were sectors still in the handicraft stage of production. They fall into the third pattern where the majority of workers were employed in small workshops with less than five employees. The last pattern identified by Good refers to those sectors which were characterized by a bipolar structure of employment distribution. "Thousands of small handicraft operations co-existed with the rapid emergence of large-scale, capitalistically organized operations"[85]. The textile industry, metal-working, foodstuffs production and the broadly defined engineering sector[86] displayed bipolarity, though with varying degrees of emphasis on either small-scale or large-scale operations.

Using Good's criterion for medium-scale operation, i.e. the dominance of employment in the 11 and 300 workers range, mechanical engineering was a sector characterized mainly by medium-scale operations with a strong leaning towards large-scale production. Bipolarity was not a feature of the employment distribution in this branch of the engineering industries. Almost 52 per cent of the labour force in machine-building were employed in plants of middle size (11 to 300), about 28 per cent in large-scale factories (301 to 1,000) and about one tenth in giant plants employing more than 1,000 people (see Table II.7)[87].

---

[85] Good, *Economic Rise*, pp.197-198.

[86] The 1902 census differentiated 19 broad industrial categories which were broken down into 273 subsectors. "Mechanical engineering" as referred to in this thesis (which includes the production of steam engines, other engines, agricultural machinery, sewing machines, milling equipment and general machinery, as listed in Table II.6) is part of the broad engineering category but does not include, for example, clock-making, the manufacture of scientific and musical instruments or the production of armaments, coaches and railway cars encompassed in this category. See also Good, *Economic Rise*, note 12, p.198.

[87] Classification as either small, medium or large-scale is mainly a matter of definition. Good's changing usage of size definitions, though, is somewhat confusing: in Table 34, brackets of "1 to 5", "6 to 10" and "over 50" are used

The results of the business census 1902 and the factory census 1906 cannot be compared directly without further adjustment. The aim of the 1902 census was to obtain a comprehensive statistical record of all productive activity, whether handicraft based or industrial. The 1906 census, in contrast, focused on factories only, i.e. on establishments generally employing more than 20 workers[88]. This size criterion, reflecting contemporary terminology and definitions[89], was also applied in the 1890 business survey[90]. Standardizing the data for 1902 and 1906 by excluding all manufacturing units with less than 20 employees yields indicators which allow an assessment of changes in the average size of engineering plants (Table II.8)[91].

---

as indicators of small, middle and large firm size. Because of the high employment share of plants with more than 50 employees, chemicals, construction and power plants are classified in this table as part of the first, large-scale pattern. Yet in the accompanying text these sectors are described as being dominated by medium-scale operations since they displayed a particularly high share of employment in the 11 to 300 range. Similarly, production of leather goods is categorized in Table 34 as of predominantly middle size only to be downgraded to small-scale status. See Good, *Economic Rise*, pp.196-197.

[88] Handelsmuseum, *Materialien zur Produktions- und Betriebsstatistik*, pp.VI-VII.

[89] Otruba, G., "Quantitative, strukturelle und regionale Dynamik des Industrialisierungsprozesses in Österreich-Ungarn vom Ausgang des 18. Jahrhunderts bis zum Ausbruch des ersten Weltkriegs", *Vom Kleingewerbe zur Großindustrie*, ed. H. Winkel (Berlin, 1975), pp.116, 127.

[90] K.k. Handelsministerium, Statistisches Departement, "Statistik der österreichischen Industrie 1890", *Nachrichten über Industrie, Handel und Verkehr (NIHV)*, vol.54 (1894), p.X.

[91] If anything, the explicit exclusion of establishments with less than 20 employees is likely to cause an upward bias in the average number of workers per factory relative to the 1890 data for which no such adjustment could be made.

Table II.8

MACHINE-BUILDING FACTORIES 1890 - 1906

	establishments	workers	workers/establ.
1890	304	35,445	117
1902	444	52,412	118
1906	497	59,484	120

Sources: Table II.7 and Handelsministerium, "Statistik der österreichischen Industrie 1890", *NIHV*, vol.54 (1894), pp.132-133.

These results suggest that there was virtually no growth in the average number of employees per machine-building factory. The average factory size may, however, be an inadequate indicator of the predominant scale of production, as an increasing share of workers may have found employment in large factories while the employment share of small plants fell over time. The figures in Table II.7 indicate that there was no shift in employment concentration from small and medium sized factories to units employing 100 workers or more between 1902 and 1906. Possible changes in previous periods cannot be measured due to a lack of adequate data. However, the apparent stagnation in average factory size can be explained plausibly with the influence of two factors. These suggest that stagnation in average plant size was not necessarily a symptom of slackening sectoral expansion but rather an indication of a fairly dynamic development.

New firm entries rapidly increased the industry's ranks during the 1890s and the early 1900s. The number of machine-building plants rose by more than 3 per cent on annual average between 1890 and 1906 (Table II.8). To the extent that, in general, young firms tended to start operation with a smaller workforce than that employed in already established older companies, the rise in the number of machinery producers implied some downward pressure on the average employment size of manufacturing units. The mergers and acquisitions movement among the leading machine-building firms which gathered pace in the decade before the turn of the century may have led to some increase in the average plant size of the companies involved. But growth in the scale of operation does not appear to have been the predominant rationale behind these moves. Rather than the realization of economies of scale, engineering firms aim at gains derived from improved specialization. These, however, were not neceesarily related to growth in the size of operation at the plant level. When legal entities, i.e. companies, merged, in most instances this did not imply a reduction in the number of plants operated which would have caused an increase in the number of workers per factory[92].

Austria's machine-building sector showed a fairly high degree of regional concentration, as can be seen in Table II.9 below[93]. Mechanical engineering was located chiefly in Bohemia, Lower Austria, and Moravia, i.e. the economically most advanced regions where indigenous machine-building originated in the first half of the nineteenth century[94].

---

[92] Sections 2 and 3 of Chapter IV provide a more detailed discussion of the problem of specialization in the context of company mergers and cartelization attempts in Austrian machine-building.

[93] The data presented in this table are at best rough indicators of the main trends rather than accurate measures of locational change. The four industrial surveys (1870, 1880, 1885, 1890) all employed different minimum size criteria for firms to be included. Either certain business tax thresholds or definitions of "factory establishment" were used. The business census of 1902, it has been mentioned above, aimed at including all manufacturing establishments and the labour force employed. Its results are, therefore, probably more representative than those of the surveys.

[94] Cf. Fischer, H., "Die Maschinenindustrie in Österreich", *Die Groß-Industrie Österreichs*, vol.I (Vienna, 1908), pp.95-109; *Die hundertjährige Geschichte der Ersten Brünner Maschinen-Fabriksgesellschaft in Brünn 1821 bis 1921* (Leipzig, 1921), pp.17-87; Klíma, A., "The Beginning of the Machine-Building Industry in the Czech Lands in the

Table II.9

REGIONAL DISTRIBUTION OF MACHINE-BUILDING INDUSTRY
(PERCENTAGE SHARE IN TOTAL LABOUR FORCE)

	1870	1880	1885	1890	1902
Bohemia	18.8	29.8	25.8	30.8	31.4
Low. Austria	39.2	25.2	37.0	30.7	33.6
Moravia	10.4	19.0	14.4	19.0	20.1
Other	31.6	26.0	22.8	19.5	14.9
Total	100.0	100.0	100.0	100.0	100.0

Sources: (1) Handelsministerium, "Statistik der österreichischen Industrie 1870, 1880, 1885, 1890", *NIHV*, vols. 3 (1874) No.2, p.109; 28 (1884), pp.94-97; 38 (1888/89), pp.106-109; 54 (1894), pp.132-133. (2) Statistische Zentralkommission, "Betriebszählung 1902", *ÖStat*, vol. 75, 1.Heft, 2.Abtlg. (1907), Table VIII, pp.96-97; 3.Heft (1905), Table II, p.18; 9.Heft (1906), Table II, p.56; 10.Heft (1905), Table II, p.34.

Though pockets of engineering activity continued to exist elsewhere, notably in Silesia and in the ship-building areas in and around Trieste, the relative locational importance of industrial centres like Vienna, Prague, Pilsen/Plzeň, and Brno increased. The employment share of other regions declined over time. Growth in Austria's machine-building industry was thus associated with a further accentuation in its pattern of spatial distribution.

The sharp deline in Lower Austria's employment share between 1870 and 1880 can plausibly be explained with the crisis in railway related machine-building which was located largely in Vienna and its surroundings. The

First Half of the 10th Century", *JEEH* 4 (1975) No.1, pp.49-78; Slokar, J., *Geschichte der österreichischen Industrie und ihrer Förderung unter Kaiser Franz I.* (Vienna, 1914), pp.609-623. See Good, *Economic Rise*, pp.148-156, for a discussion of regional disparities of economic development; his Table 24, p.150, shows that income per capita in 1911-1913 was highest in Lower Austria (850 crowns), Bohemia (761 crowns), and Moravia (648 crowns), with an Austrian average of 569 crowns.

temporary recovery of this branch of engineering in the early to mid-1880s brought with it a rise in the region's employment share. However, in the longer run it was the Bohemian lands, in particular, that became increasingly important centres of Austrian machine-building[95]. The share of Bohemia and Moravia in total machine-building employment rose from 30 per cent in 1870 to more than 50 per cent at the turn of the century (Table II.9). This shift in the locus of industrial machine-building corresponds well with locational change in Austrian industry at large[96]. For in other industrial sectors, too, the Bohemian lands' part in output and employment increased significantly in the late nineteenth century. In metallurgy and mining, for example, the shift in activity from Alpine Austria towards the Bohemian lands took place largely in response to a more favourable endowment with natural resources. In contrast to the Alpine regions, which had virtually no anthracite coal and whose lignite deposits were not well suited for coking, the Bohemian lands were abundantly supplied with both anthracite and burnable lignite. The introduction of the Thomas-Gilchrist process allowed using Bohemia's high phosphorous content iron ore. As a result, the Bohemian lands' share in Austria's iron ore mining rose from 11 per cent in 1880 to 33 per cent in 1910, while their share in output of pig iron and cast iron increased from 37 to 58 per cent, and from 84 to 90 per cent, respectively[97]. If, in addition, the preeminence of the Bohemian lands in coal mining is taken into account[98], then it seems plausible to view at least part of the locational change in Austria's

---

[95] The Bohemian crownlands included Bohemia proper, Moravia, and Silesia.

[96] The following paragraph relies on Good, *Economic Rise*, pp.129-135; see also Matis and Bachinger, "Österreichs industrielle Entwicklung", pp.222-232.

[97] Good, *Economic Rise*, Table 21, p.132.

[98] Ibid.

machine-building industry as a response to the shifts in the regional resource base of its major material inputs, namely iron and steel, and coal for fuel. Furthermore, mining and the iron and steel industry were large and rapidly growing sectors in the late nineteenth century and as such important customers of the machine-building industry[99]. Thus closer proximity to both input and output markets contributed to the rising concentration of machine-building capacity in the Bohemian lands[100].

5. Conclusion

The discussion in the previous sections was largely concerned with the forces that shaped the machine-building industry's course over time. Output growth in mechanical engineering has been examined in relation to major changes in demand for machinery. But little has been said, so far, about how the machine-building industry has influenced the course of development in either individual manufacturing branches or in the industrial sector as a whole.

The data on iron and steel consumption in Austrian machine-building allow at least a partial assessment of the relationship between the engineering sector and the suppliers of its main inputs, the iron and steel industry. Changes in engineering output went along with changes in

---

[99] Percentage shares in total industrial value added (mining and manufacturing):

sector	1870	1913
mining	12.0	19.4
iron	15.6	23.9

Source: Calculated from data in Komlos, *Customs Union*, Appendix E, Tables E.6 and E.12.

[100] Similar locational effects emanated from the machinery demand of the sugar and chemical industries. Almost all of Austria's production of sugar in the late nineteenth century was accounted for by the Bohemian lands, and three quarters of the chemical industry's output was produced in this region. See Good, *Economic Rise*, pp.132-134, and Rudolph, *Banking and Industrialization*, p.54.

material inputs and were thus transmitted backwards by a change in demand for those inputs. The data presented in Table II.10 indicate that expansion or contraction in the machine-building industry, through its large share in total iron and steel consumption, must have led to significant backward linkage effects[101]. The contraction of mechanical engineering in the 1870s, for example, implied a considerable fall in its demand for inputs and deliveries of iron and steel to the machine-building industry declined. When engineering growth accelerated again in the late 1880s and 1890s, the industry absorbed a rapidly rising amount of iron and steel, directly contributing to the steel sectors' expansion.

Table II.10

MACHINE-BUILDING DEMAND FOR IRON AND STEEL AS PERCENTAGE OF TOTAL DOMESTIC PRODUCTION AND CONSUMPTION

	Production	Consumption
1870-1874	78.4	54.8
1874-1879	64.1	60.4
1880-1884	61.2	54.0
1885-1889	59.8	55.2
1890-1899	72.3	65.7
1900-1913	71.1	68.4

Source: Appendix A, Tables A.7 to A.9, and A.11, column (2).

Forward linkages refer to the relationship between an industry (or firm) and other industries (or firms) which use its output as an input. A change in output or price

[101] This holds even if allowance is made for a substantial margin of error. The volume of iron and steel consumption associated with machine-building is likely to be somewhat over-estimated throughout the period 1870 to 1913 as a result of accounting for only a minimum proportion of iron and steel used in other industries. See Appendix A, section I.

will be transmitted forward to the users of its product, e.g. a firm may reduce its sales prices in response to increased output. Similarly, changes in product quality are conveyed to machinery users. At the sectoral level, the measurement of such forward linkages is impeded by severe data problems. Little can be said about changes in product quality and thus, over the longer run, about the associated changes in the quality of the stock of capital goods employed in other sectors. These changes, however, directly influence that part of potential growth in those sectors which is determined by the input factor combination. Output in mechanical engineering is extremely heterogenous, ranging from simple agricultural devices to complex steam turbines or machine tools. The machine-building industry thus provides products for a large variety of markets. Intertemporal changes in output prices and product quality are likely to differ markedly between these markets.

Though no direct inferences can be made about the existence and strength of forward linkages, the concept of relative contributions to growth in total industry permits an assessment of the relative importance of mechanical engineering in Austria. As a first step, a new series of total manufacturing output was derived by combining value added in machine-building with the sectoral data included in Komlos' manufacturing index[102]. This series shows cyclical peaks in 1872, 1884, 1895, 1902 and 1912 between which growth was measured. The contribution of each industrial sector to overall manufacturing growth is given as a percentage share of the overall growth rate[103].

---

[102] A proportion of 53 percent was used to convert gross output (Appendix A, Table A.13, column (2)) into value added in machine-building; see Fellner, F., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.570-571.

[103] The absolute, non-annualized overall rate of change of manufacturing output (Y_t) between two points of time equals the sum of the structurally weighted rates of growth of the

The data presented in Table II.11 below point to the increasing impact of growth in mechanical engineering. Despite the machine-building industry's relatively small share in total manufacturing output - approximately 12 to 13 per cent during the 1890s - it became the main driving force pushing Austrian industrial growth. During the last two major business cycles, more than a quarter of output growth in total manufacturing was contributed by mechanical engineering alone[104]. By the turn of the century, the industrial branch which was so severely hit during the Great Depression of the 1870s and 1880s had, finally, become a leading sector.

---

individual manufacturing sectors (M^1_t to M^9_t):

$$\frac{Y_t - Y_{t-1}}{Y_{t-1}} = \frac{M^1{}_t - M^1{}_{t-1}}{Y_{t-1}} + \ldots + \frac{M^9{}_t - M^9{}_{t-1}}{Y_{t-1}}$$

The relative contribution of a single sector to total manufacturing growth equals the product of the sector's rate of growth and its share in total manufacturing output in the year against which growth is measured. The sum of all sectors' relative contributions to growth equals the rate of growth of total manufacturing output. Here, the contribution of each sector to total manufacturing growth is expressed as a percentage of total manufacturing growth.

[104] Much of the engineering sector's similarly large contribution to industrial growth during the 1884 to 1895 cycle should be interpreted as an outcome of recovery growth rather than genuine expansion; see this chapter, section2.

Table II.11

RELATIVE CONTRIBUTIONS TO INDUSTRIAL GROWTH (PER CENT)

Branch	1872-84	1884-95	1895-1902	1902-12
Machines	-5.02	23.82	25.20	27.08
Iron	35.90	15.04	22.01	32.18
Electricity	-	1.85	4.01	5.68
Cotton	47.26	26.62	16.64	21.66
Wool	-4.41	5.04	13.04	4.91
Flour	8.67	1.62	6.18	5.27
Sugar	11.68	9.31	-1.09	-1.71
Beer	5.91	14.55	13.04	4.73
Spirits	-	2.16	0.82	0.17
Total	100	100	100	100
Growth p.a.	1.70	2.96	1.99	3.87

Sources: Appendix A, Table A.13, column (2); Komlos, *Customs Union*, Appendix E, Table E.6.

III

THE RISE OF INDUSTRIAL ENGINEERING IN HUNGARY

1. The Pattern of Output Growth

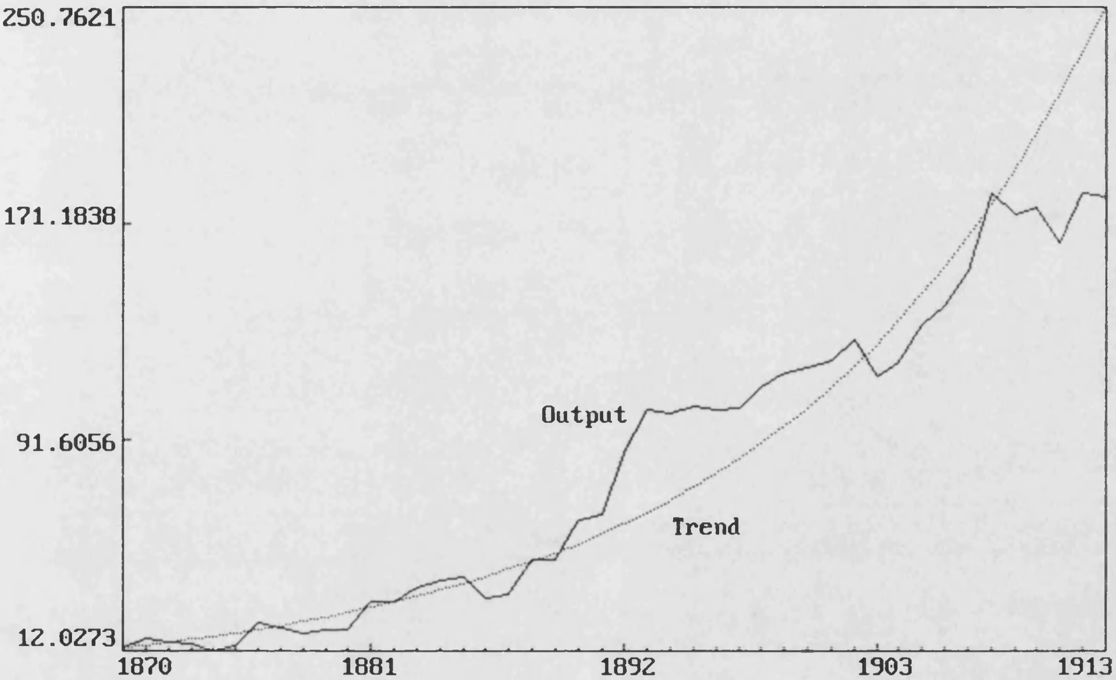
During the late nineteenth century, Hungary's machine-building industry expanded at a significantly faster pace than Austrian engineering. While Hungarian machinery output accounted for only 12 per cent of total Austro-Hungarian production in the early 1870s, this share had risen to almost a quarter on the eve of World War I. It will be argued in this chapter that five factors, in particular, account for the diverging rates of growth. Firstly, industrial machine-building in Hungary started from a substantially lower level of activity in the early 1870s. Thus even relatively modest absolute increases of output led to substantial rises in the rate of growth. Secondly, new areas of demand for capital goods opened up with the expansion of the industrial sector as a whole which also grew more rapidly than in the Western half of the Empire. A third factor which came into play was the effect of railway construction. Though new track was laid in a similarly volatile fashion, the completion of the Hungarian network was carried out at a faster rate. Consequently, Hungary's share in the length of the Monarchy's railway system increased substantially over time. Apart from the temporary collapse of construction subsequent to the railway boom of the early 1870s and the brief decline after the turn of the century, there was no significant slow-down in building activity. The demand for machinery associated with the railways and their expansion, therefore, continued to benefit Hungarian engineering at a time when similar effects in Austria were petering out. Fourthly, Hungarian agriculture became increasingly capital-intensive during this period. Its demand for machinery and implements and that of the associated food-processing industries provided a persistent stimulus to the domestic producers of those goods. Finally, the Hungarian government pursued a deliberate industrialization policy which both directly and indirectly supported the creation of a national capital goods industry. Yet before some of the more specific *causes* of faster growth of Hungarian machine-building are examined in more detail, a brief look should be taken at the pattern of output expansion in the industry.

The plot of machinery output in Figure III.1 and the growth rates reproduced in Table III.1 suggest conceptualizing development in four major cycles of varying growth intensity. During the first cycle up to a peak in 1885, machinery output increased at an annual average rate of more than 6 per cent. Hungarian machine-building was thus, clearly, less affected by the stock-market crash of 1873 than Austrian engineering. Though production fell briefly to a trough in 1874, pre-crash levels of output were surpassed again as early as 1876[1]. The second phase up to the mid-1890s was characterized by a substantial acceleration in output growth. The value of Hungarian machinery production nearly trebled between the early 1880s and 1895. However, in the following cycle up to 1902, output growth slowed down significantly to a rate of little

---

[1] This is not to say that Hungarian manufacturing or the machine-building industry, in particular, were immune to the impact of the 1873 crash. Several newly incorporated engineering firms went bankrupt at the time; Komlos, *Customs Union*, p.131. Turnover of the two leading Budapest engineering firms, Ganz and Schlick, regained its pre-crisis level only towards the late 1870; see Matlekovits, A. v., *Das Königreich Ungarn*, vol. II (Leipzig, 1900), pp.335-336. Similarly, estimated nominal output (i.e. production in current prices) of Hungarian engineering stayed at levels below the 1871 peak until 1880. But in *real* terms, sectoral output did not decline at the same rate and for the same length of time as in Austria; see Appendix A, Table A.21, columns (1) and (2).

Figure III.1: Output in Hungarian Machine-Building (Mill. Crowns; 1913 Prices)



Source: Appendix A, Table A.21, column (2).

more than 3 per cent. But it should be noted that this amounted to a faster increase than that estimated for Hungarian industry as a whole during this period (Table III.2). The last full cycle in Hungarian engineering took place in the decade before the outbreak of the First World War. It included a period of rapid expansion stretching from a trough in 1903 to a peak in 1908. Production grew by almost 6 per cent per annum between 1902 and 1908. Thereafter, however, output virtually stagnated and just about reached again its 1908 level after a downturn in 1909 to 1911.

Table III.1

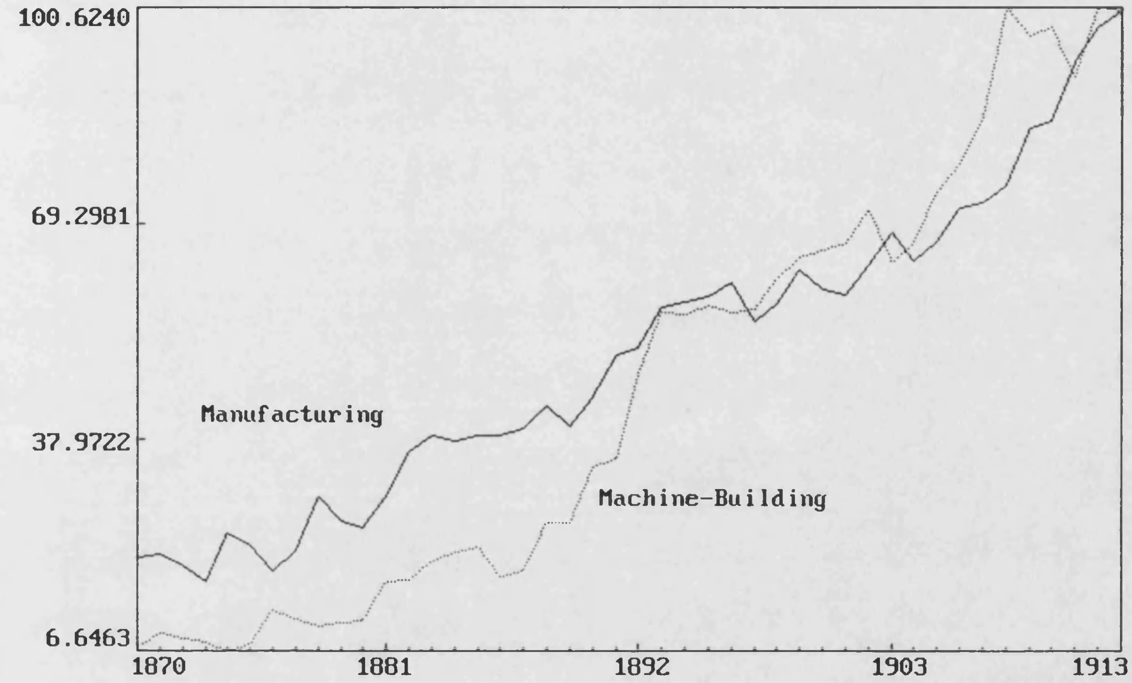
COMPOUND RATES OF GROWTH OF MACHINERY PRODUCTION IN CONSTANT 1913 PRICES (PER CENT PER ANNUM)

1870-1913	6.31	1890-1900	6.86
1870-1880	4.26	1900-1913	3.33
1880-1890	11.88		
Peak-to-peak measures:			
1871-1912	5.97	1871-1895	7.86
1871-1885	6.26	1895-1912	3.36
1885-1895	10.15		
1895-1902	3.13		
1902-1912	3.53		

Source: Appendix A, Table A.21, column (2).

A comparison with John Komlos' index of industrial production shows that the periodicity of this expansionary process is largely congruent with the temporal pattern of overall growth in Hungarian manufacturing (Figure III.2). Periods of expansion and stagnation generally coincided for the two series. Yet significant differences emerge as to the rates of growth and the intensity of output fluctuations. It has been shown in the previous chapter, that Austrian machine-building expanded faster in the long run than total industrial production. At the same time, engineering seemed more responsive to changes in the

Figure III.2: Indices of Hungarian Industrial Output (1913=100; 1913 Prices)



Sources: App. A, Table A.21, col.(2); Komlos, Customs Union, App. E, Table E.4.

business cycle. A similar pattern can also be observed for Hungary.

Table III.2

COMPOUND RATES OF GROWTH IN HUNGARIAN INDUSTRY (PER CENT PER ANNUM)

	M	MM	MMC
1871-1913	3.80	3.72	3.08
1871-1883	5.21	4.59	3.08
1883-1896	3.58	3.76	3.82
1896-1903	1.63	1.92	0.73
1903-1913	3.94	3.91	3.77
1871-1896	4.36	4.16	3.47
1896-1913	2.51	3.09	2.98

Key: M = manufacturing
MM = manufacturing, mining
MMC = manufacturing, mining, construction

Source: Komlos, J., *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century* (Princeton, 1983), Appendix E, Table E.4.

Between 1870 and 1913, and during most sub-periods in this span of time, Hungary's machine-building industry grew markedly faster than the country's manufacturing sector as a whole (Tables III.1 and III.2). Consequently, the share of machinery output in total manufacturing value added increased over time. In 1870/74, mechanical engineering accounted on average for about 8 per cent of Hungary's total manufacturing output. Twenty years later, this share had risen to more than 15 per cent, and by 1909/13, more than 17 per cent of manufacturing output originated in the nachine-building industry, despite the stagnation in engineering growth after 1908[2].

[2] A proportion of 53 per cent was used to convert gross output (Appendix A, Table A.21, column (2)) into value added in machine-building; see Fellner, F., "Das Volkseinkommen Österreichs und Ungarns", *Statistische*

Assessing the changes in industrial growth between 1830 and 1913, Komlos attaches particular significance to the years following the 1873 crash: "While Austria and much of Western Europe were in the throes of the Great Depression of 1873-1896 ... Hungary was undergoing its first widespread wave of industrialization"[3]. Between 1871 and 1883, manufacturing output is estimated to have grown by more than 5 per cent on annual average - a rate well above those achieved in earlier and subsequent periods (Table III.2)[4]. Judged solely by the growth rates achieved, it would appear that it was rather expansion during the *next* cycle from 1885 to 1895 that stood out as exceptionally fast in the long-run pattern of machine-building output. It has been shown in the previous chapter that Austrian machine-building, too, expanded rapidly during this period. The important difference is, however, that much of the output growth in Austrian engineering was clearly recovery related as the 1885 output level, though representing a peak, was still well below the 1872 peak[5].

However, the momentum achieved could not be maintained for long. First signs of a slowdown in the Hungarian economy had already appeared in 1898-99[6]. Industrial output had begun to decline in 1900, without having much immediate

---

Monatsschrift XLII (1916), pp.570-571. The series so obtained was combined with the sectoral value added data included in Komlos' index of manufacturing output. His index is composed of eight sub-series representing output of the following: beer, iron, distilled spirits (from 1880), sugar, cotton textiles, flour, woolen textiles (from 1906), and electricity (from 1891); Komlos, *Customs Union,* Appendix E, Table E.5.

[3] Komlos, *Customs Union*, p.131.

[4] See Komlos, *Customs Union*, Table 4.19, p.145, for Hungarian industrial growth during pre-1870s business cycles.

[5] See Chapter II, Table II.1 and Figure II.1.

[6] Berend, I.T. and Ránki, G., *The Development of the Manufacturing Industry in Hungary, 1900-1944. Studia Historica* 19 (Budapest, 1960), p.6.

effect on mechanical engineering, yet temporarily recovered and reached a new peak in 1903. In the following year, however, total manufacturing production fell by more than 6 per cent[7]. Berend and Ránki emphasize the gravity of this downturn and conclude that it was more severe than "in the leading capitalist countries, the United States, Germany, France, England or Russia"[8]. Preceding the drop in total manufacturing production by about a year, output in mechanical engineering fell by almost 11 percent in 1903 as the decline in railway construction, the collapse of industrial investment, and a setback in agricultural purchases following the poor harvest in 1901 drastically reduced demand for the industry's output[9].

Again, machine-building proved a sector most vulnerable to a general decline in economic activity. But after passing through the trough in 1903, Hungarian machine-building picked up again in response to the increase in investment demand associated with the revival of the industrial economy at large, which was now expanding at a rate significantly higher than that achieved between the mid-1890s and 1903 (Table III.2). Furthermore, the resumption of railway construction in Hungary led to a rise in demand for railway equipment[10]. Output of machinery expanded at a rate of almost 6 per cent per annum between the peaks of 1902 and 1908 - a figure well above that realized during the previous cycle and above the average achieved in other branches of manufacturing. It is, therefore, difficult to

---

[7] Komlos, *Customs Union*, Appendix E, Table E.4.

[8] Berend and Ránki, *Manufacturing Industry*, p.8. The downturn in the German economy and its effect on the machine-building industry are extensively discussed in Steller, P., "Die Maschinenindustrie Deutschlands", *Die Störungen im Wirtschaftsleben Deutschlands während der Jahre 1900ff.*, vol. 3, *Schriften des Vereins für Socialpolitik* 107, eds. Verein für Socialpolitik (Leipzig, 1903), pp.1-74.

[9] Berend and Ránki, *Manufacturing Industry*, pp.6-7.

[10] See Table III.9 below.

agree with Berend and Ránki who view the years after the turn of the century as a period of slow development in the machine-building industry[11]. Real stagnation came only after 1908, when the industry failed to recover fully from the 1909-11 downturn and did not return to a level of output near to its estimated long-run trend[12].

Just as overall industrial growth rates in Austria and Hungary seemed out of phase with one another between 1870 and 1913, so were the rates of expansion in machine-building[13]. And while Hungarian industry as a whole made greater advances over time than Austrian manufacturing, output in machine-building, too, increased more rapidly than in the Western half of the Empire. But two features of development were common to industrial engineering in both countries. Firstly, in terms of output growth the machine-building industry was one of the most dynamic industrial sectors, and secondly, fluctuations in engineering output were more pronounced than those in other branches of manufacturing. The evidence suggests that machine-building was an industrial sector particularly exposed to the impact of the business cycle (Figure III.3).

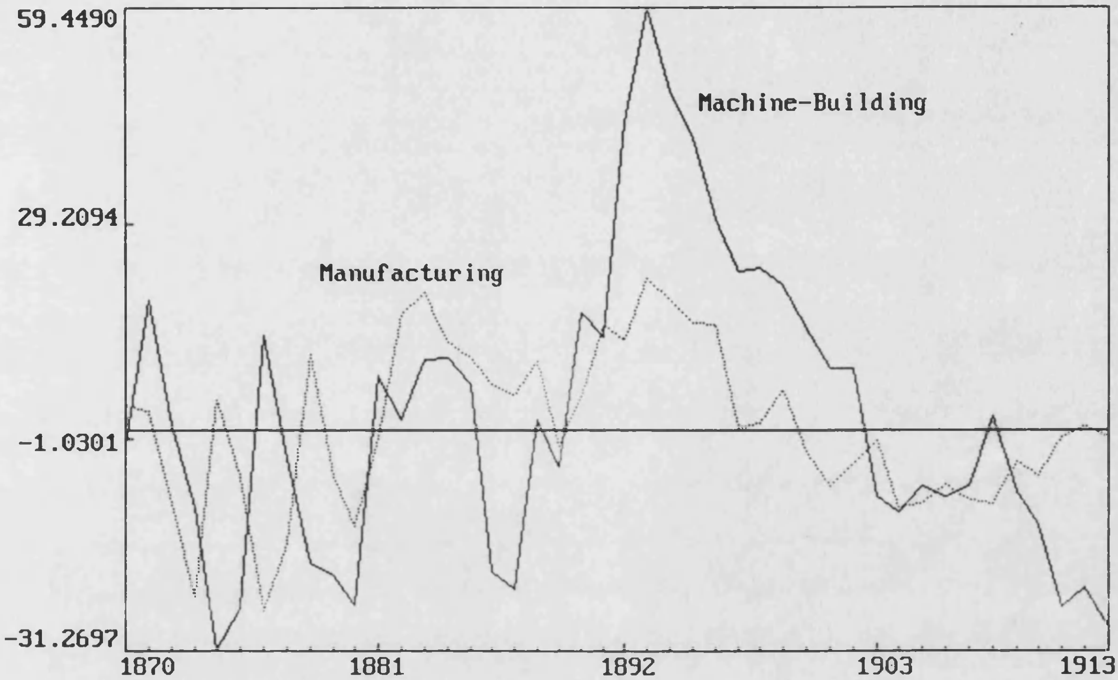
---

[11] Berend and Ránki, *Manufacturing Industry*, pp.18-20.

[12] The continued fast growth in Hungarian imports of machinery suggests that it was not a lack of absolute demand which acted as a brake on output growth; see Chapter V, Table V.1. Apparently, an increasing proportion of demand for machinery was directed towards those products which the domestic machine-building industry could not supply in sufficient quantities and qualities or at competitive prices. See Chapter V, section 5, for a discussion of effective protection in Austro-Hungarian machine-building.

[13] See Chapter II, Tables II.1 and II.2, and Komlos, *Customs Union*, pp.131-132.

Figure III.3: Deviations from Trend of Production (Per Cent of Trend)



Sources: App. A, Table A.21, col.(2); Komlos, Customs Union, App. E, Table E.4.

2. The Structure of the Industry and the Composition of its Output

The pattern of output expansion outlined in the previous section was sustained by both the enlargement of existing establishments and the foundation of new machine-building factories. The phases of most rapid growth in production generally coincided with periods when new company formations were at their highest level.
Though some of the most important machine-building firms were founded already in the 1850s and 1860s, it was in the last two decades of the nineteenth century that the number of new manufacturers rose significantly. More than half of the 83 engineering plants covered in the Hungarian industrial survey of 1898 were set up in the 1880s and 1890s. A summary is given in Table III.3 below[14].

Table III.3

FOUNDATION OF ENGINEERING FACTORIES EXISTING IN 1898
(NUMBER OF FIRMS)

pre-1850	11	1870-1879	11
1850-1859	6	1880-1889	20
1860-1869	11	1890-1898	24

Source: Kereskedelmügyi Magyar Kir. Miniszter, "Gép-gyártás és Közlekedési Eszközök Gyártása", *A Magyar Korona Országainal Gyáripara az 1898. Évben*, V. part, ed. J. Szterény (Budapest, 1901), (hereafter "Gépgyártás 1898"), pp.21-23.

By far the largest part of these plants was set up in Budapest. Out of the 73 *machine-building* establishments

[14] As only those firms which were still in operation in 1898 are included, the figures give a somewhat biased impression of founding activity. Quite a few of the machine-building firms newly incorporated in the late 1860s and early 1870s, for example, went bankrupt in the 1873 crash; Komlos, *Customs Union*, p.131.

included in the 1898 survey, 32 were located in Budapest[15]. In 1906, 37 out of 101 factories were situated in the capital[16]. The impression of a regionally highly concentrated industry is confirmed when referring to the leading joint-stock companies in Hungarian machine-building[17]. The contemporary sources focus on proximity to sufficiently large markets for the output of a still fairly unspecialized industry and the availability of skilled labour as the main reasons for the accumulation of machine-building firms in Budapest, the country's commercial and political centre[18].

Tables III.4 to III.6 provide data on the number of establishments in the industry, the size of plants and the level of employment in engineering. The 1898 and 1906 figures for the number of establishments and the labour force are probably lower bounds as the surveys did not cover firms with fewer than 20 employees[19]. According to the Austrian industrial census for 1902 less than a fifth of all machine-building establishments in the Western half of the Monarchy employed more than 20 workers. Their work

---

[15] The share of Budapest plants is even higher when only factories employing more than 200 people are taken into account; Kereskedelmügyi Miniszter, "Gép-gyártás 1898", pp.14-18.

[16] Magyar Kir. Központi Statisztikai Hivatal, *A Magyar Korona Országainak Gyáripara az 1906. Évben*, II. vol., II. part, ed. A. Edvi Illés (Budapest, 1911), (hereafter *Gyáripar 1906*), pp.554-561.

[17] See the list of Hungarian machine-building joint-stock companies in Appendix B: three quarters of the firms included in the sample were registered in Budapest.

[18] Kereskedelmügyi Miniszter, "Gép-gyártás 1898", p.19. A further explanation may be found in the benefits derived from being located at the communications centre of the domestic economy. Direct access to both river- and rail-transportation implied the ability to serve several locationally separate markets from one centre.

[19] Kereskedelmügyi Miniszter, "Gép-gyártás 1898", pp.4-5; Központi Statisztikai Hivatal, *Gyáripar 1906,* pp.546.

force, however, accounted for 85 per cent of the total[20].

Table III.4

NUMBER OF ENGINEERING ESTABLISHMENTS IN HUNGARY

	1891	1898	1906
(1) engineering:	59	83	113
machine-building	48	73	102
ship-building	7	5	5
railway car prod.	2	3	3
other	2	2	3
(2) repair works	18	44	48
(3) total	77	127	161

Sources: (1) 1891, 1898: Kereskedelmügyi Miniszter, "Gépgyártás 1898", pp.9-11, 14-18. (2) 1906: Központi Statisztikai Hivatal, *Gyáripar 1906,* pp. 554-561.

Table III.5

SIZE OF ENGINEERING ESTABLISHMENTS IN HUNGARY

	1891	1898	1906	
size class			engin.	repair
20 - 100	41	68	63	24
101 - 200	16	16	19	6
201 - 500	13	23	13	9
501 - 1,000	3	9	11	6
>1,000	4	11	7	3
total	77	127	113	48

Source: Központi Statisztikai Hivatal, *Gyáripar 1906*, II. vol., II. part, Tables I and II, p.552.

A tentative comparison of the available figures would suggest that relatively more Hungarian plants fall into the upper size-categories than Austrian machine-building factories. Excluding the firms with fewer than 20 workers from the Austrian figures and adjusting the size-categories

[20] See Chapter II, Table II.7.

to ensure compatibility between the two data sets yields indicators as reproduced in Table III.6 below.

Table III.6

SIZE OF ENGINEERING FACTORIES IN AUSTRIA-HUNGARY 1906

	establishments	
	Austria[a]	Hungary[b]
size class		
20 - 100	345	63
101 - 1,000	147	43
>1,000	5	7
total	497	113

[a] machine-building
[b] engineering

Sources: (1) Austria: Chapter II, Table II.7. (2) Hungary: Table III.5.

Unfortunately, no sectoral employment data are available other than the aggregates given in the two industrial surveys of 1898 and 1906, and the figures produced in the workers' accident insurance statistics for 1911 and 1912. The data for 1898 and 1906 differentiate only between employment in engineering plants and employment in railway and shipping repair shops, i.e. it is not possible to ascertain the exact size of the workforce in machine-building proper (mechanical engineering) as exemplified in Table III.7. In order to facilitate at least some rough comparison between the various employment data, two approximations of the workforce in machine-building have been prepared for 1898 and 1906. It was assumed that the number of workers in mechanical engineering corresponded to the share of machine-building in total engineering output, or: all branches of engineering had the same level of output per worker (Table III.7)[21]. The figures imply that Hungary's machine-building industry employed approximately one-third of the labour force in Austrian machine-building.

Table III.7

NUMBER OF EMPLOYEES IN HUNGARIAN ENGINEERING

	1898	1906	1911	1912
Engineering	24,483	33,055	-	-
Repair Shops	10,248	11,674	-	-
Machine-Building	14,445[a]	22,477[a]	28,025	33,213

[a] Approximations based on shares of machine-building output in total engineering production (1898: .59; 1906: .68).

Sources: (1) 1898: Kereskedelmügyi Miniszter, "Gép-gyártás 1898", pp.93-96, 131. (2) 1906: Központi Statisztikai Hivatal, *Gyáripar 1906*, II. vol., II. part, pp.551-552, 716-717. (3) 1911, 1912: Magyar Kir. Allami Munkásbiztosítási Hivatal, *A magyar királyi állami munkásbiztosítási hivatalnak az 1907. évi XIX. törvényezikk 177. §-a alapján a kereskedelmügyi magyar királyi minister elé terjesztett jelentesé az országos munkásbetegsegélyzö és baleset-biztosító pénztár müködéseröl 1911-1912, vol. II*, (Szeged, 1914; Budapest, 1917), tételszáma 199-214, 219, 254-255.

In 1911 - the only year for which fully compatible wage-bill and employment data exist for the two countries[22] - the value of output per worker in Austrian machine-building was about 9 per cent higher than the equivalent measure in Hungarian mechanical engineering[23]. Meaningful calculations

[21] The figures obtained for 1898 and 1906 probably underestimate the level of employment in mechanical engineering relative to the 1911 and 1912 data as only firms employing more than twenty people were included in the 1898 and 1906 surveys.

[22] See Appendix A, Tables A.12a to A.12e and A.15, for sources.

[23] Hungarian machine-building output went through a trough in 1911 while Austrian production was on the rise. Assuming that changes in the labour force were not fully proportional to output fluctuations, much of the

of changes in labour productivity over time, however, are rendered impossible by the lack of further data[24].

Data on the *structure* of Hungary's machine-building output prove useful in identifying those product areas which in terms of relative size and growth were of particular significance for the process of expansion as a whole. The figures presented in Table III.8 indicate the predominance of four such product areas: agricultural machinery; flour milling and food processing machinery; railway technology and steam technology[25]. Output of agricultural machines and implements, for example, accounted for more than 13 per cent (16 per cent) of total machinery production in 1898 (1906). Locomobiles, i.e. portable steam engines, were predominantly used in agriculture. If production of these machines is also included, the share of machinery for agriculture in total Hungarian machinery output rises to about 20 and 24 per cent, respectively. Machinery for the flour milling industry was most probably more important than the data in Table III.8 suggest. According to Berend and Ránki, manufacture of machines and installations for the milling industry represented 30 percent of the total value of machine-building output in 1909. The substantial difference to the figures for flour milling machinery given in Table III.8 probably results from the inclusion, in their data, of machinery other than milling apparatus in a

---

productivity differential may be a reflection of temporarily underutilized resources rather than a genuine gap in labour productivity. See Appendix A, Tables A.13 and A.21, for production data and Chapter II, Table II.7, for data on employment in Austrian machine-building.

[24] Even at the level of the individual firm it was not possible to gather sufficient employment data which could be matched to the available production data, e.g. for Ganz, in an attempt to compute some basic measures of labour productivity.

[25] Cf. Berend, I.T. and Ránki, G., "Ungarns wirtschaftliche Entwicklung 1848-1918", *Die Habsburgermonarchie 1848-1918*, vol. 1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), p.503.

narrow sense, such as power generators, transporters, and elevators which were also used in mills[26].

The discussion of the sources of sectoral growth in the next paragraph will explicitly relate to these product areas and the market link they established between the machine-building industry and other sectors of the economy.

---

[26] Berend and Ránki, *Manufacturing Industry*, p.19.

Table III.8

OUTPUT COMPOSITION IN MECHANICAL ENGINEERING
(MILLION CURRENT CROWNS)

	1898	1906
1. steam boilers	2.94	7.17
2. steam engines & turbines	2.39	4.18
3. int. combustion engines	0.32	3.74
4. locomotives & tenders	9.90	4.85
5. components of locomotives & railway cars	1.17	4.28
6. locomobiles	3.74	6.68
7. water turbines & wheels	0.43	1.27
8. agricultural machinery	8.35	14.31
9. flour milling machinery	4.17	4.82
10. food processing machinery	0.51	2.25
11. chemical plant equipment	0.12	0.89
12. stone-, ceramics- & glass-works machinery	0.23	0.95
13. paper-making-, binding- & printing machines	0.40	0.60
14. textile machines	0.90	2.00
15. cranes & transmissions	1.40	3.84
16. pumps & compressors	1.73	3.26
17. wood-working machinery	0.25	0.67
18. metal-working machinery	1.50	1.42
19. iron works equipment	0.86	1.32
20. mining & steel milling machines	0.13	0.32
21. railway equipment	5.07	2.68
22. iron construction	7.43	6.86
23. casting & components	3.85	6.76
24. other machinery & repairs	3.89	3.90
Total	61.67	89.00

Sources: (1) 1898: Kereskedelmügyi Miniszter, "Gép-gyártás 1898", pp.93-96. (2) 1906: Központi Statisztikai Hivatal, *Gyáripar 1906*, II. vol., II. part, Tables XXXIII to LXI, pp.617-717.

3. The Sources of Growth in Hungarian Machine-Building

The Impact of Railway Construction. Between 1869 and 1913, Hungary's network of railway lines increased from a total of 2,736 kilometres to 21,798 kilometres. This amounts to an annual average rate of expansion of 4.8 per cent, about 1.4 percentage points above the equivalent Austrian rate. But construction of new track varied significantly over time. Periods of rapid expansion alternated with phases of only little construction activity (Table III.9). After the first railway boom in the 1850s and temporary stagnation in the 1860s, railway construction became "the dynamic leading sector of the first Hungarian Gründerzeit" in the early 1870s[27]. With the depression in the aftermath of the 1873 crisis railway building slowed down markedly, only to accelerate again in a new railway boom starting in the early 1880s and lasting up to the turn of the century[28].
Apart from strengthening the competitive position of Hungarian agricultural exports and from fostering inter- and intra-regional division of labour through unification of the internal market, railway construction in Hungary directly stimulated the domestic iron and engineering industries after 1867[29]. The operation of a rapidly expanding network called for the supply of locomotives, rolling stock and general railway machinery and equipment.

---

[27] Katus, L., "Transport Revolution and Economic Growth in Hungary", *Economic Development in the Habsburg Monarchy in the Nineteenth Century. Essays*, ed. J. Komlos (New York, 1983), p.191.

[28] Ibid.

[29] Katus, "Transport Revolution", pp.199-201.

Table III.9

ADDITIONS TO RAILWAY NETWORKS
(KILOMETRES)

	Austria	Hungary
1870-1874	4,433	3,686
1875-1879	1,648	636
1880-1884	1,799	1,656
1885-1889	1,958	2,156
1890-1894	1,188	2,267
1895-1899	2,481	3,791
1900-1904	1,841	889
1905-1909	1,756	2,438
1910-1913	604	1,543

Sources: (1) Austria: k.k. Statistische Central-Commission, *Statistisches Jahrbuch der österreichischen Monarchie 1873*, IV, pp.2-3, 8-9; *1874*, IV, pp.4-5, 13 (Vienna, 1874-1875); *Österreichisches Statistisches Handbuch für die im Reichsrathe vertretenen Königreiche und Länder 1882*, p.192; *1914*, p.191 (Vienna, 1883, 1915). (2) Hungary: Magyar Kir. Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv 1912*, p.245; *1913*, p.170 (Budapest, 1913-1914).

While in the 1870s most of the railways were still owned and operated by private companies[30], the government bought two engineering firms, both of which were being financially liquidated, merged them, and reconstituted the new establishment in 1870 as machine-building and railway car plant of the Hungarian State Railway Company[31]. The purpose of this factory was to satisfy the Railway Company's demand for machinery. The first Hungarian standard gauge locomotive was built in these works in 1873. With low levels of new construction, demand for locomotives was muted and, consequently, the plant produced on average only

[30] Between 1876 and 1891 the Hungarian state bought 5,000 kilometres of railways owned by 12 private companies. After 1891 about 85 percent of Hungary's railways were owned or operated by the state; Katus, "Transport Revolution", pp.190-192.

[31] Matlekovits, A. v., *Das Königreich Ungarn*, vol. II (Leipzig, 1900), p.330.

five new engines per year between 1874 and 1880. Yet with the onset of renewed building activity in the early 1880s, output of locomotives picked up; by 1890 51 locomotives were made in the plant and only five years later deliveries reached an annual level of 171 engines[32].

Ganz, too, was heavily involved in railway engineering. The firm produced hard-rimmed cast iron railway wheels and railway crossings from the 1850s onwards, with output reaching a maximum at the time of the railway boom in the early 1870s[33]. The downturn in both domestic and foreign railway construction after 1873 caused a decline in the production of these railway items. But already in 1879, just at the onset of a new railway boom, Ganz bought the First Hungarian Waggon Factory in 1879 and almost instantaneously benefited from a fast increase in turnover[34]. Ganz and the machine-building plant of the State Railway Company are just two examples from a list of companies working in railway engineering. Schlick, Weitzer and the Hungarian Waggon- and Machine-Building Company (Györ) are other large firms which throughout the late nineteenth century kept a substantial part of their capacity for railway related production.

In 1898, more than 26 per cent of machine-building output was related to railway needs. Eight years later this share had halved to 13 per cent in response to the donwturn in construction activity at around the turn of the century (Table III.9).

---

[32] Ibid., p.331.

[33] Magyar Országos Levéltar (hereafter MOL), *Levéltari Leltárak 35*: Ganz és Társa Villamossági-, Gép-, Vagon- És Hajógyár RT., Hofherr-Schrantz-Clayton-Shuttleworth Magyar Gépgyári Müvek RT., Repertórium, vol. I., prepared by G. Szilágyi (Budapest, 1965), pp.7-8. For production data see Matlekovits, *Königreich Ungarn*, vol. II, pp.332-335.

[34] Matlekovits, *Königreich Ungarn*, vol. II, pp.333-335. See also Chapter IV, section 3.

The Machinery Demand of Agriculture and the Food-Processing Industries. On the eve of World War I, Hungary was still a predominantly agricultural country. In 1910, 60 per cent of the gainfully employed population was working in agriculture; industrial labour accounted for less than 18 per cent[35]. Agriculture contributed almost 64 per cent of the country's national income[36]. The food-processing industries, in turn, held a share of nearly 48 per cent in Hungary's industrial production; output of the flour-milling industry alone accounted for more than 20 per cent of total industrial production[37]. From 1867 more than 30 per cent of the country's wheat production was exported, an increasing share of which as flour. In the decades before 1914, Hungary became the second largest flour exporter after the United States[38]. "The food-processing sector remained Hungary's most important manufacturing sector until World War I"[39].

Under those conditions it seems not surprising to find the output structure of Hungarian machine-building heavily geared towards the machinery needs of the flour-mills and agriculture. It has been shown above that the data on domestic production of agricultural implements, flour milling and food processing machinery presented in Table III.8 almost certainly represent lower bounds for domestic machinery deliveries to the respective sectors. Steam engines and boilers, for example, were needed to power the

---

[35] Berend, I.T., Ránki, G., "Das Niveau der Industrie Ungarns zu Beginn des 20. Jahrhunderts im Vergleich zu dem Europas", Separatum *Studia Historica* 51 (Budapest, 1961), p.274.

[36] Fellner, F. v., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), p.594.

[37] Ibid., pp.548, 619-620.

[38] Katus, "Transport Revolution", p.184.

[39] Komlos, *Customs Union*, p.132.

rising number of steam mills[40]. From the 1870s until the mid-1890s Hungary's flour industry was developing at a rapid pace. Output grew at an average annual rate of almost 4 per cent between 1874 and 1894[41]. The advances made in the flour industry went along with significant innovations in milling technology. In the mid-1870s the Ganz works patented and introduced a new type of cast roller milling stool. The Hungarian mills quickly adopted the new milling machines which soon also appeared on foreign markets[42]. However, after 1896 both exports and production of the flour industry stagnated and, finally, ceased to develop in response to both a decrease in foreign demand and stagnation of Austria's demand[43]. Manufacturers of milling machinery faced sales that were virtually stagnating. This might explain why output of milling machinery remained more or less constant after 1898 (Table III.8).

The producers of agricultural implements and machines, in contrast, experienced a period of most rapid and above average growth. Nominal production rose by almost 7 per cent on annual average between 1898 and 1906. The evidence suggests that rapid expansion in this branch of machine-building continued for at least another half decade[44]. The driving force, surely, must have been increased mechanization in Hungary's agriculture rather than an increase in foreign demand for Hungarian machines. The

---

[40] See Komlos, *Customs Union*, Table 4.13, p.136 on the distribution of flour mills in Hungary by power source.

[41] Komlos, *Customs Union*, Appendix E, Table E.5.

[42] MOL, *Levéltari Leltárak* 35: Ganz, pp.9-10; see also Matlekovits, *Königreich Ungarn*, vol. II, p.334, for data on exports and production of the new milling machines.

[43] Komlos, *Customs Union*, pp.141-142.

[44] Using the sources given in Appendix A, Tables A.3 and A.15, output of agricultural machines in 1911 can be approximated on the basis of wage-bill data and wage-bill/turnover ratios as 21.55 current million crowns. The rate of growth between 1906 and 1911 was then 8.5 percent per annum.

explanatory notes of the foreign trade statistics emphasize that Hungarian machine-building proved unable to meet the rapidly rising domestic demand in the late nineteenth century. And this, in turn, resulted from advances made in the intensification of agricultural production[45].

The Effects of Industrial Policy. Since the early 1880s, the Hungarian government became increasingly involved in attempts to direct the course of industrialization. The first of a series of increasingly ambitious laws concerning financial support of the industrial sector was passed in 1881. It stipulated only a few crucial measures including tax and local charge exemption for new factories and the use of small subsidies. Nine years later the limits for tax and charges exemption were widened and the level of subsidies was increased. A minor change came again in 1899 when small industry and cooperatives were included; the level of average annual subsidies rose once again[46]. However, fundamental changes to the rules and measures governing industrial policy were carried out in 1907. The new law of the same year defined four groups of benefits:

---

[45] Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1882-1913.Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1923), p.63. See also Berend and Ránki, "Ungarns wirtschaftliche Entwicklung", pp.493-494; Katus, L., "Economic Growth in Hungary during the Age of Dualism, 1867-1918", *Social-Economic Researches on the History of East-Central Europe. Studia Historica* 62, ed. E. Pamlény (Budapest, 1970), pp.47-48. Scott Eddie computed an average annual rate of growth of agricultural output per worker of approximately 1.5 per cent during the late nineteenth century. This rate compares not unfavourably with those calculated for other countries and may to some extent serve as an indicator of the impact that increased machine utilization made on Hungarian agriculture; see Eddie S., "Agricultural Production and Output per Worker in Hungary, 1870-1913", *JEH* 28 (1968) No.1, pp.209-217.

[46] For a brief description of the policy measures applied between 1881 and 1906 see Sugár, O., *Die Industrialisierung Ungarns unter Beihilfe des Staates und der Kommunen* (Leipzig, 1908), pp.12.

state benefits (tax exemptions, etc.), direct financial support (subsidies or participation of government in stock capital), preferential treatment in relations with the public sector, and support for the construction of worker's homes[47]. The one measure of the new law which in the following years seemed most effective was the stipulation that, in general, all public sector institutions had to purchase from domestic rather than foreign firms. Foreign manufacturers wishing to do business with the Hungarian government had to open factories in the country[48]. It should be emphasized that even *Austria*, for that matter, was regarded as a foreign country. As the volume of subsidies to industry was small relative to total industrial production[49], discrimination assumed particular significance. The examples of two firms, Hofherr-Schrantz and Marchegger, are indicative.

In 1900, Hofherr-Schrantz (Vienna) - one of the two leading manufacturers of agricultural machinery in the Habsburg Empire - opened a new plant in Kispest[50]. Previously the firm was represented in Hungary only by sales subsidiaries and repair-shops founded in the early 1880s. In terms of

---

[47] Ibid., p.19.

[48] Ibid., p.21.

[49] See Paulinyi, A., "Die Industriepolitik in Ungarn und in Österreich und das Problem der ökonomischen Integration (1880-1914)", *Zeitschrift für Wirtschafts- und Sozialwissenschaften* (1977) 2, Tables 1 and 2, p.159. The machine-building industry participated with a share of 5.7 percent in total industrial subsidies during 1900 and 1909; that amounted to 2.15 million crowns over ten years. At that time, output in the industry varied between 94 and 160 million crowns *per annum*. Consequently, it is difficult to see that these subsidies should have had any fundamental effect on the industry.

[50] The following section relies on MOL, *Levéltari Leltárak 35*, Repertórium, vol.II: Hofherr-Schrantz-Clayton-Shuttleworth Magyar Gépgyári Müvek Rt., pp.129-131. See also *100 Jahre Hofherr-Schrantz, 1857-1957* (Vienna, 1957) and Matis, *Big Business*, p.152.

output and employment, the new establishment soon exceeded the old Viennese factory and became the main operation of the firm. The move of production facilities to Hungary was primarily influenced by the consideration that Hungary was the agricultural centre of the Empire and, secondly, that it was closer to the Balkan states and their important markets for agricultural implements. In 1908, the Vienna and the Kispest establishments were divided into two formally independent joint-stock companies[51]. The evidence suggest that with respect to the Hungarian operation, prospects of government support at least contributed to this decision. The firm in Kispest had contacted the Hungarian Ministry of Trade applying for state benefits in support of the enlargement of its operations. Eventually, tax exemptions were granted for a period of 15 years pending compliance with a set of conditions. For example, the firm had to be transformed into an independent joint-stock company registered in Hungary; the plant was to be equipped according to the latest state of technology; a minimum amount of new investment of at least 1.6 million crowns spread over three years (in addition to an initial investment of 2.3 million) had to be guaranteed by the company; and three quarters of the work force, of at least 1,500 workers, had to be Hungarian citizens[52]. The benefits were later transferred to the new company which resulted from the merger of Hofherr-Schrantz with its closest competitor Clayton-Shuttleworth in 1912[53].

---

[51] The owners of the Viennese firm maintained a controlling stake in Budapest company. On the relationship between the two firms see MOL, Z 450-112.cs.-759.sz.: Hofherr-Schrantz-Clayton-Shuttleworth (Vienna), protocolls of Board of Directors' meetings, 1908 to 1913.

[52] MOL, Z 451-5.cs.-21.sz.: Hofherr-Schrantz-Clayton-Shuttleworth (Kispest), communications with the Hungarian Ministry of Trade, 1908-1913.

[53] Again, the Austrian and the Hungarian operations of the two firms were merged into two formally independent joint-stock companies.

The second example used to illustrate the way in which industrial promotion in Hungary attracted interest among machine-builders is that of the Austrian "Marchegger Maschinenfabrik und Eisengießerei", a producer of processing machinery for the iron and coal industries and cement factories[54]. In an exposé, its owner outlined his plan of building a new production plant in Hungary rather than expanding the existing facilities in Austria. Apart from an expected further increase in business in Hungary, which already accounted for more than half of the firm's total turnover, he cited the definite promise of substantial orders from the Hungarian government as the most prominent reason of considering to set up a new plant. This plant and the existing factory in Austria would both be owned and operated by a new Hungarian joint-stock company. In accordance with the principles of the 1907 Law on industrial promotion, the prospect of government orders was dependent on the creation of a Hungarian company and plant. The example of the "Marchegger Maschinenfabrik" may thus show that at least to some extent industrial policies had a capacity creating effect in Hungarian machine-building[55]. Sufficient quantitative data are not available to measure more precisely the impact of industrial policies on Hungarian engineering. However, if allowance is made for the fact that investment in other industries was also financially supported with a view to foster domestic industrial production, notably in the textiles industry, it seems plausible to assume that part of the additional demand for investment goods was channelled to the domestic capital goods sector[56]. The relatively small amounts of government benefits spent directly in support of the

---

[54] See MOL, Z 40-9.cs.-238.sz.: Pesti Magyar Kereskedelmi Bank, 1909.

[55] Komlos maintains a sceptical view of the effectiveness of industrial promotion in Hungary, see his *Customs Union*, pp.154-159.

[56] Ibid., p.157.

machine-building industry were thus complemented by the benefits derived indirectly from support of other industrial branches.

4. Conclusion

The discussion in the previous pages has shown that the structure of Hungarian machine-building output was dominated by the production of agricultural machinery. Moreover, after the turn of the century this branch belonged to the most rapidly growing sections of Hungarian machine-building, expanding faster than mechanical engineering as a whole. As in the case of Austria, a rising share of engineering resources was put to use in the making of agricultural machines and implements. It will be examined in Chapter V to what extent the *increasing* specialization in machinery for agricultural purposes was a response not only to the peculiarities of the Hungarian economy but also to its relative position in international machinery trade.

The data presented in Table III.10 below suggest that variations in productive activity in Hungarian machine-building were likely to feed back to the iron and steel sector. As in the case of Austria, the machine-building industry persistently absorbed more than 50 per cent of the country's iron and steel *consumption*. The volume of metal inputs used in mechanical engineering accounted for an even higher share of domestic *output* of iron and steel. The large relative weight of engineering demand in total demand for iron and steel meant that any changes in output of the machine-building industry, which implied a variation in material inputs, led to significant changes in the demand for iron and steel output. Hence in Hungary, too, expansion and contraction in mechanical engineering entailed substantial backward linkage effects.

Table III.10

HUNGARIAN MACHINE-BUILDING DEMAND FOR IRON AND STEEL AS PERCENTAGE OF TOTAL DOMESTIC PRODUCTION AND CONSUMPTION

	Production	Consumption
1870/1874	71.5	52.3
1875/1879	56.7	51.5
1880/1884	60.2	51.6
1885/1889	55.6	51.2
1890/1894	64.1	59.1
1895/1899	62.1	59.3
1900/1904	64.0	66.3
1905/1913	68.4	63.8

Source: Appendix A, Tables A.16 to A.18, and A.20, column (2).

The relative percentage contributions of individual manufacturing branches to total industrial growth are reproduced in Table III.11. These data allow us to assess the quantitative impact the machine-building industry made on output expansion in Hungarian manufacturing as a whole[57]. The evidence suggests that mechanical engineering in Hungary was a major force accounting for growth, especially during the 1883-96 cycle when the sector contributed more than 26 per cent of the increase in total manufacturing output. In the years thereafter, however, the machine-building industry lost some of its relative strength as a growth generating sector. Between 1896 and 1903, most of the comparatively low rate of manufacturing growth was accounted for by the expansion in the consumers goods industries, notably cotton and flour production. The acceleration in overall manufacturing growth in the post-1903 period was to a very large extent dominated by the expansion in the iron and steel sector. The machine-building industry's percentage contribution to overall

[57] The methods used to compute the relative sectoral contributions to industrial growth are described in detail in Chapter II, section 5.

growth was in proportion to its share in total manufacturing value added.

Table III.11

RELATIVE CONTRIBUTIONS TO INDUSTRIAL GROWTH (PER CENT)

Branch	1871-83	1883-96	1896-1903	1903-13
Machines	11.75	26.33	17.08	19.34
Iron	11.77	33.92	-2.56	47.49
Electricity	-	-	9.16	9.79
Cotton	15.96	4.32	32.92	5.18
Flour	59.21	21.95	26.98	-1.17
Sugar	3.57	4.27	16.67	11.55
Beer	-2.26	7.04	-2.48	7.25
Spirits	-	2.17	2.23	0.55
Total	100.00	100.00	100.00	100.00
Growth p.a.	5.17	4.12	1.67	4.06

Sources: Appendix A, Table A.21, column (2); Komlos, *Customs Union*, Appendix E, Table E.5.

IV

FINANCE AND INVESTMENT IN AUSTRO-HUNGARIAN ENGINEERING: AN ANALYSIS OF BALANCE-SHEETS

1. The Scope of Analysis

This chapter deals with individual machine-building companies. Its aim is to complement the previous discussion of sectoral development in Austrian and Hungarian machine-building with an analysis of financial and investment behaviour at the firm level. Balance-sheet data are used to trace company growth, the associated changes in demand for capital and, finally, the varying forms of capital provision[1]. The examination of annual statements, however,

[1] The process by which the information contained in annual statements is generated calls for particular care in the use of balance-sheet data as source material. Annual statements are primarily addressed to people or institutions outside the firm involved (e.g. share-holders, creditors, tax authorities and the general public). They are often used to convey information compatible with a firm's perceived interests but which is not necessarily identical to that used in internal communication; cf. Wöhe, G., *Einführung in die Allgemeine Betriebswirtschaftslehre* (Munich, 13th ed. 1978), pp.757-762. The respective legal norms generally leave some scope for firms to decide how to value their assets and liabilities. But the way fixed assets and inventories are evaluated, or equity and contingency reserves are endowed, for example, directly affects the length of the balance-sheet, the stated annual surplus and the ratio of debt to assets. At the time, companies had considerable freedom in designing their annual statements: no stipulations on the structure of annual statements or denotations of the balance-sheet entries were made in the laws concerning joint-stock companies; Mosser, A., *Die Industrieaktiengesellschaft in Österreich, 1880-1913: Versuch einer historischen Bilanz- und Betriebsanalyse* (Vienna, 1980), pp.25-26. However, the eight companies examined below used a similar structure and system of denotation in their annual statements. Moreover, as all balance-sheets are analyzed on a year-to-year basis

is confined to those of public limited companies only[2]. No records are available for the privately owned firms which were under no legal obligation to publish their financial results[3].

Based on statements of the leading six Austrian and two Hungarian machine-building firms, two core sets of annual balance-sheet data have been compiled for 1880 to 1912/13 (Sample I)[4]. The Austrian companies included are[5]:

1. Aktien-Gesellschaft der Lokomotivfabrik, vorm. G. Sigl in Wiener Neustadt, Vienna (1875): *Sigl*.
2. Maschinen- und Waggonbau-Fabriks-Aktiengesellschaft in Simmering, vorm. H.D. Schmid, Vienna (1869): *Simmering*.
3. Erste Brünner Maschinen-Fabriks-Gesellschaft, Brno (1872): *Brünner Maschinenfabrik*.

---

using fairly broad standard definitions, abrupt changes in asset and liability valuation, for example, are likely to show up in the data and can be accounted for.

[2] In the following, *public limited company* and *joint-stock company* are used interchangeably.

[3] Austrian law postulated the publicity of companies' results. But, strictly speaking, joint-stock companies, too, were under no obligation to publish their results in the press. Publication was effectively secured only by the legal requirement to make the annual statement, the profit and loss account and the business report available to share-holders who had the right to approve of, or reject, the annual balance in the general share-holders' meetings. See Mosser, *Industrieaktiengesellschaft*, pp.16, 25.

[4] For definitions of the balance-sheet data and the methods employed in their derivation see Appendix B, where all indicators referred to in this chapter are presented in tabular form. Tables B.1a to B.2c provide *average* data for the six Austrian and two Hungarian firms, respectively. The balance-sheet indicators for each of the eight companies are reproduced separately in Tables B.3a to B.10d.

[5] Companies' names are reproduced as given in *Compass. Finanzielles Jahrbuch für Österreich-Ungarn* 1914 (Vienna, 1913). A company's founding year is given in parentheses, its short name used in the following is italicised.

4. Maschinenbau-Actien-Gesellschaft, vorm. Breitfeld, Daněk & Co. (Akciová spolecnost strjírny dríve Breitfeld, Daněk ispol.), Prague (1872): *Breitfeld*.
5. Prvni cesko-moravská továrna na stroje v Praze (Erste böhmisch-mährische Maschinenfabrik in Prag), Prague (1871): *Böhmisch-mährische Maschinenfabrik*.
6. Prager Maschinenbau-Actiengesellschaft, vorm. Ruston & Co. (Prazská akciová strjírma), Prague (1869): *Ruston*[6].

Sample I for Hungarian machine-building encompasses the balance-sheet data of

1. Ganz & Comp. - Danubius, Maschinen-, Waggon- und Schiffbau-Actien-Gesellschaft (Ganz és társa - Danubius, gép-, waggon- és hajógyár részvénytársaság), Budapest (1869): *Ganz*[7], and
2. Schlick-Nicholson Maschinen-, Waggon- und Schiffsbau-Aktien-Gesellschaft (Schlick-Nicholson gép-, waggon- és hajógyár részvénytársaság), Budapest (1869): *Schlick*[8].

In the 1890s, joint-stock founding activity in engineering picked up again after it had come to a virtual standstill in the late 1870s and throughout the 1880s. Taking account of the rising number of public limited machine-building companies, additional data sets have been prepared for

---

[6] The *Böhmisch-mährische Maschinenfabrik* and *Ruston* are not included in Mosser's study of Austrian joint-stock companies. He chose the *Wiener Lokomotiv-Fabriks-Aktiengesellschaft* and the *Aktiengesellschaft für Maschinenbau, vorm. Brand & Lhuillier* instead to be represented in his sample alongside the other companies named here. For the former, however, not all relevant data are available for the early 1880s. And the latter was founded as late as 1895. See Mosser, *Industrieaktiengesellschaft*, p.76.

[7] *Danubius* was added to Ganz' company name after the merger with Danubius Ship- and Machine-Building Company in 1911.

[8] *Nicholson* was added to Schlick's company name after the merger with Nicholson Machine-Building Company in 1912.

selected years (Sample II). These include nine Austrian companies for 1890, 14 Austrian and 12 Hungarian firms for 1900 and, finally, 30 Austrian and 25 Hungarian joint-stock manufacturers for 1912[9]. Sample II serves to evaluate the extent to which the main trends of development in the chosen balance-sheet indicators of Sample I also apply to a wider, more representative group of companies.

How do the number and size of companies included in the samples compare with the respective totals of public limited companies in the industry? How important were joint-stock operations relative to other types of firms? Tables IV.1 and IV.2 provide a comparison of the sample data with those for the industry as a whole. It should be emphasized, though, that the reported shares of the samples in the totals are *minimum* values as the available industry-wide data do not allow the isolation of machine-building firms proper. Hence the Austrian totals include companies of the metal-working and armaments industries, too[10]. The same problem applies to the Hungarian figures for 1880 to 1900, in particular[11]. The samples, therefore, almost certainly represent a much larger proportion of mechanical engineering in both Austria and Hungary than the shares given below would indicate.

---

[9] See Appendix B for a list of the firms included and Tables B.11 and B.12 for the average sample data derived from the statements of these companies.

[10] See Table IV.1 for sources.

[11] The Hungarian industry totals for 1912 refer to machine-building, ship-building, boiler-making and the manufacturing of "general equipment" only. These data are more narrowly defined and thus not to be compared directly with the numbers given for 1880, 1890 and 1900 which also include the non-engineering metal-working industries. See Table IV.2 for sources.

Table IV.1

AUSTRIAN PUBLIC LIMITED COMPANIES IN ENGINEERING

	Total	Sample I	%	Sample II	%
1880					
companies	15	6	40	-	-
share capital	29.1	13.7	47	-	-
total capital	50.8	21.7	43	-	-
1890					
companies	15	6	40	9	60
share capital	31.1	14.3	46	21.0	67
total capital	69.9	27.3	39	44.1	63
1900					
companies	38	6	16	14	37
share capital	124.1	21.9	18	65.8	53
total capital	224.6	54.0	24	134.2	60
1912					
companies	80	6	8	30	38
share capital	317.9	45.2	14	146.4	46
total capital	808.9	124.1	15	302.3	37

Note: share capital and total capital in million crowns.

Sources: k.k. Statistische Central-Commission, *Statistisches Jahrbuch der österreichischen Monarchie 1880*, VIII, pp.52-53; *Österreichische Statistisches Handbuch 1887*, p.204; *1891*, p.224; *1897*, p.242; *1901*, p.308; *1906*, p.322; *1911*, p.176; *1913*, p.173.

With the increasing formation of new joint-stock companies in Austria after 1890, the core-sample of six firms represents a declining proportion of all companies in terms of both their number and capital employed. But, measured by their capital endowment, the companies in Sample I commanded a higher than average volume of financial resources[12]. Sample II represents a substantially larger part of the industry than Sample I. Again the difference between the percentage shares of firms represented, on the

[12] Cf. Mosser, *Industrieaktiengesellschaft*, pp.95-98, who observes a similar characteristic in his sample of engineering and metal-working firms.

one hand, and capital, on the other, suggests that for most years the firms in the sample were above average size. Allowing for the very broad definitions of the total industry statistics, Austrian joint-stock machine-building seems fairly well covered in the samples.

The Hungarian core sample's degree of representation is falling over time, too. For 1880 and 1890, the sample seems more representative of the industry in terms of number of firms than in terms of share capital[13]. From the turn of the century, Ganz and Schlick each commanded larger than average share capital[14]. Sample II provides good per centage coverage of Hungary's joint-stock companies in the machine-building industry, especially for 1912. However, with neither equity reserves or borrowed capital included, share capital is a fairly unreliable indicator of a firm's command over financial resources and its relative importance. Ganz' and Schlick's significance for Hungarian machine-building is probably more adequately reflected in their share in the industry's total output. During most years between 1880 and 1900, the two firms' combined output accounted for approximately 30 to 55 per cent[15]. This is a very large share even if allowance is made for those parts of their production which do not fall in the mechanical engineering category used in the estimates of total

---

[13] The small initial number of joint-stock companies in the metal-working and machine-building industries (three in 1880, five in 1890) implies that the inclusion of only one fairly large or fairly small firm will strongly affect the counted totals or averages.

[14] In 1912, 48 companies had a combined share capital of 78.1 million crowns whereas a smaller number of firms in 1900 (26) had shares issued worth more than 79 million crowns. The implied difference in average firm size is explained by the inclusion of some large-scale non-machine-building operations (e.g.armaments) in the total for 1900.

[15] See Appendix A, Table A.21, column (1); Appendix B, Tables B.9c and B.10c.

machine-building output[16].

Table IV.2

HUNGARIAN PUBLIC LIMITED COMPANIES IN ENGINEERING

	Total	Sample I	%	Sample II	%
1880					
companies	3	2	67	-	-
share capital	7.9	4.7	60	-	-
1890					
companies	5	2	40	-	-
share capital	35.8	6.2	17	-	-
1900					
companies	26	2	8	12	46
share capital	79.2	8.8	11	36.8	46
1912					
companies	48	2	4	25	52
share capital	78.1	16.6	21	60.8	78

Sources: k.k. Handelsministerium, Bureau des Industrierates, *Statistische Materialien über die Besteuerung und Entwicklung der Industrie-Aktiengesellschaften in Österreich* (Vienna, 1904), Table 83, p.610, Table 85, pp.612-613. Magyar Kir. Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv 1912*, Table 43, p.214.

The data in Table IV.3 allow a partial answer to the question of how significant the public limited company was in the Austrian machine-building industry. Regardless of whether the manufacturing establishment (factory, workshop) or the legal entity (company; enterprise; concern) is chosen as the statistical object, in both cases about one third of the industry's workforce was employed by public limited companies - despite their small number relative to the total of companies. But whilst one finds a substantial degree of employment concentration in joint-stock

[16] Ganz, in particular, ran large departments for electrical engineering and railway car production; see section 3 below.

companies, remarkably less concentration can be observed at the actual production level[17]: on average 581 persons were employed per company or enterprise, yet only 238 persons per manufacturing site.

Table IV.3

EMPLOYMENT AND OWNERSHIP IN AUSTRIAN MACHINE-BUILDING 1902

	Establishments		Owners/Companies	
	number	employees	number	employees
Total	2,583	61,401	2,334	56,947
PLC	84	20,014	33	19,168
PLC/Total (%)	3.3	32.6	1.4	33.7

PLC: public limited companies. The numbers of establishments and employees differ slightly from those given in Table II.7, Chapter II, where data for plants in operation only are reproduced.

Source: k.k. Statistische Zentralkommission, "Ergebnisse der gewerblichen Betriebszählung vom 3. Juni 1902", *Österreichische Statistik*, vol. 75 (1907), 1.Heft, 2. Abtlg., Table XVII, pp.306-309.

The medium-size production unit was thus a feature characteristic not only for machine-building as a whole but also for the public limited companies in the industry. However, in terms of employment plants operated by joint-stock companies were still significantly above the industry's average[18].

[17] Mosser, *Industrieaktiengesellschaft*, pp.101-103, stresses this point with reference to the whole of industrial joint-stock companies in Austria.

[18] Cf. the discussion in Chapter II, section 4.

2. The Growth of Machine-Building Companies: The Demand for Capital

"Each company needs ... a certain amount of capital the size of which depends on the volume of production, the method of production, and the velocity of production. The need for the provision of capital and its scale are closely related to the growth of a company. The latter is reflected in the volume of investment, i.e. the conversion of money into (other) assets, and in the development of the balance-sheet total"[19].

Figure IV.1 and Table IV.4 show that the need for capital in the machine-building industry rose during the years between 1880 and 1912. In each of the three decades, the two Budapest firms' average balance-sheet total rose faster than that of the Austrian companies'. Whereas the Austrian average total grew at an annual rate of 5.58 per cent, Ganz' and Schlick's average total increased by nine per cent between 1880 and 1912. Both these rates of growth are well above the figure calculated for German machine-building companies[20]. But expansion occurred in an uneven fashion and affected the companies to a varying extent.

---

[19] Feldenkirchen, W., "Zur Kapitalbeschaffung und Kapitalverwendung bei Aktiengesellschaften des deutschen Maschinenbaus im 19. und beginnenden 20. Jahrhundert", *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 69 (1982) No.1, p.38.

[20] Ibid., p.45.

Table IV.4

AVERAGE ANNUAL GROWTH OF BALANCE-SHEET TOTAL (PER CENT)

	1880 -1890	1890 -1900	1900 -1912	1880 -1912
1. Sigl	-1.87	2.88	2.90	1.38
2. Simmering	4.44	4.86	12.24	7.43
3. Brünner	7.80	10.67	6.03	8.02
4. Breitfeld	2.42	9.14	4.18	5.14
5. Böhmisch-mähr.	6.49	9.57	3.11	6.15
6. Ruston	0.70	3.50	14.54	6.59
7. Ganz	7.90	12.16	7.50	9.06
8. Schlick	14.00	4.07	9.45	9.12
Six companies* (1.-6.)	2.28	7.17	7.06	5.58
Two companies* (7.-8.)	9.38	10.24	7.86	9.07
Eight companies* (1.-8.)	4.43	8.44	7.43	6.80

* Growth of average balance-sheet total

Sources: Appendix B, Table B.1a, B.2a, B.3a, B.4a, B.5a, B.6a, B.7a, B.8a, B.9a and B.10a.

Table IV.5

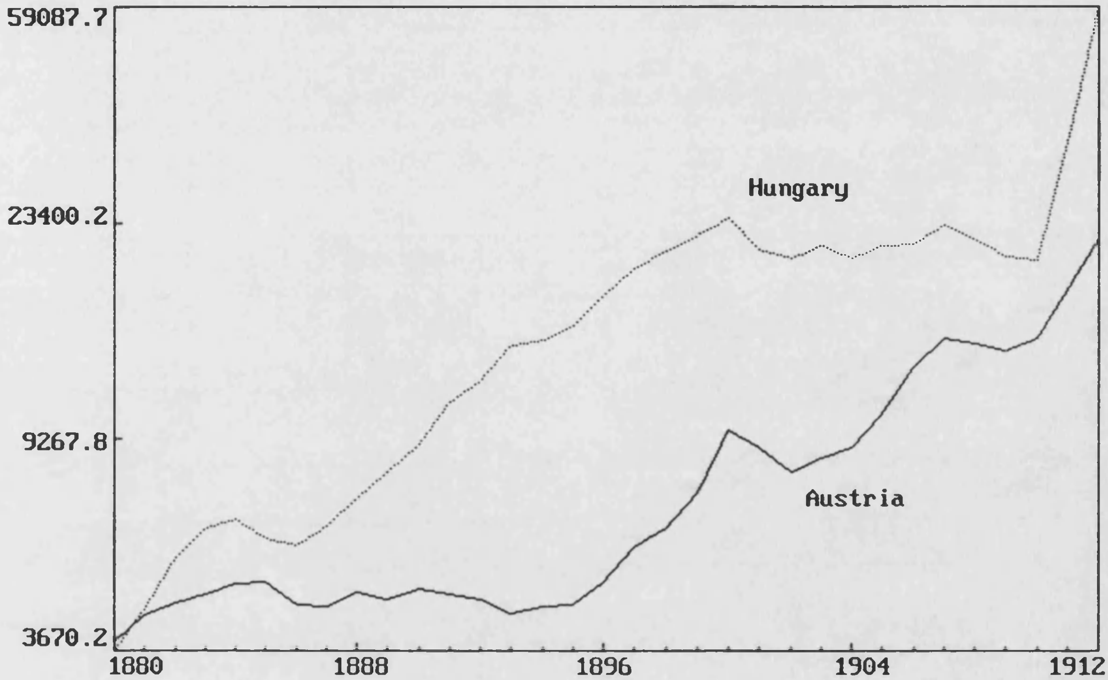
COMPOUND RATES OF ANNUAL PEAK-TO-PEAK GROWTH: AVERAGE BALANCE-SHEET TOTALS (PER CENT)

	1885 -1900	1900 -1907	1907 -1912b	1885 -1912b
Six companies	4.51	5.83	8.81	5.64
Two companies	8.45a	-0.41	20.59	8.20
Eight companies	5.82	3.28	13.52	5.04

a: 1884-1900 b: 1912 was not a peak year

Sources: Appendix B, Tables B.1a and B.2a.

Figure IV.1: Average of Balance-Sheet Totals (1000 Crowns), Semi-Log Scale



Source: Appendix B, Tables B.1a and B.2a.

A brief look at peak-to-peak rates rather than growth over ten year periods reveals a markedly more accentuated temporal pattern of expansion (Table IV.5). Clearly, the most rapid rise among both Austrian and Hungarian machine-building companies took place in the last half decade prior to World War I. As will be shown below, this was a period of intense merger and take-over activity. Several companies effectively doubled their size and scale of operation.

During the 1880s Austrian company growth and the related rise of capital requirements were limited: the average balance-sheet total fluctuated around an almost constant level up to the mid-1890s (Figure IV.1). Given the depressed state of the Austrian machinery market in the 1880s with slow growth of production and insufficient capacity utilization, it is hardly surprising to find that company investment in new production equipment remained low throughout the decade (Figure IV.2). Due to very low or even negative levels of net investment the average value of fixed assets and plant equipment shrunk at an average rate of 0.90 per cent between 1880 and 1890[21]. It was not until the close of the century that Austrian machine-building companies substantially expanded their production capacity. Negative rates of net investment imply that not even the equivalent of depreciation allowances had been fully re-invested[22]. Sigl provides an extreme example: this company's gross investment in plant equipment was at constant zero between 1882 and 1894, i.e. not even those parts of the funds built up through depreciation allowances had been channelled back into investment[23]. No replacement

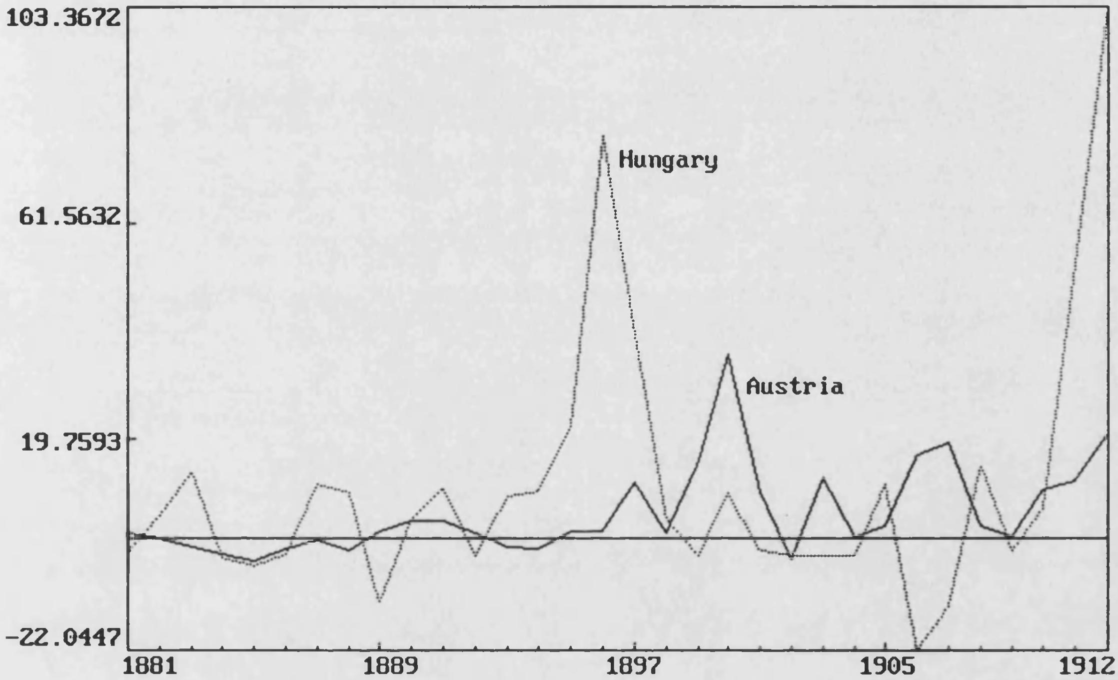
---

[21] Appendix B, Table B.1b. See also Tables B.3b to B.8b on changes of individual Austrian company's fixed assets.

[22] The common practice was to insert the value of fixed assets into the statements, corrected by the annual depreciation allowances.

[23] Gross investment (t) = value of assets (t) minus value of assets (t-1) plus depreciation allowance (t), i.e. gross investment equals net investment plus the allowance made for lost usefulness.

Figure IV.2: Average Annual Net Investment as Percentage of Fixed Assets



Source: Appendix B, Tables B.1b and B.2b.

investment took place[24].

The higher rates of company growth calculated for the 1890s and the years up to 1912 do not reflect a process of smooth, continuous expansion. They are largely the result of discrete *upward jumps* in the key indicators. Though *internal* expansion also played a role, it was mostly *external* expansion, by means of acquisitions and mergers, that determined company growth in the Habsburg Monarchy's machine-building industry. The evidence suggests that the drive for external expansion as well as the attempts to cartelize the industry were, to a considerable extent, pursued as a means of achieving economies of specialization rather than economies of scale.
For a viable pattern of product specialization among firms to develop, machinery producers must be confronted with a large demand for their output. Limited market size thus imposes a severe stricture[25]. This is a problem of which contemporary observers of Austria's machine-building industry were only too aware[26]. Because of the high degree of heterogeneity of output and the importance of custom work typical for the capital goods sector, improvements in efficiency derive largely from increased division of labour among firms. Yet the importance of growth in markets lies not in that it facilitates bigness at the firm level but rather in the ability of firms to concentrate on a limited

---

[24] See Table IV.7 below.

[25] Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), pp.143-144.

[26] Cf. Fischer, H., "Die Maschinenindustrie in Österreich", *Die Groß-Industrie Österreichs*, vol. I (Vienna, 1908), p.98; Handels- und Gewerbekammer Prag, *Bericht der Handels- und Gewerbekammer in Prag über die volkswirtschaftlichen Verhältnisse ihres Bezirkes im Jahre 1906* (Prague, 1907), pp.103-104; Pfaff, C., "Die Maschinen-Industrie", *Entwicklung von Industrie und Gewerbe in Österreich in den Jahren 1848-1888*, eds. Commission der Jubiläums-Gewerbe-Ausstellung Wien 1888 (Vienna, 1888), pp.268-269.

range of products possessing specified properties and performing specific tasks. Thus machinery producers tend to aim primarily at the realization of economies of specialization. Producers of intermediate goods, whose output is typically fairly homogeneous (e.g. chemicals, iron and steel), enjoy, in contrast, economies of scale[27]. "The economies of specialization ... derive not from the production of a completely homogeneous product but from the concentration upon a relatively narrow (heterogeneous) product range which in turn requires a relatively homogeneous collection of resources in their production. The point is that the typical machine-producing firm produces small batches of output drawn up to specifications reflecting the unique requirements of the user, but each such batch differs only slightly, and all draw upon a homogeneous collection of resources - each firm possessing plant facilities, designing abilities, and other technological 'know-how' which is geared to the effective solution of a very limited range of production problems"[28].

None of the numerous attempts to operate a cartel in Austria's machine-building industry after the turn of the century proved successful[29]. In all instances, though, it was the problem of product specialization that motivated negotiations. A first comprehensive agreement on common interests was signed in 1904 by four leading Bohemian firms, Ruston, the Böhmisch-mährische Maschinenfabrik and

---

[27] In illustrating the relationship between the two concepts, Rosenberg points out that firms which achieve economies of scale are also specialized in their output structure, but firms may achieve economies of specialization which do not involve significant economies of scale; Rosenberg, "Capital Goods", pp.143-144.

[28] Ibid., p.144.

[29] For a general discussion of the spread of cartels in late nineteenth century Austria see Good, D., *The Economic Rise of the Habsburg Empire, 1750-1914* (Berkeley, Calif., 1984), pp.218-226.

the machine-building departments of Ringhoffer and Skoda[30]. The aims of the agreement were to reduce costs through increased division of labour, joint project design and costing facilities, and joint sales offices[31]. The signatories viewed the limited capacity of the domestic market and the tendency of individual firms to produce a wide range of output as the main obstacles to increasing specialization. Product specialization of individual plants, in turn, was seen as a pre-condition for reductions in manufacturing costs. Accordingly, in an effort to avoid internal competition and thus increase the scope for realizing economies of specialization, provisions were made so that each of the four participating firms would focus on the production of a narrowly defined range of items, even if it involved giving up traditional lines of products. Machinery orders were to be allocated to a particular plant by joint institutions[32]. However, this ambitious scheme which stopped just short of merging the four companies did not materialize as one of the participants eventually withdrew its support[33].

A renewed effort to cartelize the industry was made in 1907, initially involving 11 of the largest machine-building firms in Austria[34]. In this case, though, the aims of association were less far reaching than the 1904/05 venture of the Bohemian manufacturers. Though general

---

[30] *Kartell-Rundschau* II (1904), pp.700-703, 739-741. The plants of the four firms jointly employed about 3,900 workers.

[31] Magyar Országos Levéltar, Budapest (hereafter MOL), Z-40-8.cs.-204.sz.: Pesti Magyar Kereskedelmi Bank, Proj. 405/5 - Az osztrak gyárak kartell-megállapodása, pp.75-83, 1905.

[32] Ibid.

[33] *Kartell-Rundschau* III (1905), pp.16-18.

[34] *Kartell-Rundschau* VI (1908), pp.130-131, 214, 552, 667. Another firm and a group of Galician factories joined in later.

reference was made to the task of improving product specialization in individual plants, the cartel agreement did not define explicitly future areas of specialization for its participating firms[35]. Orders were allocated to member firms according to quotas based on the shares these firms had in the total output covered within the agreement, and in the production of specific types of machinery during the preceding years. Prices were not formally fixed but offers of cartelized firms were "protected" in so far as other cartel members would not supply at lower prices in response to the quota system and the compensatory measures and penalties introduced to offset variations above and below the individual firm's quotas. The arrangements were confined to domestic sales of machinery; exports were not regulated. A virtually identical cartel agreement drafted for the Hungarian machine-building industry in 1908 was never implemented[36]. Operating since November 1907 and planned to function for ten years, the Austrian machinery cartel soon collapsed in 1911 without having achieved many of its aims[37]. The reasons for this failure were manifold[38], but the fact that the cartel encompassed only

---

[35] MOL, Z-40-9.cs.-245.sz.: Pesti Magyar Kereskedelmi Bank, Osztrák gépgyárak kartellegyezmény térvezete, 1907.

[36] MOL, Z-425-3.cs.-25.sz.: Ganz És Társa Villamossági-, Gép-, Vagon- És Hajógyár Rt., magyar gépgyárak közt kötött kartellszerü megállapodások, 1908. See also *Kartell-Rundschau* VI (1908), pp.305, 461, 552; IX (1911), pp.408-409; Berend, I.T. and Ránki, G., *The Development of the Manufacturing Industry in Hungary, 1900-1914*. *Studia Historica* 19 (Budapest, 1960), pp.33-34.

[37] *Kartell-Rundschau* IX (1911), pp.675-678, 813-814, 903-906. The hope that quotas for particular products would be absorbed by particular firms, thus increasing their share in the manufacturing of these products and facilitating product specialization at the plant level, did not materialize. Quotas were hardly exchanged between firms and hence no significant concentration of production was achieved.

[38] Contemporaries viewed the high degree of heterogeneity of the industry's output, frequently based on individual designs, and the importance of personal contacts between

a rather small part of the industry was certainly prominent amongst them. With approximately 45 million crowns on annual average, cartelized machinery output accounted for less than 10 per cent of total output in mechanical engineering[39].

Almost all mergers and acquisitions were carried out between firms on the same stage of production, i.e. machine-building companies generally combined with other machine-building firms. Very rarely do we find examples of vertical integration when companies at either preceding or subsequent stages of production were acquired. Thus horizontal combinations were the rule. Three main themes characterize external expansion among Austro-Hungarian machine-building firms. Firstly, companies often combined with other firms operating in the same or very closely related product fields. These moves were primarily motivated by the search for specialization gains: an increased share in the market for particular types of machinery allowed the allocation of a larger proportion of plant and design capacity to specialized production rather than to general machine-building still dominant in most firms at the time. Product specialization implied scope for productivity improvements as manufacturing of a more restricted range of products could draw on a more homogenous set of resources: design expertise, the specific labour skills required, the productive apparatus used in

---

producers and customers as the main obstacles to product and sales standardization required for the successful operation of a quota based machinery cartel. Cf. *Kartell-Rundschau* IX (1911), pp.904-905; Hammerbacher, *Die Konjunkturen in der deutschen Eisen- und Maschinen-Großindustrie* (Munich/Berlin, 1914), pp.109-110.

[39] Bibliothek der Kammer der gewerblichen Wirtschaft für Wien, Vienna (hereafter HKB Wien), Sign. IV.6316: Handelspolitische Zentralstelle, *Gutachten zum autonomen Zolltarif: Die Entwicklung der österreichischen Maschinenindustrie seit 1905 bis 1913*, typescript, no place, no year, pp.13-14. *Kartell-Rundschau* IX (1911), pp.988-989. Appendix A, Table A.13, column (1).

the manufacturing process or material input[40]. But, secondly, mergers and acquisitions were also used to widen the existing manufacturing programme and to gain entry to *new* product markets which had not been supplied before. Product diversification was seen as a means to shield a firm from negative effects of either extremely volatile or secularly falling demand for a particular product or type of product (risk reduction). Thirdly, the purchase of foreign firms served to acquire or maintain access to foreign markets threatened by increasing protectionism.
The next section examines the experience of individual companies in some more detail.

3. External Expansion in the Machine-Building Industry

In 1900, the Brünner Maschinenfabrik - a producer mainly of steam engines and boilers for the cotton textile industries, flour mills and electric power generation plants - bought the machine-building firm of Friedrich Wanniek & Co. (Brno)[41]. This move immediately translated into a doubling of its balance-sheet total, a 58-per cent rise in the value of its fixed assets, and a 63-per cent increase in turnover during the 12 months from 1899[42]. Two factors shaped the decision to carry out what was technically a company acquisition, but effectively the

---

[40] Rosenberg stresses that a high degree of specialization in machinery production is conducive to an effective learning process and to an effective application of what is learned; a "highly developed facility in the designing and production of specialized machinery is, perhaps, the most important single characteristic of a well-organized capital goods industry and constitutes an external economy of enormous importance to other sectors of the economy", Rosenberg, "Capital Goods", p.144.

[41] *Die Hundertjährige Geschichte der Ersten Brünner Maschinen-Fabriks-Gesellschaft in Brünn von 1821 bis 1921* (Leipzig, 1921), pp.111-113, 127, 150-151; for a description of the Wannieck works see pp.127-149.

[42] Appendix B, Tables B.5a and B.5b.

merger of two firms[43]. With the termination of the partnership in 1900, and neither of the partners in a position to run the firm on their own account, Wannieck initially contemplated the transformation into a joint-stock company, allowing for further expansion[44]. But both Wannieck and the Brünner Maschinenfabrik shared the conclusion that such a move would only intensify competition between them without much benefit for either[45]. For not only were they the two largest machine-building firms in the Brno region, they also had very similar product programmes[46]. Furthermore, it was thought that "the integration of the Wannieck factory would be possible 'without notable increase in central administration' and that a more economic utilization of both plants would induce a substantial reduction in production costs and, in turn, an equivalent rise in total profits"[47].

Further steps towards external expansion were taken in 1912 and 1913. The general shareholders' meeting in 1912 voted to increase the company's share capital from 4 to 7.4 million crowns[48]. Though part of the additional funds were to be used for financing expansion of the Brno plants, the

---

[43] In 1900 the Brünner Maschinenfabrik raised its share capital from 2.4 to 3.2 million crowns and acquired Wannieck's plant in exchange for 4000 shares at 200 crowns; *Geschichte der Brünner Maschinenfabrik*, p.150.

[44] Ibid., pp.149-150. In 1890, the Swiss machine-building firm Gebr. Sulzer, Winterthur, had taken a 41 percent limited interest in the firm. Friedrich Wannieck, the founder, and two executives of his private firm became partners in Fr.Wannieck & Company; *Geschichte der Brünner Maschinenfabrik*, pp.141-141.

[45] Ibid., p.150.

[46] Steam engines "of all systems and sizes" and machinery for sugar plants and brickworks made up the core of Wannieck's output in the 1880s and 1890s; see *Geschichte der Brünner Maschinenfabrik*, pp.139-147.

[47] Ibid., p.150.

[48] *Compass* 1914, pp.437-438; *Geschichte der Brünner Maschinenfabrik*, p.221.

anticipated takeover of the *Wiener Dampfkessel-, Apparate- und Maschinenfabriks AG, vorm. Josef Pauker & Sohn* (Vienna) and the purchase of a majority stake in *Röck István Gepgyár Részvénytársaság* (Budapest) called for an increase in equity[49]. The possession of Pauker - manufacturers of steam boilers, in particular - implied a further widening of the Brünner Maschinenfabrik's productive capacity and an increase in market share; again, as in the case of Wannieck, a producer operating in similar or complementary markets had been acquired[50]. Thus the main objective was, apparently, to strengthen the company's absolute and relative position in their existing markets it. However, the purchase of Röck added a new dimension to the Brünner's policy of external expansion[51]. For here, for the first time, a non-Austrian firm was integrated into its group of subsidiary companies[52]. One factor, in particular, accounted for this investment decision. In the light of Hungarian industrialization policy, the Brünner Maschinenfabrik realized that it had to acquire a manufacturing base in Hungary if it were to have access to this market. Röck provided this access through its established links with both customers and public administration in Hungary[53]. Consequently, those products

[49] Ibid.. Pauker was affiliated on 1 January 1913, the Röck shares were bought on 31 December 1912.

[50] For a brief description of Pauker, its output range and its company acquisitions (Th.Schultz & L.Goebel, Vienna, 1911; Röhrenkesselfabrik Mödling vorm. Dürr, Gehre & Comp. AG, Mödling/Vienna, 1911-12) see *Geschichte der Brünner Maschinenfabrik*, pp.173-209.

[51] On Röck István machine-building works see *Geschichte der Brünner Maschinenfabrik*, pp.209-220.

[52] The participation in Simmering's Bucarest subsidiary works in 1909 does not appear to have been of great significance to the Brünner Maschinenfabrik. It is neither mentioned in the firms centennial publication *Geschichte der Brünner Maschinenfabrik*, nor in the Compass entries dealing with the Brünner.

[53] *Geschichte der Brünner Maschinenfabrik*, p.221.

which were previously a speciality of the parent company in Brno were now added to Röck's existing range, namely equipment for sugar refineries and brickworks, steam turbines and Diesel-engines[54].

To a large extent, the rapid growth of Breitfeld in the late 1890s and of Ruston and Simmering after the turn of the century can also be explained in terms of external expansion. Breitfeld acquired the *Fürst Salm'sche Eisenwerke* (Blansko) in 1897 and, in the following year, the machine-building firm of *Bolzano, Tedesko & Cie* (Schlan)[55]. Again, turnover, balance-sheet total and the value of assets rose to considerably higher levels as a consequence[56]. In 1911, Breitfeld concluded a cooperation agreement with *Nicholson Maschinenfabriks-AG* (Budapest) and took a minority stake in the firm[57].

During the 1880s and 1890s, Ruston grew at a rate well below the average of the six Austrian companies. In 1900 it ranked last of these firms in terms of its balance-sheet total. But by 1912 two major take-overs had completely changed the situation. In a first step to expand business Ruston bought the machine-building factories of *Bromovsky, Schulz & Sohr* (1910) where production was moved to from the original plant. A year later the machine-building department of *F. Ringhoffer* was added[58]. As a result the balance-sheet total rose from its previous maximum of 6.3 million crowns in 1907 to 14.7 million in 1910 and - with

[54] Ibid., p.220; *Compass* 1914, p.940.

[55] *Compass* 1903, pp.1223-1225. See also *Die Industrie 1892-1913. Festnummer zum 20-jährigen Bestand des Zentralverbands der Industriellen Österreichs*, Vienna 1913, pp.90-92.

[56] Appendix B, Tables B.6a and B.6b.

[57] *Compass* 1913, pp.412, 856; *Die Industrie*, p.90.

[58] In the same year Ruston sold all its shares of the *Maschinen-Fabriks-AG vorm. Tanner, Laetsch & Co* (Vienna) to Simmering; *Compass* 1913, pp.426-428.

the integration of Ringhoffer - 24.6 million crowns in 1911[59]. These acquisitive activities made Ruston the second biggest of the six Austrian firms after Breitfeld. In 1911 Ruston bought a majority stake of the *Ungarische Sangerhäuser Maschinenfabriks-AG* (Budapest) and arranged its merger with the firm of *Josef Eisele*, a steam-boiler factory[60]. Thus some form of participation in the Hungarian market was secured. But Ruston's drive for growth was soon to be penalized. The downturn in the business cycle, a heavy debt and interest burden, and delays in the completion of the new plant on the recently acquired Ringhoffer site caused a massive loss in 1913[61]. The Skoda works played a central role in the reorganisation of Ruston the following year. Share capital was reduced to 3.5 million crowns to cover the loss, to fund extraordinary depreciation allowances, and to finance restructuring[62]. New stocks were then issued to raise share capital to 16 million crowns. Skoda acquired shares with a nominal value of 7 million crowns in exchange for machinery, equipment and patents of its machine-building factory in Pilsen/Plzeň. Thus, as a result of the reorganization, a new engineering combine was created as part of the Skoda concern[63].

---

[59] Appendix B, Table B.8a.

[60] *Compass* 1914, pp.452-454, 945. The company's name was then changed into *Vaterländische Maschinenbau-AG Sangerhausen-Eisele*.

[61] The 1913 loss amounted to more than 5.8 million crowns at a time when share capital was 14 million crowns. The annual surplusses in 1911 and 1912 stood at 0.67 and 0.52 million crowns. See Appendix B, Tables B.8a and B.8b and *Compass* 1916, pp.471-473.

[62] *Compass* 1916, pp.471-473.

[63] Consequently, the company's name was changed into *Vereinigte Maschinenfabriken AG vorm. Skoda, Ruston, Bromovsky und Ringhoffer*. See also März, E., *Österreichische Bankpolitik in der Zeit der großen Wende 1913-1923* (Vienna, 1981), pp.85-88.

Sigl and Simmering[64] were predominantly active in railway related production. Therefore, both firms were subject to the extreme fluctuations in demand for locomotives and rolling stock. The data on annual turnover clearly reflect this problem[65]. The responses to the challenge, however, were quite different. Whilst Sigl continued to rely heavily on the production of locomotives and tenders[66], Simmering made a clear move towards product diversification. In order to become less dependent on variations in demand for railway cars - hitherto the core field of production - Simmering bought the *Brünn-Königsfelder Maschinenfabrik Lederer & Porges* (near Brno) in 1903[67]. With the integration of this firm as branch-works, Simmering obtained expertise and capacity in new fields of engineering, reducing dependence on railway related output. Thus machines and apparatus for the petroleum, paraffin and chemical industries, as well as cooling technology and wood-working machinery were added to Simmering's product range[68]. The production of gas and Diesel engines, in the Brno plant, linked the company to the more recent, dynamic

---

[64] A short account of Simmering's history is given in the company's centennial publication *Hundert Jahre Maschinen- und Waggonbau-Fabriks-AG in Simmering, vorm. H.D. Schmid* (Vienna, 1931). See also Mathis, F., *Big Busines in Österreich. Österreichs Grossunternehmen in Kurzdarstellungen*, pp.284-287.

[65] Appendix B, Tables B.3c and B.4c.

[66] Between the early 1890s and 1912/13 the share of these products in Sigl's total turnover fluctuated between 60 percent and 90 percent with other machinery having largely a compensatory function. When locomotive production was low - as, for example, in 1892/93 - the production of other machinery, spare parts and accessories, etc. took a larger share. But these never accounted for more than 40 percent of overall turnover. Appendix B, Table B.3c; *Compass* 1905, p.259 and 1916, p.467.

[67] *Compass* 1905, pp.263-264; *Hundert Jahre Simmering*, p.13.

[68] *Hundert Jahre Simmering*, p.13.

sections of the machine-building industry[69]. The short run effect of the integration of Lederer & Porges was an upward shift in the scale of operation - both the value of assets as well as the balance-sheet total more than doubled from 1902 to 1903[70]. Certainly more important, however, was the fact that Simmering, in contrast to Sigl, was now much better placed to benefit from the expansion of the wider machinery market. Yet Simmering continued to increase its company holdings. Already in 1904 Roumanian subsidiary works were opened in Bucarest as a means of circumventing tariff barriers. Four years later this firm was transformed into an independent joint-stock company, with Simmering holding a 50 per cent stake[71]. The privately owned engineering firm of *G.Topham & Co.* (Vienna) was acquired in 1909 and henceforth run as a limited company. Topham produced largely for the wood-working industries[72]. A new share issue in 1911 provided the funds to take-over all shares of *Maschinen-Fabriks-AG vorm. Tanner, Laetsch & Co.* (Vienna). This company, which previously belonged to Ruston, employed about 500 workers in the production of steam technology, cooling-systems and brewery equipment[73]. There is no indication, however, that any of these three firms was as closely tied into the productive structure of the parent company as Lederer & Porges. Moreover, they each remained companies of legally independent status.

The two Hungarian firms, Ganz and Schlick, participated in

---

69 *Compass* 1905, pp.263-264 and 1910, pp.364-365.

70 Appendix B, Tables B.4a and B.4b. It should be noted, though, that Simmering's business year 1903/04 had 15 month due to a change in accounting practice.

71 Matis, *Big Business*, p.285. In 1909, the Brünner Maschinenfabrik participated in the Bucarest subsidiary, *Compass* 1911, p.377.

72 *Hundert Jahre Simmering*, pp.13-14.

73 Ibid.; *Compass* 1914, pp.456-458.

the mergers and acquisitions movement, too. Schlick joined in rather belatedly, yet did so with considerable effect. Subsequent to a doubling of its share capital, the Budapest firm merged its operation with *Nicholson Maschinenfabriks-AG* (Budapest)[74]. This company had established close ties with Breitfeld (Prague) the previous year. As a result of the amalgamation, Schlick's balance-sheet total rose by almost 120 per cent in 1912[75]. As production of the combined companies was to be concentrated in Schlick's premises, with the Nicholson factory to be demolished, Nicholson's fixed assets were written off completely in its final 1911 statement[76]. Mere one-off capacity expansion was, therefore, not the primary goal behind the fusion. The concentration of all production into the existing Schlick plant and its subsequent reorganization indicate that the main aims were rationalization of the manufacturing process and improved capacity utilization. As a result, the new firm of Schlick-Nicholson implemented a major investment programme in 1913[77]. The rise in Schlick's 1912 balance-sheet total thus largely originated from the increase in share capital, the integration of Nicholson's equity reserves and liabilities, credit and stocks - but not a

---

[74] *Compass* 1913, pp.855-857 and 1914, pp.914-916. At the time of the merger, Nicholson employed about 750 to 800 workers. Its manufacturing programme included agricultural machinery, steam engines and locomobiles. Annual turnover amounted to approximately 6 million crowns.

[75] Schlick's balance-sheet total (net of accumulated depreciation allowances) amounted to 10.93 million crowns in 1911, whereas Nicholson stated a total of 10.04 million. The new firm of Schlick-Nicholson had a balance-sheet total of 23.83 million crowns in 1912. Appendix B, Table B.10a; *Compass* 1913, pp.855-859.

[76] Technically this was done by endowing accumulated depreciation allowances up to the level of gross value of fixed capital. See *Compass* 1913, pp.855-857; 1916, p.975.

[77] The net value of fixed plant and equipment rose by 58 percent, Appendix B, Table B.10b.

consequence of taking-over of its fixed capital[78].

The temporal pattern of Ganz' external and internal expansion was somewhat unusual among the eight firms[79]. As has been shown above, the increase in company concentration via mergers and acquisitions was by and large a feature of the post-1900 years. In contrast, Ganz branched out very early and pursued external growth already in the 1870s and 1880s. With little acquisitive activity in the 1890s and early 1900s, amalgamation later became a theme again only after 1910.
As early as 1869 - the year of its conversion into a joint-stock company - Ganz set up branch works in Ratibor (Prussia). Proximity to the German, Polish and Russian markets as well as ready energy supplies from the Silesian coal fields were the main driving forces. A reduction in transport and energy cost and the overcoming of tariff-barriers were the envisaged benefits of this move[80]. Whereas there is no indication that the Ratibor venture implied any significant change in Ganz' manufacturing programme, modifications were heralded by the purchase of the *First Hungarian Waggon Factory*[81]. This company had run into financial difficulties in the aftermath of the 1873 crisis. Ganz bought the firm in 1879/80, thus adding modern, valuable capacity just on the eve of an upswing of

---

[78] *Compass* 1914, pp.914-916; Appendix B, B.10a.

[79] The first fifty years of Ganz & Co. are the subject of Berlász, J., "A Ganz-gyar elsö félszázada 1845-1895", *Tanulmányok Budapest multjából*, vol.XII (1957), pp.349-458.

[80] Ibid., pp.380-381.

[81] At the time, Ganz mainly produced railway wheels, tramway wheels and railway crossings as well as other cast iron products for engineering and construction purposes; Berlász, "Ganz-gyar", p.380.

the Hungarian economy[82]. Moreover, the manufacturing of railway and tramway cars was fully complementary to Ganz's already well-established production of cast iron wheels. Thus one may view this acquisition to some extent as one of the rare cases of forward integration in the industry.

In the mid-1880s the cellulose and paper-making industries of Austria-Hungary with her large and rich woodlands began developing. Ganz noticed the opportunities this potential market offered and bought the machine-building factory in *Leobersdorf* near Vienna (1887)[83]. Despite its small size and its substantial financial problems, Ganz considered the firm as the only important manufacturer of machinery for these industries[84]. The plant was reorganized and fully integrated as branch works into the productive structure of Ganz[85]. This acquisition immediately led to a 26 per cent increase in the value of Ganz' net fixed assets and an 11 per cent rise in the balance-sheet total[86]. Yet probably more important in the longer run was that Ganz had now significantly widened its product range and expanded into markets so far unserved.

During the following 20 years, no further steps were taken towards external expansion. The emphasis lay now, clearly, on internally generated company growth. A large investment programme in 1896-98 completed the structure of manufacturing sites which was to be in place for the next

---

[82] Berlász, "Ganz-gyar", pp.388-390; *Compass* 1880, pp.828-829, 839 and 1882, pp.697-698. At around the same time Ganz became increasingly involved in electro-technical engineering and water-turbine technology.

[83] *Compass* 1889, pp.463-464; Berlász, "Ganz-gyar", pp.400-401.

[84] Ibid..

[85] Voltmann, W., "130 Jahre Leobersdorfer Maschinenfabrik" (unpublished diploma thesis, Wirtschaftsuniversität Wien, Vienna, 1981), provides only little information on this firm for the years between 1870 and 1913. See also Mathis, *Big Business*, p.185.

[86] Appendix B, Tables B.9a and B.9b.

ten years. The value of Ganz net fixed capital rose from 1.7 million crowns in 1895 to 8.3 million in 1898[87]. A new plant was built in Budapest in response to the needs of Ganz' fast expanding electro-technical department. The premises in Leobersdorf were substantially enlarged to include a new department for electrical engineering and a new foundry. A blast furnace complex in Petrovagora (Carniola), which hitherto had been leased, was now bought from the Krainische Industriegesellschaft. Thus Ganz got hold of its own supply of special iron qualities essential for hard castings[88]. Only eight years later, in 1906, the electro-technical department was separated from the parent company and henceforth run as a formally independent joint-stock company. Similarly, the Leobersdorf works were sold to a newly established joint-stock company in 1907[89]. In both cases, though, Ganz maintained a substantial interest as shareholder and continued to be involved in the management of the now affiliated firms[90]. The loss of plant

---

[87] Ibid.

[88] At around the turn of the century, Ganz operated six plants:
1. machine-building factory (original plant), Budapest
2. railway car factory, Budapest
3. electro-technical factory, Budapest
4. subsidiary works, Leobersdorf
5. subsidiary works, Ratibor
6. blast furnace complex, Petrovagora.
A brief list of the major output items of these plants is to be found in *Compass* 1900, pp.1019-1022.

[89] *Compass* 1909, pp.320-323.

[90] MOL, Z-436-1.cs.-1.t.: Ganz-Féle Villamossági Rt., Notarielle Bescheinigung (Übersetzung), 1906; Z-58-51.cs.-161.t: Magyar Altalános Hitelbank, No. 161g, 1907-1913. Ganz held 45 percent of the share capital (8 million crowns) of the new firm Ganz-Féle Villamossági Rt.. Both transactions were carried out in collaboration with the Hungarian General Credit Bank (Magyar Altalános Hitelbank) which itself took up large portions of the new companies' stock. The changes in Ganz' securities portfolio reflect the company's continuing financial interest in the two new firms; the total value of securities held by Ganz and inserted in its balance-sheet are for

and equipment to the new companies nevertheless implied a significant fall in fixed capital[91].

But these changes in the legal and organizational framework of the Ganz concern only preceded a re-arrangement of Ganz which fundamentally altered its structure, scale and scope. For in 1911 Ganz merged its operations with those of *Danubius Schiffbau- und Maschinenfabriks-AG*, Budapest[92]. Though Danubius produced railway cars, too, the firm mainly operated shipyards in Budapest and - since 1908 - in Fiume (Rijeka). In 1909, it employed about 2,000 workers compared with Ganz' 4,000 strong workforce[93]. A rapid increase in orders from the Austro-Hungarian navy induced the new firm of Ganz-Danubius to expand its ship-building capacity and to attract more labour. Already in 1913, Ganz-Danubius had about 10,000 workers on its payroll[94]. Whereas the Fiume shipyards accounted for only 22 per cent of Ganz-Danubius' gross fixed capital in 1911, this share had risen to more than 50 per cent by 1913[95]. Most of the company's massive new investment was now geared towards naval armaments production. Its rapid expansion between 1910 and 1913 was therefore directly linked to the pre-World War I re-armament boom[96].

1905: 2.7 million crowns,
1906: 6.6 million crowns,
1907: 10.8 million crowns,
1910: 10.0 million crowns;
Compass 1908, p.312; 1910, p.652 and 1913, p.855.

[91] The value of Ganz net fixed assets fell by 28 percent in 1906 and 23 in 1907; Appendix B, Table B.9b.

[92] *Compass* 1913, pp.852-855.

[93] *Compass* 1911, pp.679-680, 683.

[94] *Compass* 1913, pp.852-855.

[95] Ibid.; *Compass* 1914, p.913 and 1916, p.972.

[96] The value of fixed assets rose by 82 percent in 1912 and by more than 130 percent in 1913; Appendix B, Table B.9b.

Three factors, in particular, explain the varying growth of machine-building companies and the resulting differences in capital requirements:

1. Company growth in the machine-building industry was largely a function of external expansion. Most companies realizing above average growth rates in the respective decades did so by company acquisitions or amalgamations. The Böhmisch-Mährische Maschinenfabrik[97] and Schlick, the latter in the 1880s, were an exception. A renunciation of external growth as opposed to internal growth, for whatever reason, generally implied a renunciation of faster growth overall.

2. The different development of demand in the various branches of machine-building, too, led to differential rates of company growth. Growth rates differed because firms acted in different markets. The experience of those companies operating in railway equipment markets supports the argument that the failure to extend production into other fields caused penalty in terms of restricted growth. This is not to say that railway engineering as such was an activity detrimental to company growth since eventually almost all companies discussed here produced either rolling stock, locomotives or other railway equipment to some extent. Yet insufficient product diversification allowed little compensation for the effects of temporarily stagnant

[97] The substantial rise of both balance-sheet total and value of fixed assets in 1899 and 1900 reflects high rates of *internal* growth. New share capital was raised in both years in order to finance the construction of a new locomotive factory, further building and machinery investment and debt repayment. In 1907, the company founded - in a joint-venture with F.Ringhoffer - the Prager Automobilfabrik Ges.m.b.H.. The following year the Böhmisch-mährische Maschinenfabrik purchased Ringhoffer's stake, liquidated the car factory and integrated its plant as new department for car engineering. *Compass* 1914, pp.432-433.

or volatile demand for one product or group of products[98].
3. The course of the respective domestic economy, apparently, played a role as well. For the two Hungarian firms - Ganz and Schlick - showed a temporal pattern of expansion markedly different from that of most of the Austrian companies. If the two economies were not in the same phase of a cycle, this should to some extent have affected relative company growth.

4. The Provision of Capital

Fixed capital in Austrian machine-building firms continuously declined during the 1880s up to the mid-1890s. The industry aimed at reducing excess capacity. It seems safe to assume that at least parts of this surplus capacity were a left-over from the boom prior to 1873 not reduced to a sufficient level in the depression thereafter. The recovery of Austria's machine-building industry in the 1880s was a slow, gradual process. Low capacity utilization and poor company growth caused demand for fresh capital to be weak. Only one of the six Austrian companies - the Brünner Maschinenfabrik - raised new share capital between 1880 and 1890[99]. Similarly, equity reserves endowed out of profits were built-up slowly. As a result, total equity capital grew by only 1.51 per cent on annual average in this decade (Table IV.6). Though the use of borrowed funds expanded faster, its relatively small volume meant that the

---

[98] These preliminary conclusions summarize results strikingly similar to those Feldenkirchen obtained for German machine-building companies during the same period; see his "Kapitalbeschaffung und Kapitalverwendung", pp.44-45.

[99] In 1889, the Brünner Maschinenfabrik increased its joint-stock capital from 1.2 million to 1.8 million crowns. Appendix B, Table B.5a.

level of total capital was barely affected[100]. Low rates of company growth generally implied limited increases in the capital employed.

[100] The fast rise in the Böhmisch-Mährische Maschinenfabrik's credit capital is largely a result of its extremely low level at the onset of the 1880s. In 1880, borrowed funds accounted for less than 15 percent of the balance-sheet total; Appendix B, Table B.7a.

Table IV.6

AVERAGE ANNUAL GROWTH OF EQUITY AND BORROWED CAPITAL (%)

	1880 -1890 EQC	1880 -1890 BOC	1890 -1900 EQC	1890 -1900 BOC
1. Sigl	1.21	-10.94	0.58	11.54
2. Simmering	0.09	12.13	5.49	4.87
3. Brünner	5.94	11.80	8.10	12.70
4. Breitfeld	0.70	5.42	8.68	8.74
5. Böhmisch-mähr.	1.40	20.68	10.82	8.78
6. Ruston	1.51	-0.48	0.10	9.80
7. Ganz	5.31	13.09	8.89	18.92
8. Schlick	11.24	18.16	5.65	3.27
Six companies* (1.-6.)	1.51	3.70	5.46	9.19
Two companies* (7.-8)	6.60	14.82	8.09	14.75

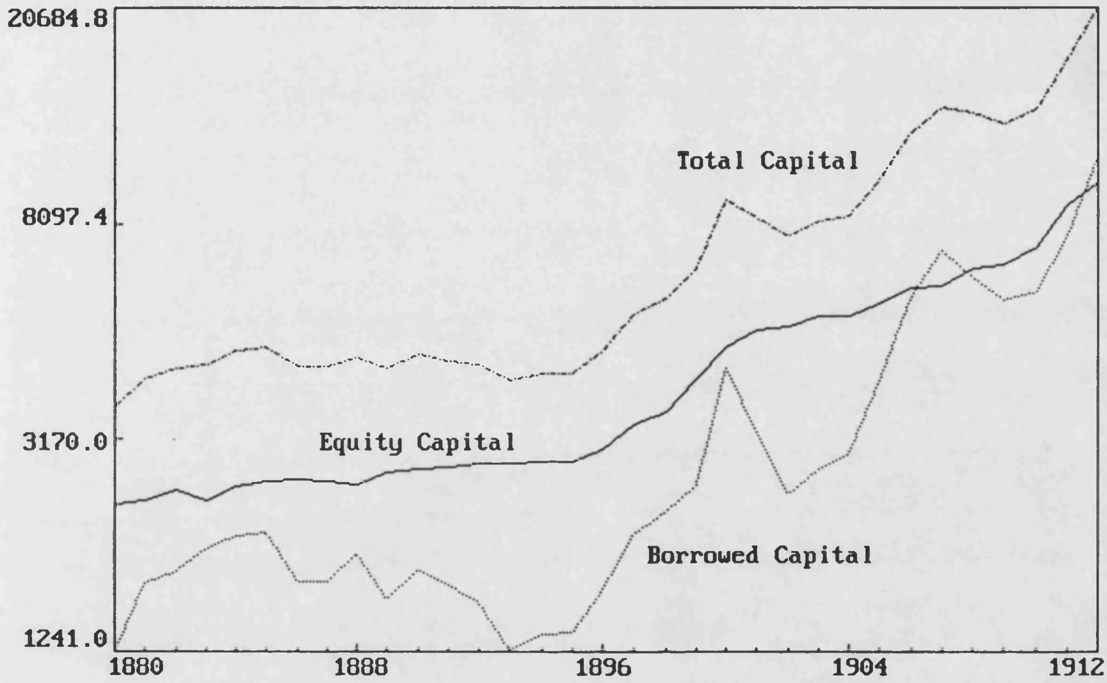
	1900 -1912 EQC	1900 -1912 BOC	1880 -1912 EQC	1880 -1912 BOC
1. Sigl	1.46	4.50	1.11	1.45
2. Simmering	9.86	14.67	5.37	10.73
3. Brünner	3.97	8.44	5.86	10.80
4. Breitfeld	4.53	5.18	4.57	6.02
5. Böhmisch-mähr.	0.90	4.33	4.05	10.62
6. Ruston	15.22	14.05	5.98	8.00
7. Ganz	3.59	9.75	5.76	13.59
8. Schlick	6.16	12.28	7.65	11.14
Six companies* (1.-6.)	6.25	8.10	4.50	7.04
Two companies* (7.-8.)	4.21	10.14	6.16	13.02

* Growth of average equity and borrowed capital

Key: EQC: equity capital
BOC: borrowed capital

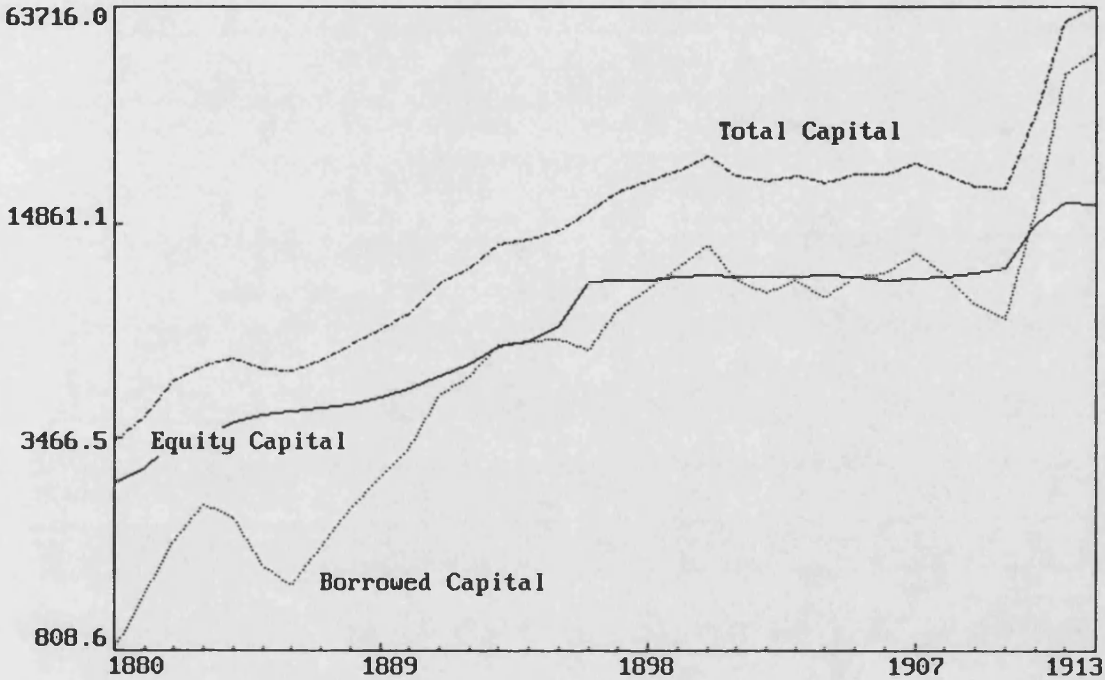
Sources: Appendix B, Tables B.1a, B.2a, B.3a, B.4a, B.5a, B.6a, B.7a, B.8a, B.9a, B.10a.

Figure IV.3: Average Capital Structure, Austria (1000 Crowns), Semi-Log Scale



Source: Appendix B, Table B.1a.

Figure IV.4: Average Capital Structure, Hungary (1000 Crowns), Semi-Log Scale



Source: Appendix B, Table B.2a.

In response to faster expansion, the two Hungarian firms increased both their equity and their borrowed capital at clearly higher rates than most of the Austrian companies. Schlick repeatedly raised new share capital to finance its rapid growth in the 1880s. New shares were issued in 1881, 1882 and 1884. Given the substantial increase in borrowed funds and the still very low level of reserves in the 1880s, further equity had to be raised if a deterioration of Schlick's debt ratio was to be avoided[101]. Ganz, in contrast, did not increase its equity by recourse to external sources. The company systematically built up its reserves as a substantially larger than average part of annual profits was *not* distributed but kept at the disposal of the firm. As a result, the share of reserves in Ganz' equity capital increased from 8 per cent in 1880 to almost 45 per cent only ten years later[102].

In the 1880s, Austrian engineering companies were capable of financing most of their restricted investment projects by recourse to depreciation equivalents only. Provisions made for the replacement of capital-stock were not fully used for this purpose. This, again, is a clear indicator of sluggish company growth and associated low levels of demand for capital. The persistent feature of negative rates of net investment in the 1880s (Figure IV.2) suggests that some companies were in a position to finance at least part of their working capital out of accumulated depreciation allowances. This, surprisingly, applied even to Ganz and Schlick - despite their faster than average expansion in this decade (Tables IV.4 and IV.6). The example of Sigl and Breitfeld, in particular, shows that the funds involved were quite significant. An exception, again, was the Brünner Maschinenfabrik. In contrast to Ganz and Schlick - where company growth was not directly associated with an

---

[101] Appendix B, Table B.10a.

[102] Ibid., Table B.9a.

increase in fixed capital[103] - the Brünner Maschinenfabrik maintained high levels of positive net investment throughout the 1880s. Its fixed capital thus expanded at a rate well above the average of all eight companies[104]. Accordingly, capacity growth had to be supported by increasing utilization of both equity and borrowed capital.

Table IV.7

ANNUAL DEPRECIATION ALLOWANCES AND ACTUAL RE-INVESTMENT (1000 CROWNS)

	Sigl		Simmering		Breitfeld	
	A	B	A	B	A	B
1881	84.5	84.5	27.9	27.9	-	-
1882	0	0	32.1	32.1	123.9	0.9
1883	176.0	0	33.2	33.2	124.2	21.4
1884	332.3	0	33.9	33.9	125.0	125.0
1885	297.6	0	34.4	34.4	131.9	26.4
1886	133.0	0	33.9	22.0	125.3	17.9
1887	126.0	0	35.1	35.1	28.5	28.5
1888	119.4	0	34.2	10.8	155.3	11.3
1889	113.1	0	34.1	27.3	19.8	19.8
1890	107.2	0	33.8	19.3	36.5	36.5
Total	1363.1	84.5	332.6	276.0	870.4	287.7

Key: A: depreciation allowances
B: actual re-investment

Note: Since actual re-investment not necessarily equals the allowance made for this purpose the smaller one of the two values for depreciation and gross investment represents re-investment.

Sources: Appendix B, Tables B.3b, B.4b and B.6b.

The upswing of Austrian machine-building production in the 1890s induced a change in investment behaviour which eventually had to be accommodated by different forms of finance. Capital requirements could not be met any more by sole use of funds reserved for equipment replacements.

[103] See Appendix B, Tables B.9a, B.9.b, B.10.a and B.10b.

[104] Ibid., Tables B.1b, B.2b and B.5b.

External expansion - which gathered pace at around the turn of the century - called for additional means of finance. As a result, both equity capital as well as outside capital grew at much higher rates than in the previous decade (Table IV.6).

The general recovery of the industry and stable and at times improving returns on equity - notably in the late 1890s and during 1907 to 1912 - contributed to an environment in which raising further equity on the capital market posed no serious problems. Most of the Austrian companies increased their stock capital in the late 1890s and early 1900s in several consecutive steps. A second wave followed in the years 1910 to 1913[105]. With share prices above the nominal value of shares, companies could often realize substantial issuing premiums which, in most instances, were allocated to equity reserves[106]. Yet in the long run share capital nevertheless lost much of its significance relative to other forms of financial capital. Whereas the average balance-sheet total of the eight companies rose by 720 per cent between 1880 and 1912, average share capital increased by only 235 per cent. In both Austria and Hungary, the average ratio of equity capital to statement total also fell over time. This holds even though the favourable development of profits during the 1890s and after the stagnation 1901-04 facilitated more

---

[105] Breitfeld, for example, carried out seven increases of its joint-stock between 1897 and 1913: as a consequence, its share capital rose from 3.0 million crowns in 1896 to 11 million in 1912 (13.2 million crowns in 1913). The case of Ruston is even more striking. The rapid expansion in its scale of operation achieved by company u caused a sharp increase in demand for long term capital. This demand was satisfied by both a rise in borrowing and a widening of its basis of equity capital. Ruston's joint-stock rose from 2.4 million crowns in 1901 to 14 million crowns in 1912. See Appendix B, Tables B.6a and B.8a.

[106] Breitfeld cashed in an issuing premium of 832.000 crowns in 1900, 640.000 in 1901, and 717.900 crowns in 1906; with its 1911 share issue, Ruston realized a premium of 1.3 million crowns. Cf. *Compass* 1909, pp.274-276; 1914, p.453.

extensive endowment of equity reserves[107]. Unless share capital was increased, the rate of growth of equity was determined by the change in equity reserves. The latter, in turn, was a function of company growth, the *level* of profits and their *distribution*. Consequently, equity ratios varied between firms and over time (Table IV.8).

Ganz pursued a markedly different approach to self-financing out of un-distributed profits than the other companies. Before the turn of the century, in particular, Ganz maintained persistently lower rates of distribution of annual surplus[108] and the company's share capital was increased only twice[109]. As a result, reserves dominated the equity structure to a much larger extent than in any of the other firms examined here. It is difficult to assess the reasons for this policy. Yet it seems plausible to link Ganz' extensive self-financing to the relationship between company growth on the one hand, and the debt ratio on the other. For if a company grows rapidly it requires funds to finance expansion. If then, for whatever reason, it does not wish to or is not able to raise further equity on the capital market, it is confined to either increasing its borrowing or using withheld profits[110]. Continuous

---

[107] See Appendix B, Tables B.1a to B.1c. The continuous rise in the ratio of equity to share capital (Ratio2) up to the mid-1890s resulted from building up reserves while share capital remained more or less constant. When stock capital was increased from around the turn of the century onwards reserves continued to grow as well. From then on the two parts of equity funds were kept in a fairly stable ratio.

[108] See Appendix B, Ratio7 in Tables B.3d, B.4d, B.5d, B.6d, B.7c, B.8c, B.9d and B.10d.

[109] Share capital was increased from 3.84 million crowns to 4.8 million in 1896 and, eventually, to 8.64 million crowns in 1911; Appendix B, Table B.9a.

[110] In the event of new share issues, a change in the ownership structure of a firm occurs unless all current share-holders participate in full and in proportion to their current holdings of stock. But owners and management may want to prevent outsiders from gaining influence over the company and thus abstain from issuing new equity.

increases in credit finance may, however, negatively affect a company's debt position and its ability to obtain credit at more favourable conditions.

Table IV.8

SUMMARY STATISTICS OF EQUITY RATIOS: 1880 TO 1912

	maximum	minimum	mean	coeff.var.
1. Sigl	92.6	28.1	62.5	.321
2. Simmering	76.5	30.9	55.5	.222
3. Brünner	75.8	36.8	60.3	.131
4. Breitfeld	72.5	42.5	53.2	.136
5. Böhm.-mähr.	81.4	37.8	55.9	.235
6. Ruston	77.9	44.4	66.2	.142
7. Ganz	74.8	26.4	51.9	.185
8. Schlick	88.6	39.0	58.2	.211

Sources: Calculations based on equity ratios (Ratio1) given in Appendix B, Tables B.3c to B.10c.

With generally declining equity ratios, borrowed funds became increasingly important over time among all eight companies discussed here (Table IV.6)[111]. The most rapid

[111] Sigl was the firm experiencing the most pronounced fluctuations in its share of equity capital. These were largely a reflection of severe jumps of turnover and variations in stocks; see Appendix B, Tables B.3b and B.3c. A decreasing volume of production translated into a drop of absolute annual surplus which - in turn - reduced the balance-sheet total. Since the volume of equity capital was rarely subject to substantial short-run reductions the equity share rose sharply. In 1892, for example, Sigl's equity ratio peaked at more than 92 percent. At the same time the annual surplus more than halved as a consequence of another fall in output. The same "mechanism" was at work again in 1902 and 1903 - though the rise in equity share was induced by a massive reduction in material stocks in 1901 which offset the effects of a rising surplus in this year. The steep fall of Sigl's ratio of equity capital in 1906 - despite a high level of production - resulted mainly from the heavy losses in this year. These losses in combination with an unprecedented rise in net investment boosted the balance-sheet total while equity capital remained more or less unchanged. As a consequence, reserves were dissolved, the value of share capital halved, and new

rise in the use of credit capital can be observed for years characterized by high levels of investment and company growth. This holds, in particular, for the Austrian companies. Peaks in investment coincided closely with peaks in credit finance (Figures IV.2 and IV.3).

The available balance-sheet data rarely allow differentiating between short-term and long-term credit capital. Thus it proves difficult to assess the term structure of borrowed funds. The only type of long-term borrowed capital which occasionally has been referred to in some of the Austrian companies' statements was mortgage credit, notably from the 1890s onwards. Yet even these data are rather patchy and cannot be integrated into a coherent series. There are two likely explanations for the apparent lack of more detailed information. Either long-term credit did in fact not play any important part or was "hidden" in the total debt positions.

The results Feldenkirchen derived for German joint-stock engineering companies may provide some rough indication about the relative significance of short and long-term borrowing[112]. According to his findings, many firms did not employ any long-term borrowed capital during long spans of time or even the whole period between 1880 and 1913. Other companies, in contrast, made extensive use of loan or debenture capital. The average share of long-term credit in the balance-sheet total, though, was fairly constant over time at approximately 10 to 11 per cent. But the values varied considerably between companies[113]. With falling

---

shares issued increasing share capital to 5 million crowns in 1907. The losses were explained with badly calculated export orders, delayed completion of the current investment programme, and penalty payments for incompleted orders; *Compass* 1909, pp.284-285 and 1911, pp.358-360.

[112] Feldenkirchen, "Kapitalbeschaffung und Kapitalverwendung", p.48.

[113] For 1913, for example, a minimum of 0 percent and a maximum of 34.6 percent was recorded for the share of long-term credit in the total among engineering companies

equity ratios and a more or less constant share of long-term credit, short-term borrowing became an increasingly important form of finance in German machine-building[114]. Feldenkirchen finds an explanation in the willingness of banks to offer increasing overdrafts. Continuous prolongation made these credit funds permanently available. The companies were thus put into a position to finance essential investment projects by use of bank credit and to delay recourse to the capital market until more favourable conditions prevailed (i.e. higher issuing premiums or better loan conditions)[115].

Similar circumstances seem to have characterized the Austrian situation. Little evidence can be found suggesting extensive long-term borrowing in the form of loans or debentures among *Austrian* engineering firms. Ganz was the only company among the eight which issued a long-term loan. In 1898, six million crowns were raised by means of debenture bonds with a 20-year amortization period. No other form of long-term credit had been explicitly stated in the company's balance-sheet[116]. Yet bank records indicate that rolling overdrafts were effectively providing a form of longer term credit finance to the industry. Occasionally, further bank credit was secured against mortgage[117]. The share-holdings of the Credit-Anstalt

---

registered at the Berlin stock-exchange; Feldenkirchen, "Kapitalbeschaffung und Kapitalverwendung", p.48.

[114] Ibid., pp.48-49.

[115] Ibid.

[116] The subsequent pay-off and ongoing company growth caused the loan's share in the total to fall rapidly over time. In the year it was issued, this loan on debentures accounted for 41 percent of Ganz' balance-sheet total. By 1912 this share had dropped to less than four percent; *Compass* 1900, p.913 and 1914, p.913.

[117] Archiv der Creditanstalt-Bankverein, Vienna (hereafter CAA): Verwaltungsratsprotokolle, a) for Breitfeld: no.7 (23.3.1897), no.27 (22.12.1900), no.1 (8.1.1902), no.18 (22.8.1905), no.14 (18.6.1907), no.17 (30.7.1907), no.15

implied substantial interests of the bank in the Austrian machine-building industry[118]. This, in fact, may explain the bank's preparedness to accommodate the financial needs of the industry by supplying bank credit on a longer term basis.

For most of the period discussed here the ratio of equity capital to fixed assets and stocks was above 100 per cent[119]. This shows that long-term investment in machinery and equipment was generally covered by long-term finance. Even stocks as part of the working capital were completely covered. This ratio, too, fluctuated over time and varied between firms, largely in response to short-run variations in stocks held and changes in investment behaviour. With another sharp rise in the scale of operations just prior to World War I and the associated expansion of both assets and material stocks more outside funds had to be used to finance - at least partly - the holding of material stocks. As a result, the average ratios for both the six Austrian firms and the two Hungarian companies fell[120]. But with the

---

(19.7.1910), no.8 (22.4.1913); b) for Ruston: no.25 (13.12.1898), no.27 (22.12.1900), no.26 (15.12.1908); c) for Sigl: no.28 (4.12.1888), no.9 (3.5.1898), no.26 (11.12.1900).
The argument about the increasing significance of bank credit and its prolongation for company finance is further strengthened when other firms are taken into account. The Credit-Anstalt's records on firms like Stabilimento Tecnico, Ringhoffer, Tanner-Laetsch & Co., Heid, Ruesch-Ganahl, Kaiser's Söhne and Zieleniewski - which are included in Sample II for Austria - provide ample evidence in support of the hypothesis that rolling overdrafts were effectively employed as a form of long-term credit.

118 CAA: Verwaltungsratsprotokolle, no.27 (27.11.1906), no.11 (24.5.1910), no.16 (12.8.1913). See also März, *Bankpolitik*, pp.85-88.

119 See Appendix B, Ratio4 in Tables B.1c, B.2c, B.3d to B.6d, B.7c to B.8c, B.9d to B.10d.

120 Ibid., Ratio4 in Tables B.1c and B.2c. The sharp fall in the average ratio for the two Hungarian companies (1911 to 1913) results from the re-organization of Ganz. The merger

exception of Simmering (1907 to 1910) and Ganz (1913), all firms maintained a level of equity capital which covered their long-term investment in fixed capital. The endowment with equity - *relative* to the value of plant and equipment - probably accounted to some extent for the limited use of long-term credit capital in Austrian machine-building. If growth of fixed capital was moderate, the demand for long-term finance, too, grew only moderately. While the fixed capital bound long-term in the company could be financed completely by own funds, there was no pressing need to raise long-term credit.

Finally, the problem of how successful machine-building firms were in economizing their capital requirements should be discussed briefly. How did the ratio of turnover to balance-sheet total change? Here only a tentative answer is possible as turnover data are available for only six of the eight companies and only for limited periods of time. However, the results obtained are interesting for several reasons. Firstly, before the turn of the century the ratios of all firms were generally much higher than after[121]. Though substantial differences existed between the companies as to the actual level of their respective ratios, the trend indicates a long-run decline from the peaks in the 1880s and 1890s. Except for improvements as a

---

with the Danubius shipyards implied not only a 370 percent increase in fixed assets, but stocks of materials, semi-finished and finished products rose more than tenfold between 1910 and 1913. Whereas stocks made up less than 20 percent of Ganz' balance-sheet total in 1900, they accounted for more than 36 percent in 1913. For German engineering, Feldenkirchen observed that "the share of non-monetary components in working capital was particularly high among shipyards"; Feldenkirchen "Kapitalbeschaffung und Kapitalverwendung", p.46. Large projects spread over longer periods of time - like large-scale ship-building - required maintenance of larger stocks. The move of Ganz into this section of engineering thus went along with a rise in its stock holding.

[121] See Appendix B, Ratio5 in Tables B.3d to B.6d and B.9d to B.10d.

consequence of short-run increases in annual turnover, none of the companies managed to increase the productivity of the capital it employed. In most cases, it actually fell over time.

Another point of interest is that the *causes* of high or low ratios varied between firms. Sigl, for example, responded to slow company growth by continuous net desinvestment. The firm reduced its capital stock in an attempt to *downwardly* adjust its plant and equipment to fluctuating and declining levels of railway related output. The ratio of turnover to balance-sheet total rapidly improved from its low level in the mid-1880s and stayed above the 100 per cent mark up to 1901[122]. The Brünner Maschinenfabrik, in contrast, achieved markedly lower ratios[123]. This, however, was *not* a consequence of sluggish growth but rather one of fast expansion of both turnover and capital employed. Much of the Brünner's growth was capacity driven. Permanent positive net investment caused the ratio of turnover to total capital to fluctuate around a level of 81 per cent - despite rapidly rising output.

Ganz, finally, reached exceptionally high turnover/total ratios in the mid-1880s which gradually declined, while remaining above 100 per cent, towards the end of the century and, eventually, fell strongly in the years after 1898[124]. Though fluctuating, turnover rose rapidly up to the late 1890s; but at the same time fixed capital was not increased.

---

[122] Appendix B, Ratio5 in Table B.3d. The substantially lower levels of the ratio after the turn of the century can be explained by the collapse of turnover (1902 to 1905), the massive loss in 1906 and the effects of the subsequent re-organization of Sigl.

[123] See Appendix B, Ratio5 in Table B.5d.

[124] See Appendix B, Ratio5 in Table B.9d.

Table IV.9

SUMMARY STATISTICS: TURNOVER / BS-TOTAL, 1885-1903 (%)

	maximum	minimum	mean	coeff.var.
1. Sigl	144.6	30.3	92.0	.328
2. Simmering	153.7	34.5	108.3	.296
3. Brünner	95.6	56.7	80.5	.124
4. Breitfeld	107.3	64.8	84.7	.149
5. Ganz	201.2	62.8	120.9	.325
6. Schlick	112.4	69.9	88.9	.151

Key: BS-Total: balance-sheet total

Note: The period 1885 to 1903 delimits the years for which turnover data of all six companies are available.

Sources: Calculations based on Appendix B, Ratio5 in Tables B.3d to B.6d, B.9d to B.10d.

The subsequent modernization and expansion of Ganz' operation in 1896 to 1900 preceded the downturn in the Hungarian economy when output dropped dramatically. Similarly, Schlick's turnover collapsed, too. As a result, both firms experienced historically low ratios of turnover to capital employed. Here, the temporal coincidence of large capital investment with a downswing in the business cycle may provide an explanation. Yet as no turnover data are available for the years after 1905 and 1903, respectively, we cannot observe whether or not the two companies' ratios improved again in the upswing.

5. Conclusion

The growth of machine-building companies in Austria-Hungary, the pattern of their investment, the volume and forms of finance varied significantly between different firms and over time. The diverging development of demand in the various machine-building branches, the impact of the business cycles in Austria and Hungary, and companies' preparedness to pursue external growth, were the main factors accounting for differential rates of company growth.

In most instances, faster than average company growth was achieved by mergers and acquisitions within the industry. Moves towards external expansion seem to have been motivated by three basic considerations. Some firms acquired other manufacturers as a means of diversifying their output and thus reducing the impact of stagnant or volatile demand for their existing product range. Other companies, in contrast, focused on producers operating in the same or fairly similar markets; in these cases, it has been shown, the primary aim was to facilitate improvements in product and plant specialization. A third type of external company growth was that involving the purchase of machine-building firms abroad in an effort to secure access to foreign machinery markets.

As in German machine-building, the relative importance of credit capital increased during the decades from 1880 to 1912 - a result confirmed when more than the original eight companies are taken into account[125]. Hungarian engineering firms, in particular, seem to have operated on a comparatively low equity level. Though the decline in equity ratios was somewhat more pronounced in Austrian and Hungarian companies than in German firms[126], on average all firms in Samples I and II maintained levels of equity capital sufficient to finance their fixed assets bound long-term.

---

125 See Appendix B, Tables B.11 and B.12; Feldenkirchen, "Kapitalbeschaffung und Kapitalverwendung", Table 3, p.56.

126 Cf. Feldenkirchen, "Kapitalbeschaffung und Kapitalverwendung", Table 3, p.56.

V

THE IMPACT OF FOREIGN COMPETITION: INTERNAL AND EXTERNAL TRADE OF MACHINERY IN AUSTRIA-HUNGARY

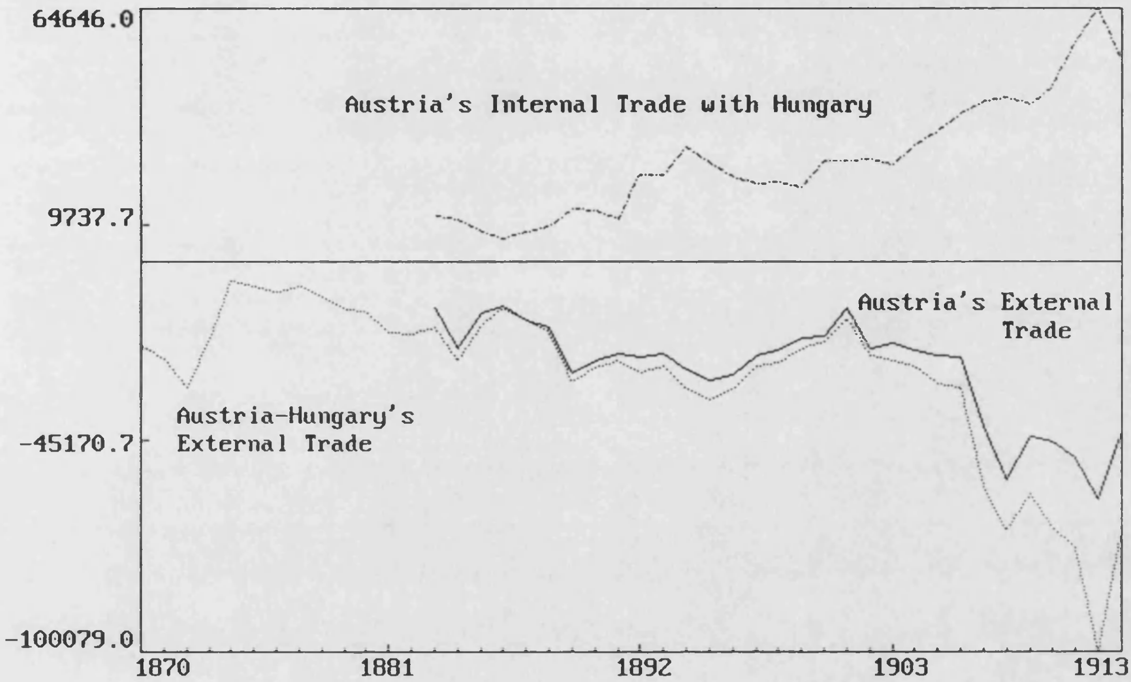
1. Trade and Production

Despite the rapid advances in domestic machinery production, especially from the 1890s, the Habsburg Monarchy remained heavily dependent on imports of foreign capital goods throughout the late nineteenth century. Though the size of the gap varied, the balance of trade in machinery was in deficit for each year between 1870 and 1913 (Figure V.1). Moreover, the value of imports exceeded that of exports in almost all categories of machinery during these years. Isolating Austrian trade flows yields results which indicate that this dependency was not confined to the economically less developed Eastern half of the Empire[1]. With the exception of her trade with Hungary, Austria herself also suffered a negative balance of machinery trade, too, from the 1880s up to 1913.

Between 1872 and 1912, the Empire's imports of machinery from abroad grew in line with Austrian output (in current prices) by 3.7 per cent on annual average - a rate below the average of Hungarian machine-building growth. Exports

[1] Though for most of the period under consideration here no official data on *Austrian* machinery trade are available, the major trends and changes can be traced by making use of the Hungarian trade statistics. Austria's trade flows were derived by subtracting Hungary's imports and exports related to the rest of the world from the overall figures for Austria-Hungary. The Hungarian material allows, moreover, to take account of the internal trade in machinery between the two halves of the Empire. See the discussion in Appendix D.

Figure V.1: Balances of Machinery Trade (1000 Crowns)



Source: Appendix D, Tables D.1, D.2 and D.3.

expanded by about 3 per cent over the whole period[2]. The considerable difference between the respective growth rates for selected periods suggests that domestic production and imports did not respond proportionally to changing market conditions (Table V.1). While output of machines rose fairly rapidly from the mid-1880s to 1900, imports increased at a significantly lower pace. But after the turn of the century, the growth in machinery imports outstripped that of both Austrian and Hungarian production[3].

Table V.1

COMPOUND RATES OF GROWTH
IMPORTS AND EXPORTS OF MACHINERY (PER CENT)

	Habsburg Empire		Austria		Hungary	
	Imp.	Exp.	Imp.	Exp.	Imp.	Exp.
1872-1912	3.7	3.0	-	-	-	-
1883-1912	5.5	4.3	4.7	4.3	6.4	5.4
1872-1883	-0.3	-1.1	-	-	-	-
1883-1900	2.5	4.1	2.6	3.6	0.5	5.9
1900-1912	9.6	4.5	7.7	5.1	15.3	4.6

Peak-to-peak measurement. Since the peaks in Austria may not correspond precisely to the peaks in Hungary (or the Habsburg Empire as a whole), the periods compared are not identical. The figures for Austria and Hungary do not include growth in internal trade.

Source: Appendix D, Tables D.1 and D.2.

However, from the late 1880s imports of capital goods from abroad showed a temporary decline relative to Austrian and Hungarian production. The degree of import penetration in Austria was falling as domestic producers provided a rising

---

[2] Since trade data are available only in current prices, comparisons with domestic production are based on Austrian and Hungarian machine-building output in current rather than in constant prices.

[3] See Appendix A, Tables A.13, column (1), and A.21, column (1).

proportion of machines and equipment for use in the Austrian economy (Figure V.2)[4]. For Hungary, though, no such effect can be observed, largely because of the structure of her machinery imports. By far the largest part of Hungarian imports of capital goods came from Austria, i.e. from within the customs area. The relative decline in the Habsburg Empire's total machinery imports during the 1890s thus primarily affected Austria, which absorbed about 80 per cent of all foreign imports at the time[5].

The slow growth of total imports relative to domestic production seems less an outcome of increased tariff protection but rather one of changing economic circumstances in those countries which exported machinery to the Habsburg Monarchy. As growth in the German economy, for example, accelerated again in the second half of the 1880s, some of the external pressure on Austrian producers was reduced[6]. For much of the "surplus" output, previously sold as exports to the Monarchy, was now supplied to an expanding market where demand for capital goods was beginning to rise again. Moreover, it has been shown in the previous chapter that up to the mid-1890s Austrian machine-building was still operating on under-utilized capacity. When domestic demand for machinery eventually recovered again in response to an acceleration in Austrian industrial growth, it was readily accommodated by an increase in output. Consequently, a relatively small share of this demand was diverted to imported items. The industrial boom which unfolded in Germany during the final years of the century induced a rise in German product prices and so

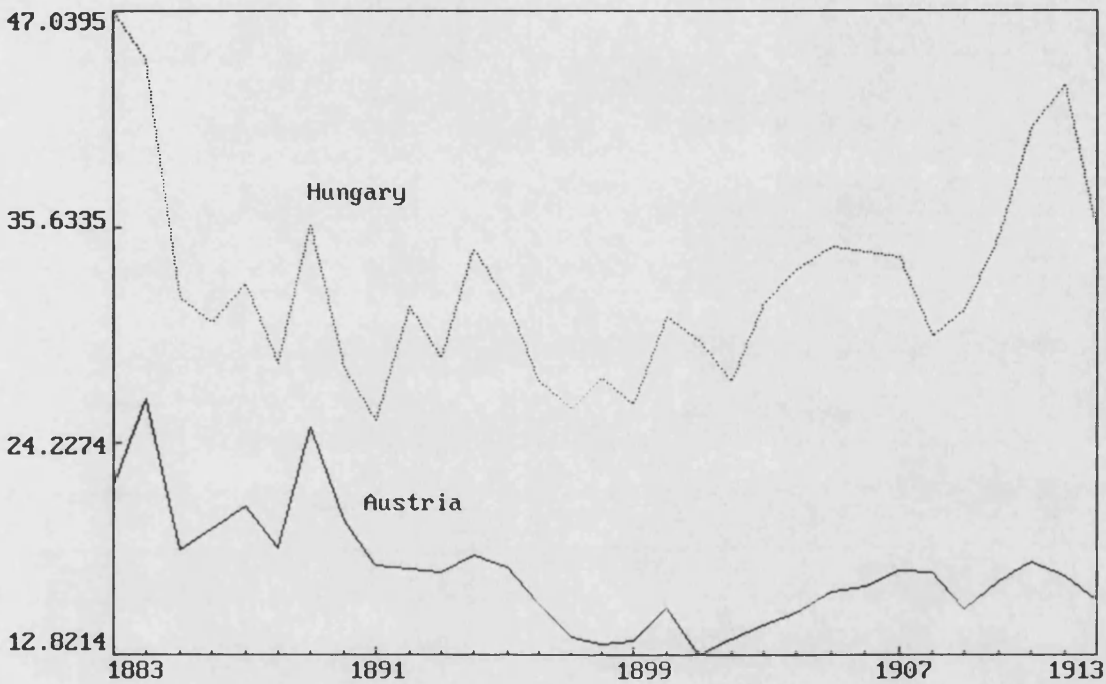
---

[4] Import penetration: machinery imports/(domestic production + machinery imports - machinery exports). Internal trade between Austria and Hungary is included in the trade figures used.

[5] Appendix D, Tables D.1, D.2, and D.3.

[6] Cf. Hoffmann, W.G., *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts* (Berlin, 1965), Table 76, pp.390-395.

Figure V.2: Import Penetration of Machinery Markets (Per Cent)



Sources: App. A, Tables A.13, col.(1), A.21, col.(1); App. D, Tables D.2, D.3.

further improved the competitive position of Austrian manufacturers in their home market[7]. But to the extent that Austrian machinery producers benefitted from the upswing in the German economy, they suffered afterwards when a downturn followed in 1901. The effects of contracting Austrian machinery demand were aggravated by increasing German competition both at home and in export markets. Because of rapidly falling domestic sales German machine-building firms turned abroad in search of foreign customers[8].

With a few exceptions, Austria - as the larger of the two economies - persistently absorbed more than 80 per cent of the Monarchy's imports of machines until the turn of the century. Thereafter, this share quickly fell in response to Hungary's more rapid industrial expansion and the associated re-direction of demand for imported plant and equipment. At the same time, Austrian manufacturers were apparently not in a position to exploit to the full extent the opportunities provided in the Hungarian market. For the trade statistics show that their position of relative strength in the Hungarian economy was gradually eroded by rising foreign competition. Whereas Hungary used to procure about 70 to 80 per cent of her imported machinery from the Western half of the Monarchy, this share had fallen to 60 per cent in 1913[9].

---

[7] Rudolph, *Banking and Industrialization*, pp.31-32.

[8] Cf. "Waggon- und Maschinenfabrikation", *Die Störungen im deutschen Wirtschaftsleben in ihren Rückwirkungen auf die industriellen, Effekten- und Geldmarktverhältnisse Österreichs. Schriften des Vereins für Socialpolitik* 112, eds. Verein für Socialpolitik (Leipzig, 1903), pp.55-57, and, in the same volume, "Die Maschinenindustrie", pp.67-69.

[9] Appendix D, Tables D.2 and D.3.

Table V.2

AUSTRIAN IMPORTS AND EXPORTS OF MACHINERY AS PERCENTAGE OF DOMESTIC PRODUCTION

Period	Imports from Abroad	Exports to Hungary	Exports Elsewhere
1883/1885	21.1	11.4	7.3
1886/1890	20.8	9.3	5.8
1891/1895	16.4	12.2	3.7
1896/1900	12.7	9.4	4.4
1901/1905	12.2	10.6	5.9
1906/1910	15.3	10.3	6.2
1911/1913	15.7	11.0	6.8

Sources: Appendix A, Table A.13, column (1); Appendix D, Tables D.2 and D.3.

The strong regional orientation of Austrian machine-building is clearly reflected in the volume and direction of its exports. Machinery sales to Hungary alone always accounted for a larger share of Austrian production than those to the rest of the world (Table V.2). Hence Austrian engineering was to some extent dependent on the expansion of machinery demand in Hungary. Contemporaries viewed the increasing success of Hungarian and foreign firms in the Hungarian market as a severe problem for the manufacturers in Bohemia, Moravia, and Lower Austria[10]. For the growth of exports to other countries was not fast enough as to fully offset the effects of declining shares in Hungarian imports of capital goods after the turn of the century. Despite advantages such as geographical proximity and operation within one customs area, Austrian exports of capital goods to Hungary rose by less than 7 per cent on annual average between 1900 and 1912, whereas imports of foreign

[10] Bibliothek der Kammer der gewerblichen Wirtschaft für Wien, Vienna (hereafter HKB Wien), Sign. IV.6316: Handelspolitische Zentralstelle, *Gutachten zum autonomen Zolltarif: Die Entwicklung der österreichischen Maschinenindustrie seit 1905 bis 1913*, typescript, no place, no year, pp.9-10.

engineering products to Hungary grew by 15 per cent during the same period[11]. Although Austrian exports of machinery to the rest of the world increased by about 5 per cent, too, these could not compensate for the lost opportunities because the volume of Austria's export trade with other countries was well below that with Hungary[12]. However, much of the contemporary Austrian manufacturers' complaints about being virtually excluded from the Hungarian machinery market were greatly exaggerated[13]. Austria remained Hungary's main source of imported capital goods throughout the late nineteenth and early twentieth centuries (Figure V.3)[14].

---

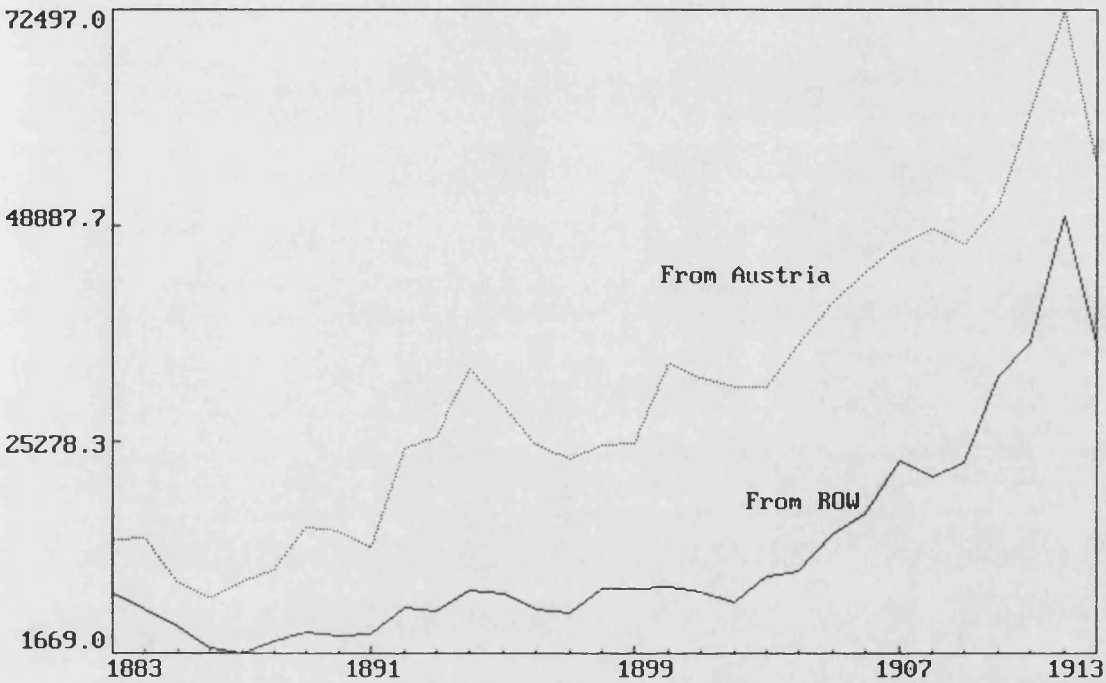
[11] Appendix D, Tables D.2 and D.3.

[12] Ibid.

[13] Cf. "Die Maschinenindustrie", p.69; Handels- und Gewerbekammer Prag, *Bericht der Handels- und Gewerbekammer Prag über die volkswirtschaftlichen Verhältnisse ihres Bezirkes im Jahre 1896* (Prague, 1897), pp.99-100.

[14] ROW = rest of the world.

Figure V.3: Hungarian Imports of Machinery (1000 Crowns)



Source: Appendix D, Tables D.2 and D.3.

2. The Composition of Austria-Hungary's Machinery Trade

The analysis of Austria-Hungary's trade in machinery is somewhat hampered by frequent changes within the foreign trade statistics. In general, the goods classification scheme was modified when tariff variations were carried out[15]. From 1891 onwards the trade data are fairly detailed and largely compatible with those after the tariff change in 1906. The following discussion will therefore focus on the period 1891 to 1913. With a few exceptions[16], any statement about the composition of trade flows in earlier years would be virtually meaningless as the share of "other, unclassified machinery" in both total imports and exports was extremely high in the 1870s and 1880s; at times it accounted for more than 90 per cent. A second problem should also be kept in mind: average import and export unit prices were rather volatile throughout the four decades[17]. Significant jumps, drops, peaks, or troughs can be observed for years near to or within those of tariff changes and re-classification[18]. These upward or downward movements reflect to some extent changes in the composition of machinery trade; i.e. the share of high or low unit price products fluctuated in both imports and exports. But re-evaluations by the trade authorities seem to have played a

---

[15] Import tariffs were changed in 1878, 1882, 1887, 1892, and 1906; k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XL: Maschinen, Apparate und Bestandteile derselben* (Vienna, 1913).

[16] Imports and exports of locomotives and locomobiles are reported in the trade statistics throughout the period discussed here.

[17] Unit price = crowns per 100 kilograms of machinery. The official trade statistics report both the value and the weight of traded goods.

[18] This holds especially for import prices in 1882, 1887, and 1892. See Appendix D, Figure D.1.

role as well[19]. They do not, however, indicate the direct impact of tariff changes on unit prices, since the value of any imports is given as *commercial value* at the customs borders, i.e. exclusive of domestic freight and tariff levied upon them[20].

Figure V.4 depicts the percentage shares in total imports of the three largest groups of machinery - textile machines, agricultural machines, and metalworking machines[21]. It shows that textile machines accounted for most Austro-Hungarian machinery imports between the early 1890s and 1912. This seems hardly surprising given the relative weight of cotton and woollen textiles manufacture in the industrial economy. According to Fellner, the production of textiles and clothes in 1911 made up 25 per cent of total industrial output in Austria[22]. Domestic producers were apparently at no time in a position to satisfy the machinery demand of this industry. The balance of trade in textile machines was negative throughout the late nineteenth and early twentieth century[23]. The small initial size of specialized textile machine-building, in particular, contributed to the persistence of import dependency. On the eve of World War I, for example, there was only one company in Austria producing spinning machines

---

[19] The reported import or export unit prices were estimated and established by the Austro-Hungarian "k.k. Permanenz-Commission für die Handelswerte" (= permanent commission for the establishment of trade values). See the introductory sections of k.k. Handelsministerium, Statistisches Departement, *Statistik des auswärtigen Handels des österreichisch-ungarischen Zollgebiets* (Vienna, 1893-1916).

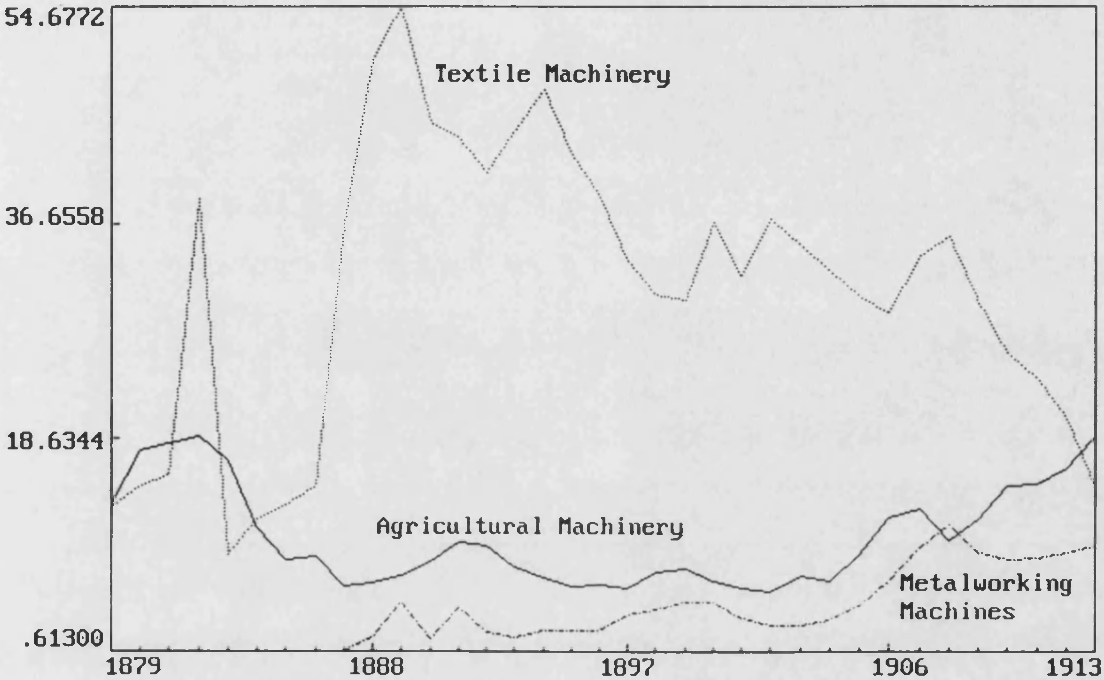
[20] Ibid.

[21] Textile machines *inclusive* of sewing and knitting machines; see Appendix D, Tables D.5.

[22] Fellner, F. v., " Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.570-571.

[23] Appendix D, Table D.5.

Figure V.4: Shares in Austro-Hungarian Machinery Imports (Per Cent)



Source: Appendix D, Tables D.1, D.4, D.5 and D.6.

with an estimated annual output of 1.5 million crowns[24]. In contrast, the Monarchy imported spinning machines worth more than 6.5 million crowns on annual average between 1907 and 1913[25]. Given the relatively low share of Hungary in total imports of textile machinery[26], it is fair to assume that the bulk of these spinning machines was shipped to Austria: domestic production was then nowhere near to playing a significant role. Similarly, the width of the gap in trade of sewing and knitting machines and its long-run persistence indicate that the Monarchy's clothing industries had to turn to suppliers abroad[27]. The use of machinery of foreign origin spread as these industries increasingly mechanized their manufacturing processes[28]. In 1913, domestic producers of sewing machines still provided only manually or foot-driven devices: "All other sewing machines (were) procured from abroad"[29]. The only area in textile machinery production where Austrian factories seemed able to expand somewhat was in the production of looms[30]. According to estimates based on the data of the workers' insurance association, annual output averaged approximately 5.7 million crowns between 1907 and 1911[31]. Even if the lower contemporary output estimate of 4 million

---

[24] HKB Wien, Sign. IV.6316: Gutachten, p.131.

[25] Handelsministerium, *Statistik des auswärtigen Handels* 1907 (III), pp.176-177; 1912 (IV), p.168; 1915 (IV), p.85.

[26] Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1882-1913. Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1923), p.313; Appendix D, Table D.5.

[27] Appendix D, Table D.5.

[28] HKB Wien, Sign. IV.6316: *Gutachten*, pp.136-137.

[29] Ibid.

[30] Ibid., p.128.

[31] See Appendix A, Table A.12b, for sources.

crowns is used[32], the ratio between domestic production and imports from abroad is clearly more favourable than in the case of spinning and sewing machines[33]. The value of Austria-Hungary's imports of looms was about 2.4 million crowns on annual average between 1907 and 1911[34]. However, even in this branch of textile machinery production, the Monarchy maintained a substantial trade deficit from the 1880s up to 1913[35].

After the turn of the century, imports of machine tools grew particularly fast[36]. Their value share in the Monarchy's total machinery imports rose from an average 3.1 per cent in 1889/99 to 6.0 per cent in 1900/10[37]. The

---

[32] This estimate refers explicitly to Austrian production of looms only, see HKB Wien, Sign. IV.6316: *Gutachten*, p.128. The former estimates (5.7 million crowns) are based on data from loom manufacturing establishments and thus, presumably, also cover production of other auxiliary machines.

[33] See Appendix A, Table A.11d, and Appendix D, Table D.5, for data on production and trade of sewing and knitting machines.

[34] Handelsministerium, *Statistik des auswärtigen Handels* 1915 (IV), p.85; 1912 (IV), p.168; 1907 (III), p.177.

[35] See Appendix D, note 1, for sources on import and export data.

[36] The available trade data do not allow differentiation between machine tools and the larger class of power-driven metal-working machinery: "The basic distinction is that machine tools shape metal through the use of a cutting-tool and the progressive cutting away of chips, whereas other metalworking machinery shapes metal without the use of a cutting-tool - by pressing (forming, stamping, punching), forging, bending, shearing, etc.", Rosenberg, N., "Technological Change in the Machine Tool Industry, 1840-1910", *Essays in American Economic History*, eds. A.W. Coats and R.M. Robertson (London, 1969), p.167.

[37] Appendix D, Tables D.1 and D.6. There is some indication that actual unit prices of imported machine-tools were much higher than reported in the foreign trade statistics. The overall value of these imports and hence their share in total machinery imports were probably substantially above those stated here. Estimates based on records of purchase

fairly sudden upsurge in deliveries of metal-working equipment from abroad is quite in accordance with the development of Austrian engineering as outlined in the previous chapters. This was a period of massive investment in new plant equipment. Though much of the rapid rise in average annual net investment was induced by acquisitions and mergers within the machine-building industry, low or even negative levels of net investment in the 1880s and early 1890s had left a small and outdated capital stock now to be replaced and expanded. The demand for the machine tool industry's output is largely determined by the requirements of primary machine makers and the demand situation they face. Ceteris paribus, rising demand for sewing machines, for example, will lead to a rise in the demand for machine tools necessary to make them. The growth of engineering in terms of output and employment caused an increase in demand for machine tools once the industry came close to full capacity utilization. A further motive was rationalization of the production processes. Labour-saving machinery was imported in order to reduce the share of labour in production costs, i.e. to increase labour productivity in the machine-building industry. "After labour-saving methods originated and developed abroad ... it is obvious that one turned there for the appropriate working machinery and neglected domestic production"[38]. To some extent, machine tools were also supplied by domestic manufacturers, but limited market size impeded product specialization at the factory level[39]. The most important

---

negotiations of the k.k. Österreichische Staatseisenbahnen (Austrian state railways) suggest prices which imply imports of machine-tools (in 1912) worth more than 21 million crowns rather than the officially registered 13.6 million; HKB Wien, Sign. IV.6316: *Gutachten*, pp.119-123.

[38] HKB Wien, Sign. IV.6316: *Gutachten*, p.116.

[39] Cf. Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), pp.143-146. The following discussion relies on Carden, G.L., *Machine-Tool Trade in Austria-*

machine tool firm in Austria-Hungary were the Vulkan works which, in 1909, employed approximately 500 workers in Vienna and about 400 to 600 men in their Budapest plant. Catering primarily to the machinery requirements of iron works and locomotive shops, the firm turned out more than 200 different types and sizes of machine tools and accessories, often made according to a multitude of patterns[40]. Similarly, the Ernst Dania works in Vienna, one of the leading machine tool firms in the Habsburg Monarchy, were also not able to fully specialize output and standardize production. Though first steps towards series production were made by turning out lathes, drills, planers, and shapers in lots of either six or twelve, the firm was still prepared "to build to order any of nearly 200 varieties of tools"[41].

An American observer of the machine tool trade in Europe concluded that Austria-Hungary's machine tool industry did not offer sufficient quantities of high-grade medium-sized tools, in particular[42]. Contemporary estimates put Austrian production of metal-working machinery at 6,000 tons in 1913/14[43], this contrasts with an import volume of 17,499

Hungary, Denmark, Russia, and Netherlands with Supplementary Reports on Italy and France. U.S. Department of Commerce and Labor, Bureau of Manufactures, Special Agents Series-No.34 (Washington, 1910), pp.11-19.

[40] Output of Vulkan included lathes; planers, shapers, and slotters; drilling and boring machines; horizontal and vertical milling machines; screw-cutting, tapping, sawing, and grinding machines; punching, shearing, bending, and straightening machines; eccentric and friction presses; steam and pneumatic hammers; hydraulic presses, and wood-working machinery.

[41] *Carden, Machine-Tool Trade*, p.16.

[42] Ibid., p.11.

[43] HKB Wien, Sign. IV.6316: *Gutachten*, p.123.

tons in 1912 and almost 15,000 tons in 1913[44]. Austrian engineering was thus to a large extent dependent on the supply of machine tools from abroad where a larger market had allowed a higher degree of standardization and specialization[45].

The examination of the Monarchy's trade in agricultural machinery reveals a pattern of development significantly different from that of overall machinery trade and, in particular, that in equipment for the textiles industries. Machines for use in agriculture almost always accounted for a substantial part of Austria-Hungary's capital goods exports. But their share rose even further after the turn of the century. By 1910, more than 40 per cent of the Monarchy's machinery exports were equipment for agriculture[46]. The balance of trade in threshing machines, ploughs, sowing and reaping equipment, and other

---

[44] About 70 percent of the Monarchy's imports of metal- and wood-working machinery in these years went to Austria; Handelsministerium, *Statistik des auswärtigen Handels* 1915 (IV), p.86; Központi Statisztikai Hivatal, "Külkereskedelmi Forgalma", p.307. The Hungarian statistics do not distinguish between metal- and wood-working machinery. In the total of Austro-Hungarian imports, however, wood-working machines accounted for only a minor share; see Appendix D, Table D.6.

[45] It may be noted in this context that even in Germany with her larger industrial economy, insufficient market size was an obstacle to more rapid specialization and standardization within the machine-building industry and its machine tool branch, especially in comparison with American engineering. Though Germany was the Habsburg Monarchy's main source of imported metal-working machinery (see Table V.5), she herself relied on supplies from the generally more advanced American machine tool firms. Even after the turn of the century, Germany continued to depend on imports of American precision machinery, especially turret lathes and automatic lathes. See Milward, A.S, and Saul, S.B., *The Development of the Economies of Continental Europe 1850-1914* (London, 1977), pp.38-41; for a more detailed discussion see Barth, E., *Entwicklungslinien der deutschen Maschinenbauindustrie von 1870 bis 1914* (Berlin, 1973), pp.47-58.

[46] Appendix D, Tables D.1 and D.4.

agricultural implements improved to such an extent that a surplus was generated in most years between 1901 and 1910. However, the significance of trade for the Austrian producers of agricultural machinery is more evidently reflected in the reconstructed trade data which refer to Austria alone. If internal trade with Hungary is taken into account as well, Austria maintained a substantial surplus in agricultural machinery trade from the 1880s onwards. This holds despite the sharp increase in domestic demand, especially after the turn of the century, when Austria's imports of agricultural machines rose by 16 per cent on annual average[47]. The ratio of total exports to Austrian output of agricultural machinery fluctuated between a minimum of 38 per cent (1901) and a maximum of 49 per cent (1906) during the period 1897 to 1911[48]. Countries other than Hungary increasingly became markets for the products of Austrian agricultural machine manufacturers; hence the relative weight of shipments to foreign lands rose rapidly after the turn of the century (Table V.3).

Table V.3

OUTLETS FOR AUSTRIAN AGRICULTURAL MACHINERY PRODUCTS (PER CENT)

	Domestic Market	Hungary	Rest of the World
1897	59.7	37.6	2.7
1901	61.9	30.0	8.1
1906	51.4	31.2	17.4
1911	58.3	22.0	19.7

Sources: Appendix A, Table A.12c; Appendix D, Table D.10.

It has been shown in Chapter II that the manufacture of

47 Appendix D, Table D.10.

48 See the estimate for Austrian production of agricultural machinery given in Appendix A, Table A.12c, and the data on Austrian trade in Appendix D, Table D.10.

agricultural machines and implements was one of the largest and most rapidly growing branches of Austrian machine-building[49]. Both the development of output as well as that of exports indicate that Austria's machine-building industry increasingly specialized in the production of agricultural machinery. Though temporary export surpluses were generated by trade in steam engines and locomotives[50], too, no other machine-building branch of important size was as persistently orientated towards export business. The evidence suggests that relative market size and relative input material costs were the two main factors which accounted for the emergence of this pattern of specialization at the meso-level.
As a first step in dealing with these problems, the next section briefly examines the regional direction of Austria-Hungary's machinery trade. Where did imports come from? Where were exports sent to? And how did these flows relate to the process of specialization as outlined above?

3. The Geographical Pattern of Machinery Trade

The regional orientation of Austria-Hungary's international trade in machines was fairly simple: machines were imported from the West and exported mainly to Eastern and South Eastern Europe. Table V.4 shows that this pattern remained remarkably stable throughout the late nineteenth and early twentieth century. Structural shifts within this basic pattern, however, took place.

---

[49] See Chapter II, section 3.

[50] See Appendix D, Tables D.8 and D.9.

Table V.4

AUSTRIA-HUNGARY'S PARTNERS IN MACHINERY TRADE
(1000 CROWNS, CURRENT PRICES)

(1) Imports

Year	Total	Germany	Britain	USA	Switzerld.
1913	122,970	89,197	14,708	12,330	1,903
1912	151,959	110,535	20,162	13,968	3,197
1910	106,719	76,856	17,117	7,203	2,427
1905	62,275	40,290	14,990	3,622	1,434
1900	50,710	29,525	14,342	2,872	2,515
1895	44,632	25,812	14,776	942	2,036
1891	34,794	19,282	11,972	456	1,492

(2) Exports

Year	Total	Russia	Romania	Germany	Italy
1913	54,063	15,957	6,453	10,117	3,457
1912	51,880	12,383	10,807	7,311	5,334
1910	38,801	12,125	7,874	6,221	3,101
1905	31,184	6,129	7,522	5,528	3,610
1900	30,575	6,909	9,815	5,867	7,650
1895	9,386	3,274	2,688	1,826	625
1891	9,812	1,780	1,030	1,978	640

Sources: Appendix D, Table D.1; Handelsministerium, *Statistik des auswärtigen Handels* 1915 (III), pp.223-226, 278-281, 450-453, 604-606, 780-782, 845-848, 925-927, 1545-1547; 1910 (III), pp.201-204, 255-258, 426-429, 582-584, 745-748, 812-815, 884-886, 1469-1471; 1905 (I2), pp.127-128, 149-150, 168-169, 215-216, 335-336, 395-396, 421, 630, 723, 726, 744-745, 749, 752, 776, 782, 784-785; 1896 (I1), pp.424, 426, 430, 432, 439, 454, 467-468, 475-476; 1896 (I2), pp.36-37, 58-59, 103-104, 179-180, 285-286, 207-208, 389-390, 511.

In the early 1890s, Britain supplied about one third of the Monarchy's imports of machinery. The share continuously fell in the following two decades - by 1913 it accounted for only 12 per cent. During the same span of time, Germany's share rose from 55 to more than 70 per cent. Machinery imports from the United States amounted to only one per cent of the total in 1891, but stood at 10 per cent by 1913 (Table V.4).

The relative decline of imports from Britain was largely a result of changes in the material composition of foreign supplies: import demand for textile machines grew more slowly than that for other types of machinery and, consequently, their share in total machinery imports continuously fell from the late 1880s (Figure V.4). But textile machines, notably cotton spinning-machines, constituted the bulk of imports from Britain, the world's premier textile machinery maker[51]. Thus it was not by chance that the 1908 peak in Austro-Hungarian textile machinery imports coincided with the peak in British machinery exports to the Habsburg Empire[52]. The increasing presence of German machine-builders in the Monarchy's import markets was less closely associated with a particular group of products. However, machine tools and metal-working machines were of special significance[53]. German firms developed dominant stakes in a market characterized by a lack of strong domestic competition and a rapid rise of import demand[54]. Though imports in this

---

[51] Handelsministerium, *Statistik des auswärtigen Handels* 1915 (III), pp.451-452; 1910 (III), p.428; 1905 (I2), p.335; 1896 (I2), p.104. Cf. Saul, S.B., "The Market and the Development of the Mechanical Engineering Industries in Britain, 1860-1914", *EHR* 2nd ser. XX (1967), p.112-113; the foreign trade of Austria-Hungary suggest, contra Saul, that the Habsburg Empire belonged to the large group of countries whose cotton spindles had been mostly bought in Britain.

[52] In 1908, Austria-Hungary imported textile machinery worth 32.5 million crowns; Appendix D, Table D.5. At the same time Britain shipped machinery for more than 29 million crowns to the Monarchy, about 70 percent of which accounted for textile machines; see Handelsministerium, *Statistik des auswärtigen Handels* 1910 (III), pp.426-428.

[53] For an account of machine tool building in late nineteenth century Germany and the impact of British and American technology see Buxbaum, B., "Der deutsche Werkzeugmaschinen- und Werkzeugbau im 19. Jahrhundert", *Beiträge zur Geschichte der Technik und Industrie*, vol.9 (Berlin, 1919), pp.97-129.

[54] Given that Germany herself relied to some degree on imported machine tools from America, it may seem surprising that she was able to command such a large share in Austro-

field were not as voluminous as those of textile or agricultural machinery, they grew particularly fast.

Table V.5

IMPORTS FROM GERMANY IN PER CENT OF TOTAL

	Agric. Ma.	Text. Ma.	Sewing Ma.	Machine Tools
1912	41.8	51.7	62.8	81.7
1910	31.2	52.0	63.3	87.5
1905	26.2	40.6	45.4	74.9
1900	24.3	34.1	52.1	61.3
1895	32.3	27.8	62.8	86.5
1891	32.3	39.7	69.6	87.2

Sources: See Table V.4 and Appendix D, Tables D.4, D.5 and D.6.

After the turn of the century, the United States emerged as a major supplier to the Austrian machinery market. American agricultural machines - reapers and mowing machines, in particular - quickly gained a rising share in the Monarchy's expanding imports. Whereas in 1900 only 17 per cent of imported farm implements came from the United States, this share rose to 25 per cent in 1905, and, eventually, 38 per cent in 1912[55].

Hungarian imports of machine tools and metal-working machinery; cf. Milward and Saul, *Development*, pp.38-41, and Barth, *Entwicklungslininen*, pp.47-58. But German exporters probably benefited from their proximity to the Habsburg Monarchy's markets. Moreover, they were aided by the lower (negotiated) tariff imposed on their products, whereas imports from the United States were subjected to the higher (autonomous) tariffs. Finally, it seems possible that the structure of Austria-Hungary's import demand favoured especially the inflow of those types of machinery in whose production German firms had become fully competitive in the late nineteenth and early twentieth centuries. However, the available foreign trade statistics are not sufficiently detailed to examine this problem in more detail.

[55] See Appendix D, Table D.4, and Handelsministerium, *Statistik des auswärtigen Handels* 1915 (III), p.1546; 1910 (III), p.1470; 1905 (I2), p.630.

Austro-Hungarian exports of machinery were predominantly directed towards Russia and Romania. They increasingly consisted of agricultural machines and implements and thus reflected the changing output structure of Austrian machine-building. Other export items were locomobiles, largely for agricultural applications as well, and steam engines[56]. However, locomobiles and steam engines played only a comparatively minor role.

Table V.6

SHARE OF AGRICULTURAL MACHINES IN AUSTRIA-HUNGARY'S MACHINERY EXPORTS (PER CENT)

	Russia	Romania
1912	59.3	42.0
1910	52.7	57.6
1905	47.0	39.8
1900	39.2	31.1
1895	34.5	30.1
1891	30.4	36.5

Sources: See Table V.4 and Appendix D, Table D.4.

The pattern of output specialization and the associated change in the product composition of Austria's trade of machinery, outlined in the previous section, was thus complemented by a parallel regional specialization. Machinery for largely industrial purposes was imported from the North-West of the industrial world, whereas exports of mostly agricultural machines were shipped to the predominantly agricultural economies of Eastern Europe. An increasing share of the Austrian machine-building industry's output was geared towards catering for these markets (Table V.3).

[56] See Appendix D, Tables D.8 and D.9.

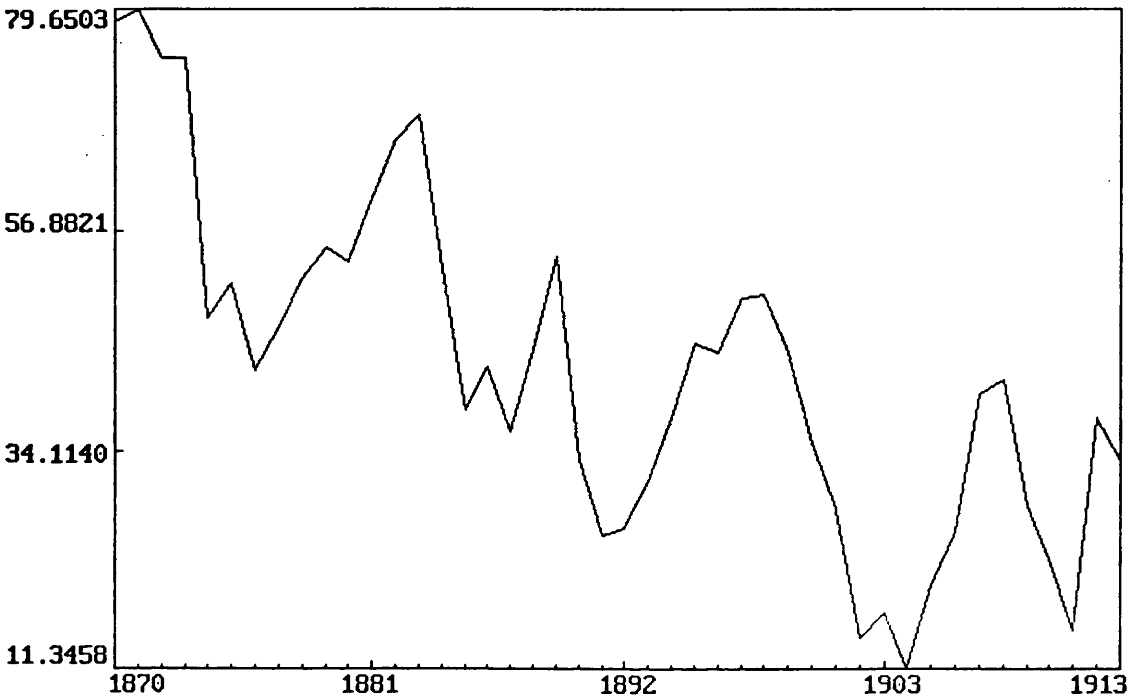
4. Input Prices and the Effects of the Austro-Hungarian Tariff on Iron and Steel

Throughout the late nineteenth century, machine-building in the Habsburg Monarchy had to rely to a substantial degree on foreign supplies of input materials. Cast iron, in particular, was a major import item[57]. The volume of domestic production was insufficient to satisfy the demands of the engineering industry. Though the share of imports in Austrian consumption of cast iron declined in the long run, it was subject to pronounced fluctuations in response to changes in the industry's business cycle. An upswing almost immediately translated into an over-proportional rise of imports. Almost 80 per cent of cast iron consumption in 1871 was imported. And still in 1912, more than a third of all the cast iron consumed came from abroad (Figure V.5). This dependency on imported inputs provides the background against which the contemporary debate between producers and consumers of iron should be seen. Prices of iron and the level of tariffs were at the centre of continuous disputes between these groups, which also involved the Ministry of Trade[58]. The significance of iron and steel prices, in turn, was a direct consequence of their central role in the cost calculations of consumers, i.e. the machine-building industry. Material input costs accounted for almost 40 per

[57] Cf. Appendix A, Tables A.8 and A.17.

[58] In 1881, a group of prominent machine-building and metal-working companies approached the Ministry of Trade, intervening against the proposed increase in tariffs on crude iron; Österreichisches Staatsarchiv - Allgemeines Verwaltungsarchiv (hereafter AVwA): Akten des Handelsministeriums, H. 27547-1881 and H. ad34514-1881. The period after the turn of the century is covered in "Materialien zur Kartellenquete 1912, VIII. Eisenindustrie", *Die Kartellfrage in Österreich* (Vienna, 1897-1912), (hereafter "Eisenkartellenquete"), Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, pp.1-21.

Figure V.5: Share of Imports in Austrian Cast Iron Consumption (Per Cent)



Source: Appendix A, Tables A.7 and A.8.

cent of the industry's gross value of production[59]. Even minor variations in the relevant prices were thus exercising a strong influence on gross output or value added.

Table V.7

TARIFF PER TON OF IMPORTED CAST IRON (CROWNS)

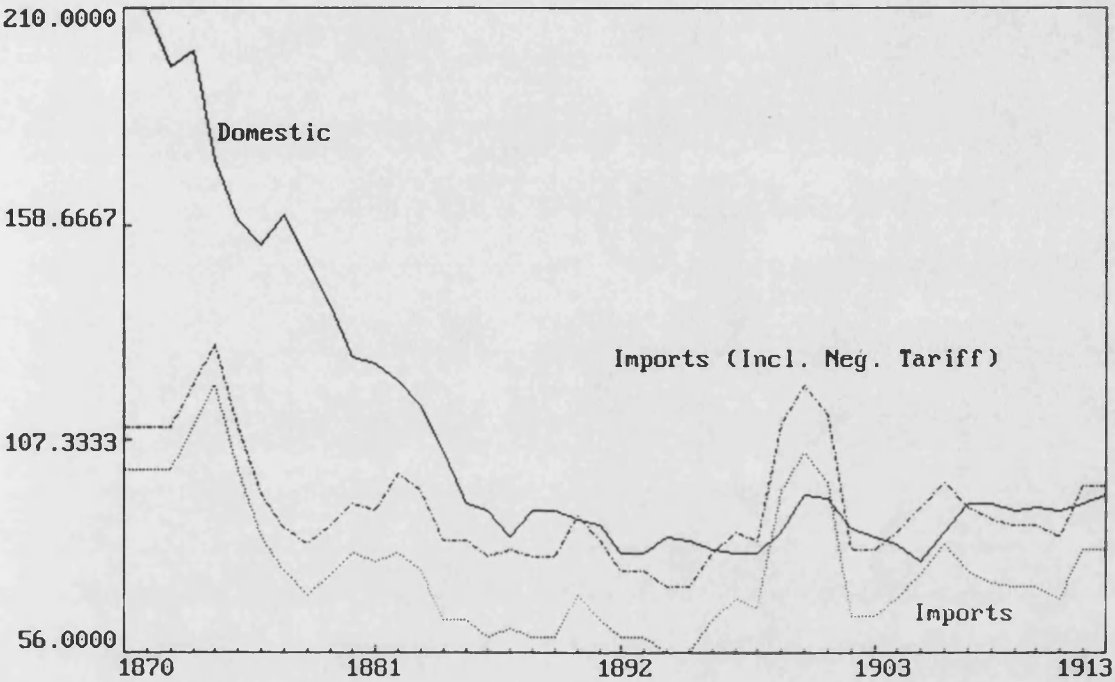
	Autonomous Tariff	Negotiated Tariff
post 1906	19.0	15.0
1892-1906	19.0	15.5
1882-1892	19.0	-
1878-1882	11.9	-
pre 1878	16.8	10.0

Sources: k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XXXVIII: Eisen und Eisenwaren* (Vienna, 1912), p.3; Handelsministerium, "Eisenkartellenquete", Abschnitt IV: Statistische Materialien, Table 16, pp.36-37.

With a few exceptions from 1899 to 1901, unit prices of domestically produced cast iron were always well above the commercial value of imported materials. Figure V.6 nevertheless indicates a long-run decline in the price differential between Austrian and foreign cast iron prices. The excess of domestic prices over import prices reached a maximum in 1878 with 114 per cent. Only during the brief period 1899 to 1901 were Austrian unit prices lower than import prices. The prices of imported cast iron, however, were so-called *commercial values*, i.e. they did not include the quantity tariffs levied upon imports of iron and steel. These were substantial and often accounted for more than 30 per cent of the value of imported cast iron (Table V.7; Figure V.7). The mark-up provided by tariffs ensured that, from the mid-1890s onwards, actual import prices of cast iron (as opposed to prices *exclusive* of tariffs) were

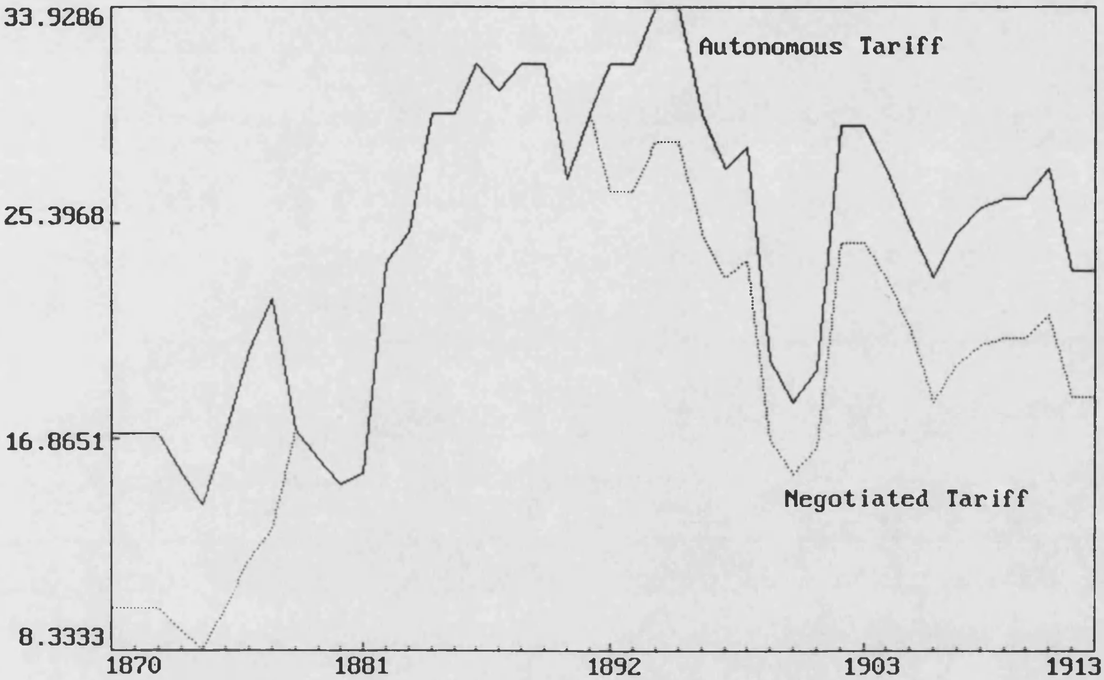
[59] Fellner, "Volkseinkommen", pp.570-571.

Figure V.6: Unit Prices of Cast Iron (Crowns/Ton)



Source: Appendix C, Table C.1.

Figure V.7: Tariffs as Percentage of Unit Prices of Imported Cast Iron



Source: See Appendix C, Table C.1.

clearly above domestic prices. Iron consumers were thus not in a position to benefit from the alternative of lower cost materials provided by imports. Moreover, the quantity-tariff system implied that - in contrast to an ad-valorem regime - the degree of relative protection rose in times of falling import prices because then the value share of a tariff in the total import price increased. This was clearly the case from the mid-1870s to the mid-1890s. It should be noted, however, that total import prices (i.e. *inclusive* of tariffs) were still below the prices of domestically produced cast iron during this period. But due to the quantity tariff, machine-builders in Austria were not able to proportionally reduce their material costs. This probably contributed to the agony in Austrian machine-building in the 1870s and 1880s by implicitly facilitating the inflow of lower price machinery imports from abroad.

The argument put forward here, namely, that the machine-building industry in Austria-Hungary faced serious supply side constraints (costs of raw material inputs) which were aggravated by the prevailing tariff policy, is likely to meet some reservations. Three points of criticism seem obvious.
Firstly, cast iron was not the only relevant input of the machine-building industry. An input-costs argument based on cast iron prices alone is, therefore, necessarily biased. Secondly, average unit prices of domestically produced cast iron at the place of production are unrepresentative. They are not market prices but average values computed by public authorities on the basis of data provided by the various producers. These average prices are too high as they - probably - cover not only regular, standard qualities of iron but also specialist qualities of substantially higher value[60]. And, finally, alternative data suggest that for 1898 to 1911 cast iron prices in Berlin, for example, were

[60] Handelsministerium, "Eisenkartellenquete", Abschnitt IV: Statistische Materialien, p.14 and Table 6, p.19.

actually higher than those in Vienna, rather than the other way round[61]. Domestic iron consumers were thus not put at a comparative disadvantage by higher input costs. There is sufficient evidence to refute these three objections which will be addressed in turn.

The discussion of price differentials in this section and in section 6 further below relies on the compilation of Austrian and German iron prices presented in tabular form in Appendix C. In addition to a set of cast iron prices, the data include wholesale prices for Austrian and German support iron, heavy sheet metal, and bar iron in Vienna and Berlin, respectively. For these products, so-called *parities* of the respective German price in Vienna are given as well. These parity prices are composed of the German wholesale price, the charge for freight from the German mill to Vienna and the Austrian tariff levied on iron imports from Germany.

Cast iron was certainly not the only important input material. However, if other iron and steel qualities are also taken into account, the argument developed here is strengthened even further. Average wholesale prices for bar iron, iron profiles, and sheet metal in Vienna were almost always well above the respective levels in Berlin between 1890 and 1911 (with some exceptions between 1899 and 1902)[62]. But quantity tariffs and, to some extent, freight rates caused the parity of the German prices in Vienna to be pushed above the level of Austrian prices[63]. In brief,

---

[61] Ibid., Abschnitt III: Tabellen und graphische Darstellungen, Table XXIV, p.33.

[62] This holds regardless of whether or not the longer distance between Berlin and the Ruhr area (as the main iron and steel producing region in Germany) relative to the distance between Vienna and the major Austrian iron producing regions introduces an upward bias in the German prices. The sources do not mention the place of production of the iron delivered to Berlin and Vienna. Cf. the discussion below, p.171.

[63] Appendix C, Tables C.2 to C.4.

Austrian consumers of iron faced higher input prices than their German competitors. The tariffs imposed effectively ruled out the substitution of cheaper foreign supplies for domestic products[64]. Table V.11 in section 6 below shows that, ceteris paribus, the opportunity to import iron and steel from Germany free of tariff would have closed most of the large gap between input prices in Austria and those in Germany.

The possibility that the inclusion of certain special qualities of cast iron drives up the average unit price cannot be rejected out of hand. But exactly the same objection could be raised against the use of the average unit price (commercial value) of cast iron imports for comparative purposes. However, there is no indication that domestic production included a higher share of those special qualities than did imports. Only if the composition were substantially different would the observed price differential between domestically produced cast iron and imported cast iron lose its significance. But there is no evidence to support this view.

The direct comparison of the given Berlin and Vienna cast iron prices in "Eisenkartellenquete" is misleading for a variety of reasons. Firstly, the Berlin price quoted refers to German cast iron of category I - the product with the highest unit price among those listed. Unit prices in Germany of German cast iron III and, in particular, Luxembourg cast iron III were substantially lower throughout the period than the prices cited[65]. Thus it seems likely that the quoted German prices are upwardly biased and not as representative as they appear to be. This holds even more so, as it is not clear to what category or

---

[64] Market protection arrangements between Austrian and German iron and steel works meant, moreover, that Austrian consumers could not obtain offers from cheaper German producers for the delivery of T- and U-profiles; HKB Wien, Sign. IV.6316: *Gutachten*, p.144.

[65] Appendix C, Table C.1.

quality of cast iron the Austrian price relates to. Secondly, almost all of the difference between cast iron prices in Berlin and those in Vienna turns out to result from different transport costs. Though the place of production of German cast iron is not given in "Eisenkartellenquete", the freight rate charged for transport from iron mills to Berlin, which is reproduced separately, implies a distance of approximately 450 to 500 kilometres[66]. The Ruhr area is the major iron producing region in that distance to Berlin. The Austrian cast iron price relates to the Witkowitz iron works in Moravia; the charge for transport, included in the Vienna price, is not reproduced in the sources. But it can be approximated on the basis of railway freight rates and the distance between Witkowitz and Vienna, which is roughly half of that between the Ruhr area and Berlin. Although German freight rates were somewhat lower than Austrian rates, the charge for transport of the same amount of iron from the Ruhr to Berlin was almost 50 per cent higher than the charge for delivery from Witkowitz to Vienna[67]. The quoted German price for cast iron simply includes a larger transport cost component than the Austrian price[68]. Thirdly, whereas the Berlin price is based on average trade prices for the given

---

[66] Handelsministerium, "Eisenkartellenquete", Abschnitt III: Tabellen und graphische Darstellungen, Table XXIV, p.33, and Table XXXII, p.38. *Statistische und tarifarische Daten insbesondere über die im Betriebe der k.k. Staatseisenbahn-verwaltung stehenden Eisenbahnen* (Vienna, 1904), pp.154-155.

[67] Ibid.

[68] For comparative purposes, the assumption of relatively longer transport distances and thus higher transport costs in Germany seems justified only if there is reason to believe that they reflect the relative locational situation of iron producers and iron consumers in Austria and Germany more accurately than, for example, the simpler assumption of, in general, similar distances between iron producers and consumers in the two countries.

quality of iron plus freight, the Austrian quotation is given as the final price of cast iron from the Witkowitz mill for Viennese wholesalers or major consumers. It seems highly unlikely that this Austrian price has an equivalent upward bias as the German price, for the report in which these data are produced was prepared by the chief executive of the Witkowitz iron and steel works[69]. He certainly had no professional interest to quote higher prices which could justify complaints from domestic iron and steel consumers, i.e. his customers[70].

The quantitative basis of the argument that iron prices in Austria were both absolutely and relatively lower than maintained here appears rather weak. The evidence suggests that Austrian consumers of iron and steel, like the machine-building industry, had to face higher prices for essential material inputs than their foreign competitors. Though by around the turn of the century, effectively all domestic sales of Austrian iron production were subject to cartelized marketing and price policies[71] we will not further investigate to what extent the observed price differentials were a more or less direct result of the

---

[69] The section of the "Materialien zur Kartellenquete 1912" dealing with the iron and steel industry (here: "Eisenkartellenquete") was prepared as a memorandum by Friedrich Schuster (chief executive of Witkowitz) on behalf of the Austrian iron and steel industry's association and upon request by the Austrian Ministry of Trade. It was also separately published as *Materialien zur Eisenkartell-Enquete. Denkschrift des Vereins der Montan-, Eisen- und Maschinen-Industriellen Österreichs* (Vienna, 1912).

[70] It is interesting to note, though, that the other comparative price data supporting the argument put forward here were provided in the same source; cf. Appendix C, Tables C.1 to C.4.

[71] Cf. Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, pp.7-8. See also Mejzlik, H., *Probleme der alpenländischen Eisenindustrie* (Vienna, 1971), pp.208-224.

cartel[72]. Here it suffices to establish that there was a substantial price and thus material cost differential to foreign competitors.

The following section takes a closer look at the effects of input prices on the cost competitiveness of an individual engineering firm. Though only a "snapshot", it illustrates that raw material price differentials observed at industry level trickled down so as to cause relative disadvantages at the company level.

5. The Relative Cost Position of Austrian Machine-Building: The Example of Voith

The German machine-building firm of J.M. Voith (Heidenheim) decided in 1903 to set up a new plant in St. Pölten, Lower Austria[73]. This move was designed to circumvent the likely effects of the forthcoming trade treaty negotiations: Austria-Hungary was the company's main foreign market to which access seemed to be threatened by the anticipated rise of import tariffs[74]. Both the parent company and its Austrian subsidiary works specialized in the production of water turbines, paper-making machines, and auxiliary and preparatory machinery for the paper-making industry[75]. Employment in the St. Pölten operation rose from 230

---

[72] The production and sale of bar iron, iron profiles, and heavy sheet metal and plate was cartelized as early as 1886; crude iron - including cast iron - was included in further cartel arrangements in 1902. Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, pp.2-4, 13.

[73] Werksarchiv, Voith GmbH, Heidenheim/Germany (hereafter VWA), Nr.2 / 3.4: paper of Director Gottschick, 1. January 1917.

[74] Ibid. and Nr. 1 / 2.7: memorandum of Director Gottschick 1904, quoted in May 1923 report.

[75] VWA, Nr. 1 / 2.7: report on the development of J.M. Voith, Heidenheim a/Brenz, 23 May 1907.

workers in 1904 to 682 in 1913[76].

The similarity in the manufacturing programme allows for a direct comparison of cost in the two plants. Data on wage cost, material cost and "Regie"-expenses[77] are available for the production of identical Francis-turbine wheels, paper-making machines, and a number of auxiliary machines[78]. The results of such a comparison are striking. Total cost of production of a paper-making machine were more than 20 per cent higher in the Austrian plant. None of the 13 major elements of the machine was built at lower cost in St. Pölten than in Heidenheim[79]. Though in this case, cost cannot be split up into its main components, the data relating to other types of machinery suggest that input material price differentials played the decisive role.

The percentage difference in total cost of production and its components between the German and the Austrian plant is given in Tables V.8 and V.9[80]. The numbers in parentheses indicate the relative percentage contribution of each cost component to the percentage difference in total cost[81]. Given the cost structure in both plants and all production processes, differences in wage cost or "Regie" were, apparently, of only minor importance. Material cost accounted by far for the largest share in total cost with

---

[76] VWA, Nr. 1 / 2.7: report, May 1923.

[77] Cf. Mosser, A., *Die Industrieaktiengesellschaft in Österreich 1880-1913: Versuch einer historischen Bilanz- und Betriebsanalyse* (Vienna, 1980), pp.53, 54, 67, on the varying use of "Regie" or "general expenses" as a poorly defined cost component.

[78] HKB Wien, Sign. IV.6316: *Gutachten*, pp.142-147.

[79] Ibid., p.146.

[80] Percentage difference: $((C_{Aut} - C_{Ger})/C_{Ger})*100$, where C_{Aut} and C_{Ger} denote costs in the Austrian and German plant, respectively.

[81] Each percentage difference was multiplied by the component's share in total German costs.

their share varying between a minimum of 54 per cent and a maximum of 75 per cent[82]. The price for input materials was therefore the variable with the most pronounced influence on total cost. Turbine wheels, for example, were largely made of cast iron[83]. On average, more than 80 per cent of the difference in production cost of turbine wheels and auxiliary and preparatory machinery are attributable to the substantially higher cost of material inputs in the Austrian plant. Wage expenses were, in general, slightly lower but could not compensate for the gap.

Table V.8

COST DIFFERENTIALS - TURBINE WHEELS (PER CENT)

	Total	Materials	Wages	"Regie"
I.	28.6	41.4 (22.5)	1.9 (0.3)	20.9 (5.8)
II.	23.9	30.3 (17.4)	3.4 (0.6)	22.8 (5.9)
III.	24.5	35.1 (20.7)	-2.7 (-0.4)	16.6 (4.2)
IV.	15.8	20.4 (12.7)	1.1 (0.2)	12.6 (2.9)
V.	23.6	28.3 (19.7)	2.7 (0.3)	19.0 (3.6)
VI.	17.3	24.3 (17.0)	-8.9 (-1.0)	6.8 (1.3)
Aver.	22.2	30.0 (18.6)	-2.5 (-0.3)	16.5 (3.8)

Numbers I to VI indicate turbines of different weight in kilograms (KG): I = 1,350 KG; II = 1,650 KG; III = 3,500 KG; IV = 9,300 KG; V = 10,900 KG; VI = 15,400 KG.

Source: HKB Wien, Sign. IV.6316: *Gutachten*, p.143.

[82] HKB Wien, Sign. IV.6316: *Gutachten*, pp.143, 147.

[83] Ibid., p.142.

Table V.9

COST DIFFERENTIALS - AUXILIARY MACHINES (PER CENT)

	Total	Materials	Wages	"Regie"
I.	9.8	18.3 (11.1)	-10.6 (-1.1)	-0.4 (-0.1)
II.	25.2	36.7 (18.2)	2.9 (0.4)	17.9 (6.5)
III.	13.2	17.3 (12.5)	-5.8 (-0.5)	5.8 (1.1)
IV.	13.1	11.7 (7.7)	-0.7 (-0.1)	21.9 (5.5)
V.	14.5	16.8 (12.1)	-5.6 (-0.4)	14.2 (2.8)
VI.	24.3	30.2 (15.9)	3.8 (0.5)	23.0 (7.9)
Aver.	16.7	21.8 (13.6)	-2.7 (-0.3)	13.7 (3.7)

Numbers I to VI indicate different types of machinery:
I = hydraulic power grinder II = stone sharpener for grinder
III = hollander IV = graining machine
V = (stone) refiner VI = rolling machine.

Source: HKB Wien, Sign. IV.6316: *Gutachten*, p.147.

Although this section looked at only one producer with a limited output range, the case of Voith nevertheless demonstrates the effects of iron and steel prices on cost differentials and, ultimately, cost competitiveness in Austrian machine-building.

6. The Effectiveness of Import Tariffs on Machinery

Austrian iron producers rejected the claim that protective tariffs were an essential source for the iron consumer's difficulties by pointing out that tariffs on imported machinery outweighed by far the additional expenses incurred by tariffs on raw materials[84]. The argument ran as follows: assuming it takes 57 kilograms (kg) of pig iron to produce 50 kg of cast iron, and 32 kg of smelted iron and 38 kg of ingots to make 50 kg of wrought iron, then the tariff expense on all imported materials for a hypothetical machine of 100 kg of weight (1/2 of which cast iron, 1/2

[84] Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, p.16.

wrought iron) amounts to

0.57 * 1.50 K =	0.86 K
+ 0.38 * 3.40 K =	1.29 K
+ 0.32 * 4.50 K =	1.44 K
Total	3.59 K[85].

This total was compared to an average tariff of 20 K per 100 kg of imported machines and it was concluded that the iron tariff could not have posed a major obstacle for the finishing industries[86].

The argument, however, is misleading. For the problem was not the actual absolute difference between the respective quantity tariffs on iron and steel on the one hand, and those on imported machines on the other. As has been shown in the previous sections, the iron tariff operated in a way which lifted input prices in Austria substantially above those which competing industries faced abroad[87]. The question with respect to the domestic market was then, in the first place, whether the degree of protection offered to the domestic machine-building industry via the tariff on imports of machines fully offset the negative effects of import tariffs on inputs. On export markets, of course, no such protection was offered and Austrian producers were confronted with the same tariff barriers as their foreign competitors who may or may not have had access to more favourably priced iron and steel inputs.

The virtually complete lack of disaggregate price data other than import values, however, is a major obstacle to a thorough analysis. We cannot directly compare the cost and price of a certain type of machine produced in Austria

---

[85] Ibid.. These are the lower, negotiated tariff rates for the post 1906 period. The corresponding higher autonomous (general) tariff rates were 1.90 K, 3.80 K, and 4.80 K, respectively, per 100 kg; Handelsministerium, *Statistische Materialien: Eisen und Eisenwaren*, pp.5, 12, 14.

[86] Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, pp.16-17.

[87] Cf. Appendix C, Tables C.1 to C.4.

with a similar machine made elsewhere, study what the effects of the specific tariffs applicable were on relative cost and relative market prices, and establish significant changes over time. However, some broad generalizations do seem possible.

The micro data for Voith suggest material cost differentials between Austria and Germany ranging from 12 to 41 per cent (Tables V.8 and V.9). These data refer only to one firm, a limited range of products and, presumably, only one particular year or short period of time. Table V.10 therefore provides longer run information on the percentage difference between Austrian and German iron prices, assuming again these were relevant for the larger part of machine-building.

Table V.10

PERCENTAGE DIFFERENCE OF AUSTRIAN AND GERMAN IRON PRICES[a]

	Cast Iron	Support Iron	Bar Iron	Sheet Metal
1909/1911	24.0	35.8	28.9	51.6
1906/1908	3.1	30.6	24.2	45.2
1903/1905	11.1	31.4	31.3	40.0
1900/1902	0.4	6.0	4.0	-7.3
1897/1899	7.9	34.0	19.1	25.4
1894/1896	14.9	52.2	57.5[c]	57.4
1891/1893	16.9	38.1[b]	-	28.4[b]
1888/1890	13.9	-	-	-
Mean	11.5	32.6	27.5	34.4

[a] Percentage difference: absolute difference between Austrian and German price in per cent of German price

[b] 1890/1893

[c] 1893/1896

Source: Appendix C, Tables C.1 to C.4.

In order to avoid an undue upward bias of the respective Austrian price, the lower price of either the domestic product or the imported product (inclusive of tariff) has been chosen in each year[88]. For it is plausible to assume that Austrian machine-builders would have turned to foreign supplies if these were cheaper. The figures reproduced in Table V.10 reflect a large gap between input prices in Austria and those in Germany. They show, moreover, that this was not a temporary problem but a continuous one. Most important, though, is to establish that it was the Austrian tariff which accounted for most of the price differential. 1903 is a suitable year to illustrate this problem in that it is typical insofar as the percentage differences in that particular year were fairly close to their long-run averages[89]. Subtracting the respective tariff from the parity of German iron prices in Vienna yields results as given in Table V.11[90]. These data suggest that, ceteris paribus, the availability of tariff-free iron imports would have narrowed dramatically the gap between Austrian and German prices. Input material costs of Austrian machine-builders would have been 14 to 16 per cent lower than they actually were. Similarly, the percentage price difference to Germany would have dropped to levels between 11 and 13 per cent, respectively, with the remaining gap resulting

---

[88] The German cast iron price used is an arithmetic average of prices GCI1, GCI3, and LCI3 in Appendix C, Table C.1. The Austrian cast iron price applied is either ACI or ICITa, depending on which one is lower. For support iron, bar iron and sheet metal Austrian wholesale prices (ASI, ASM, ABI) have been compared with German wholesale prices (GSI, GSM, GBI). Parities of German prices in Vienna were used instead of the Austrian prices if the latter were higher. That, however, was only once the case (1892, support iron). See Appendix C, Tables C.2 to C.4.

[89] Percentage price difference in 1903: cast iron - 14.1 percent; support iron - 29.4 percent; bar iron - 30.8 percent sheet metal - 33.7 percent. See Table V.10 for sources.

[90] Negotiated (lower) tariffs for 1892 to 1906 in crowns per metric ton: 59.5 crowns (support iron); 71.4 crowns (bar iron) and 90 crowns (approximate average for various qualities of sheet metal); Handelsministerium, *Statistische Materialien: Eisen und Eisenwaren*, pp.17-18, 25-34.

from transport costs (Table V.11).

Table V.11

COMPARATIVE IRON PRICES, 1903 (CROWNS/TON)

support iron:	ASI	GSI	PSI	PSI-tariff
	198	153	229	170
bar iron:	ABI	GBI	PBI	PBI-tariff
	191	146	235	164
sheet metal:	ASM	GSM	PSM	PSM-tariff
	230	172	282	192

ASI, ABI, ASM: Austrian wholesale prices (Vienna)
GSI, GPI, PSM: German wholesale prices (Berlin)
PSI, PBI, PSM: parities of German wholesale prices inclusive of tariff and freight in Vienna

Source: (1) prices: Appendix C, Tables C.2 to C.4. (2) tariffs: Handelsministerium, *Statistische Materialien: Eisen und Eisenwaren*, pp.17-18, 25-34.

In a further step towards analyzing the simultaneous effects of import tariffs on iron and steel and on machinery, the nominal quantity tariffs are transformed into ad-valorem rates; the negotiated (lower) tariff per unit of imports is expressed in per cent of the import price per unit (Table V.12)[91].

[91] An average negotiated tariff of 20 crowns per 100 kilograms of imported machinery, as used in Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, pp.16-17, and as assumed in the discussion below (see Tables V.12 and V.14), seems a fairly reasonable approximation. For 1906 to 1913, the following unweighted average negotiated tariff rates applied to the four most important groups of Austro-Hungarian machinery imports (the number of different tariff rates applied in each group is given in parentheses):
(1) agricultural machines 16 crowns (4)
(2) metal-working machines 21 crowns (6)
(3) textile machines 9 crowns (7)
(4) sewing machines 51 crowns (7).
Combining these unweighted average tariff rates by use of the share of each of the four groups of machinery imports

Table V.12

NOMINAL PERCENTAGE TARIFFS ON IMPORTS

	Machinery[a]	Cast Iron	Bar Iron	Sheet Metal	Support Iron
1890/94	17.9	25.0	46.9[c]	39.8	35.1
1895/99	19.5	22.1	39.2	44.5	35.8
1900/04	19.6	19.4	39.1	40.2	33.3
1905/09	18.3	19.8	39.8	48.9	33.6
1910/11	18.9[b]	19.8[b]	42.8	50.7	34.7
Mean	18.8	21.3	40.5	44.0	34.5

[a] Average negotiated tariff of 20 crowns per 100 kg of imported machinery in per cent of average import unit price of machinery

[b] 1910/1913

[c] 1893/94

Note: The nominal percentage tariff is defined as the ratio of the negotiated tariff to the respective import unit price *exclusive* of the tariff.

Sources: (1) iron prices: Appendix C, Table C.1: ICI; Table C.2: PSI (minus tariff); Table C.3: PSM (minus tariff); Table C.4: PBI (minus tariff). (2) iron tariffs: Handelsministerium, *Statistische Materialien Eisen*, pp.3, 17-18, 25-34. (3) machinery prices: see Appendix D, Figure D.1. (4) machinery tariff: Handelsministerium, "Eisenkartellenquete", Abschnitt II: Darstellung des Kartellwesens in der Eisenindustrie, p.16.

---

in their combined total, yields a rough approximation of the average negotiated tariff imposed on machinery imports in 1890, 1900, and 1910:

1910 17 crowns
1900 17 crowns
1890 14 crowns.

During 1887 to 1905, tariff rates were generally slightly lower than in 1906 to 1913. These results would suggest that the assumption of a tariff of 20 crowns overestimates rather than underestimates the actual level of nominal tariff protection accorded to machine-building. Imports of machinery in these four groups accounted for about 50 per cent of total Austro-Hungarian machinery imports between 1890 and 1910. These findings should thus be fairly representative. See Handelsministerium, *Statistische Materialien: Maschinen*, pp.64-127, 132-140, and Appendix D, Tables D.1, and D.4 to D.6.

The tariff rates imposed on imports of iron and steel were on average substantially above those levied on imports of machinery[92]. We can now ask what the effective or implicit rate of protection was in contrast to the nominal tariff, in order to measure the degree of protection offered to domestic machine-building.

According to the concept of effective rates of protection, the nominal tariff on a good may differ from the rate of protection given to the value added in the production of the good when material inputs (intermediate goods) are taken into account[93]. The proponents of this concept argue that the purpose of a tariff is to protect the factors of production which create value added; hence the effective rate of protection accorded to value added is more meaningful a measure than the nominal tariff[94]. This concept can be adapted so as to allow a rough and static approximation of the benefits and disadvantages Austrian machinery producers derived from the existing tariff structure. In terms of an input-output system, value added (v_j) can be defined as

(1) $v_j = 1 - \Sigma a_{ij}$

where v_j denotes value added in industry j and a_{ij} is the value of inputs delivered from the ith industry to the jth industry, all at world market prices. If tariffs are in operation, domestic prices will differ from world market prices and the equation for domestic value added (v_j^*) can be re-written as

(2) $v_j^* = 1 + t_j - \Sigma a_{ij} (1 + t_i)$

where t_j and t_i denote the nominal tariffs in the jth and ith industries, respectively. The effective rate of protection

---

[92] The nominal percentage tariffs on imports of bar iron, sheet metal, and support iron would be even higher if they were computed on the basis of import prices *exclusive* of freight.

[93] Cf. Södersten, B., *International Economics* (London, 2nd ed., reprint 1983), p.207.

[94] Ibid.

(τ_j) is then

(3) $\tau_j = (v_{j*} - v_j)/v_j$

$= (t_j - \Sigma a_{ij}t_i)/v_j$

$= t_j + ((t_j - t_j')\Sigma a_{ij})/v_j$

where $t_j' = \Sigma a_{ij}t_i/\Sigma a_{ij}$ is the weighted average tariff rate on material inputs into the jth industry[95].

According to Fellner, value added in Austrian machine-building amounted to about 53 per cent of gross output[96]; machinery imports into the Monarchy were subject to an average 18.8 per cent duty on the official value as recorded in the trade statistics (Table V.12), and, finally, the weighted average tariff rate on material inputs was approximately 25.3 per cent[97]. The effective rate of protection of Austria's machine-building industry would thus be

$\tau = 18.8 + ((18.8 - 25.3)47)/53$

$= 13.0.$

Though the effective tariff is lower than the nominal tariff on machinery imports, it is still positive. Hence this result would suggest that the machine-builders' claims of being put at a disadvantage through the tariff system were out of place. However, all the evidence available indicates that the data on import prices of machinery

---

[95] Ibid., pp.212-213.

[96] Fellner, F., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.570-571.

[97] The weighted average (1890/1911) tariff rate on material inputs (iron and steel) was computed by combining the nominal tariff rates given in Table V.12 with weights derived from those used in the input price index:

$t_j' = .80*(.45*21.3 +.35*40.5 + .10*44.0 + .10*34.5)$

$= 25.29.$

The weights of cast iron and bar iron have been reduced to 45 per cent and 35 per cent, respectively, to allow for the inclusion of tariffs on sheet metal and support iron, two iron qualities which are not covered in the input price index. Iron and steel accounted for 80 per cent of material inputs and fuels, which we disregard here for the sake of simplicity, for 20 per cent. See Appendix A, Table A.5.

produced in the official trade statistics and used for the above computation are substantially underestimated. The examination of sales price data for various types of machinery yields results which show a massive gap between actual market prices and the official trade values (Table V.13).

Table V.13

MACHINERY PRICE DIFFERENTIALS IN PER CENT

	number of prices	average differential
(1) metal-working machinery	6	31.8
(2) steam boilers & distilling apparatus	7	64.8
(3) agricultural locomobiles	1	-10.5
(4) steam engines	5	39.9
(5) internal combustion engines	3	120.0
(6) steam turbines	5	246.1
(7) water turbines & parts	9	61.5
(8) mechanical transmissions	3	42.2
(9) transport & elevation equipment	5	74.1
(10) presses	3	87.8
(11) milling machinery	5	41.2
(12) centrifuges	2	87.5
(13) wood-working machinery	1	85.6
(14) pumps & compressors	6	73.4
(15) drying apparatus	1	53.8
(16) textile machinery	2	1.8
Mean	64	72.4

Source: HKB Wien, Sign. IV.6316: *Gutachten*, pp.18-29.

64 market prices in 16 groups of machinery were compared with the prices used in the trade statistics[98] (Table

[98] If the tariffs imposed work, domestic sales prices differ from world market prices by the amount of the tariff. In order to ensure comparability between domestic sales prices (SP) and the official import prices (IP), the tariff levied on a particular machine was subtracted from its sales price before comparing the sales price with the official import price, which does not include the tariff. The formula used to compute the machinery price differentials is as follows: ((SP - t) - IP)/IP, where t denotes the negotiated tariff in crowns.

V.13). Multiplying the average import unit price of machinery by a factor of 1.72, as a means of roughly correcting for the underestimation of machinery prices, yields two series of revised machinery import prices and adjusted machinery import tariff rates (Table V.14)[99]. According to these data, the actual percentage tariff imposed on imports of machinery was substantially lower than the official foreign trade prices would imply.

Table V.14

REVISED IMPORT PRICES OF MACHINERY AND TARIFF RATES

	import price (crowns/100kg)	tariff rate* (per cent)
1890/94	191.9	10.42
1895/99	176.3	11.34
1900/04	175.3	11.41
1905/09	187.5	10.66
1910/13	182.4	10.96
Mean	182.7	10.95

* Average negotiated tariff of 20 crowns per 100 kg of imported machinery in per cent of average import unit price of machinery

Sources: See Tables V.12 and V.13

Using the revised mean nominal tariff rate of 10.9 per cent instead of the initial 18.8 per cent, the re-calculation of the effective rate of protection produces this result:

$$\tau = 10.9 + ((10.9 - 25.3)47)/53$$
$$= -1.9.$$

A negative rate of effective protection means that the

[99] In a strict sense, the revised prices apply only to the years after the turn of the century because they are based on price differentials observed in the 1905-1913 period; see sources given in Table V.14. By using the factor of 1.72 also for the earlier years, we assume implicitly that machinery import prices in the earlier years were as much underestimated as in the immediate pre-World War I years.

tariff protection accorded to value added is eliminated by the tariff levied on inputs. This finding suggests that the Austrian tariff structure did indeed discriminate against the users of iron and steel, namely the machine-building industry, and put them at a systematic competitive disadvantage[100].

However, the result of a negative implicit tariff needs to be qualified. As an average measure, it does not imply that all machinery producers in the Habsburg Monarchy were faced with negative rates of protection. Clearly, not all manufacturers operated with a similar or even more iron intensive input-mix than the one assumed in the computation. Sales prices of some types of machines were most certainly significantly below the revised industry average, as others were above it, and specific machinery tariffs varied strongly around the average of 20 crowns per 100 kilograms. Hence some machinery producers enjoyed high effective rates of protection, whereas others had to cope with negative implicit tariffs.

However, the point is that, at least after the turn of the century[101] a sizeable part of Austria-Hungary's machine-building industry, especially its iron and steel input-intensive branches, was most probably squeezed between high material input costs and fierce foreign competition. Generally rising demand contributed to the growth of machinery imports. The absolute and relative size of product markets shaped the pattern of output specialization. But Austria-Hungary's tariff structure, too, appears as a major causal factor in the explanation of both the rapid rise in Austro-Hungarian machinery imports after 1900[102], and the increasing specialization in the

---

[100] Toniolo observed a similar constellation in the Italian tariff structure; Toniolo, G., "Effective Protection and Industrial Growth: The Case of Italian Engineering", *JEEH* (1977) No.3, pp.659-673.

[101] Cf. note 99 above.

[102] See above, Table V.1.

production of agricultural machinery. Growing domestic demand was directed to relatively cheaper imports of machinery as domestic suppliers were hampered by higher material input costs. Furthermore, the tariff structure intensified a shift into product areas with a relatively low iron and steel content per unit of output, like agricultural machines and implements[103]. This branch of machine-building was thus less exposed to the competitive pressures emanating from high domestic iron and steel prices.

---

[103] HKB Wien, Sign. IV.6316: *Gutachten*, p.11.

VI

CONCLUSION: THE ROLE OF THE MACHINE-BUILDING INDUSTRY IN THE PROCESS OF INDUSTRIALIZATION

The economic development of Austria-Hungary's machine-building industry was, to a large extent, a reflection of the course which the Habsburg economy took in the late nineteenth century. Periods of expansion and phases of contraction in mechanical engineering generally coincided with growth variations of the same direction in the industrial sector at large. But just as overall industrial growth rates in Austria and Hungary were out of phase with one another between 1870 and 1913, so were the rates of expansion in the machine-building industry. While Hungary's industrial sector as a whole grew at a more rapid pace than Austria's, Hungarian machinery output, too, increased at a faster rate than in the Western half of the Empire. In both countries, however, the rates of growth of engineering output over individual business cycles as well as over the full period under review differed markedly from those observed in other branches and the industrial economy at large. Though machine-building was an industry particularly exposed to the impact of variations in the business cycle, it was one of the most dynamically growing branches of manufacturing.

However, the new output estimates derived here indicate that Austria's machine-building industry took a course distinctly different from that implied in earlier research by Richard Rudolph[1]. Between 1870 and 1913, production expanded at a substantially lower rate. The temporal pattern of output growth shows, contrary to the view held recently, that the capital goods sector in the Western half of the Habsburg Monarchy was subject to a severe downturn and prolonged depression after the stock-market crash of 1873[2]. Austrian machinery output fluctuated at levels below its long-run trend until the early 1890s. Only towards the very end of the 1880s was there any sustained advance above pre-crash levels of production. This finding amounts to fresh evidence in support of the controversial notion of a "Great Depression" which has featured so prominently in recent Austrian historiography.

In the 1960s and early 1970s, Eduard März and Herbert Matis formulated what is now generally regarded as the traditional view of Austria's economic development in the latter half of the nineteenth century[3]. Proceeding from a largely non-quantitative approach, both authors argue that economic growth in Austria conformed "to the long-wave pattern that Kondratieff and others sketched out for the late nineteenth century"[4]. According to their hypothesis, the years 1873 and 1896 mark trend breaks. A long upswing

---

[1] Rudolph, R., "The Pattern of Austrian Industrial Growth from the Eighteenth to the Early Twentieth Century", *Austrian History Yearbook*, Table 2; and *Banking and Industrialization in Austria-Hungary. The Role of Banks in the Industrialization of the Czech Crownlands, 1873-1914* (Cambridge, 1976), Table A.3, p.207.

[2] Cf. Rudolph, *Banking and Industrialization*, pp.28-29; and Good, D.F., *The Economic Rise of the Habsburg Empire, 1750-1914* (Berkeley, Calif., 1984), p.165.

[3] März, E., "Zur Genesis der Schumpeterschen Theorie der wirtschaftlichen Entwicklung", *On Political Economy and Econometrics*, Essays in Honour of Oskar Lange (Warsaw, 1965), pp.370-380, and *Österreichische Industrie- und Bankpolitik in der Zeit Franz Josephs I.* (Vienna, 1968); Matis, H., *Österreichs Wirtschaft 1848-1913: Konjunkturelle Dynamik und gesellschaftlicher Wandel im Zeitalter Franz Josephs I.* (Berlin, 1972).

[4] Good, *Economic Rise*, p.163.

from 1848 to 1873 was dominated by the rapid construction of railways. The 1873 crash rang in a downswing, the Great Depression, which was characterized by price deflation and low rates of growth of real output. A new upswing began in 1896 and lasted until the outbreak of the First World War; its main driving forces were the rise of new industries and the increase in demand associated with Austria-Hungary's re-armament programme[5]. This periodization of Austrian economic development and especially the view that the period between 1873 and 1896 is adequately understood as one of great depression was first challenged in 1974 by David Good[6]. He estimated rates of growth of financial intermediary assets in Austria and translated them into GNP growth rates by using a finance-income ratio originally calculated for several other countries. Good concludes that real per capita output in Austria grew at approximately the same rate between 1873 and 1896 as between 1896 and 1913, and so rules out a break in secular trend in 1873. In terms of the behaviour of real output, he maintains, the Great Depression in Austria, as in Britain, is essentially a myth[7]. Using the same data but employing different estimating methods, John Komlos challenged Good's results and argues that output growth did indeed accelerate after the mid-1890s, following sluggish expansion during the preceding two decades[8]. The debate was resumed again in

---

[5] Cf. März, E., "Die wirtschaftliche Entwicklung der Donaumonarchie im 19. Jahrhundert", *Wirtschaft und Gesellschaft* (1985), p.368; Matis, *Österreichs Wirtschaft*, p.19.

[6] Good, D.F., "Stagnation and 'Take-Off' in Austria, 1873-1913", *EHR* 2nd ser. XXVII (1974) No.1, pp.72-87.

[7] Ibid.. Cf. Saul, S.B. *The Myth of the Great Depression 1873-1896* (Basingstoke, 2nd ed., reprint, 1989).

[8] Komlos, J., "Is the Depression in Austria after 1873 a 'Myth'?", *EHR* 2nd ser. XXXI (1978) No.2, pp.287-289. For Good's response to the criticism see "The Great Depression and Austrian Growth after 1873" in the same issue of *EHR*, pp.290-294.

Good's 1984 synthesis of Habsburg economic history[9]. Good acknowledges that the mid-1890s mark the dividing line between secular deflation and secular inflation; but he points out that most of the downward movement of prices had occurred before this date and that prices were basically flat for two decades from the mid-1880s[10]. In support of his thesis that the performance of Austria's economy between the early 1870s and the mid-1890s did not differ significantly from its performance in the subsequent periods, Good draws on the estimates of industrial output prepared by Nachum Gross and Richard Rudolph[11]. Komlos argues, in contrast, that this evidence is heavily biased and that Good's smoothing of his (Komlos') production series, which yields results broadly in support of the revisionist view, implies a loss of "important information on what was going on in the economy at crucial cyclical turning points"[12]. However, though Good rejects the traditional interpretation, he recently provided quite telling evidence in its favour, when he presented new estimates of real per capita regional product in the Habsburg Empire. Between 1890 and 1910, Austrian per capita output grew by more than double the rate than during the preceding twenty-year interval[13]. These estimates imply a

---

[9] Good, *Economic Rise*, pp.162-185.

[10] Ibid., p.171.

[11] Ibid., p.172. Cf. Gross, N.T., "Industrialization in Austria in the Nineteenth Century" (unpublished doctoral thesis, University of California, Berkeley, 1966), pp.61-66, and Rudolph, *Banking and Industrialization*, pp.12-13.

[12] Komlos, J., Review of D.F. Good, The Economic Rise of the Habsburg Empire, 1750-1914. *JEEH* 18 (1989) No.2, pp.453-455, and *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century* (Princeton, 1983), Appendix C, pp.238-254.

[13] Good, D.F., "Austria-Hungary", *Patterns of European Industrialization. The Nineteenth Century*, eds. R.Sylla and G. Toniolo (London, 1991), Table 11.3, p.230. It should be emphasized that the increase in per capita output growth was achieved in a period characterized by an acceleration

temporal pattern of per capita income increases that corresponds to the major phases of contraction and expansion in Austrian machinery output.

Due to a lack of adequate data, the output estimates presented here do not stretch further back than 1870 and, consequently, do not permit any inference about the early 1870s as a break in the secular trend of Austrian machinery production. Similarly, the financial data of the companies examined here start only in 1880. Thus no conclusions can be drawn on the validity of the long-wave concept as such, since we have no measure of the extent to which the trends discernible in the period from the early 1870s to the mid-1890s are different from those in the preceding period. But it has been shown in this thesis that the experience of Austria's machine-building industry in the 1870s and 1880s clearly diverged from its course in the following two decades, when output growth was markedly faster. This result has implications for the understanding of the timing and pace of Austrian economic development.

The link that justifies using a section series like machinery production for making main economic inferences is the nature of the machine-building industry's output, which constitutes replacements or additions to the capital stock of an economy[14]. If the domestic machine-building industry produces primarily for the domestic market and if it holds a dominant share in this market, both conditions apply in the Habsburg case, then changes in the rate of growth of machinery production are likely to reflect changes in investment demand for plant and equipment effective in the

---

in the rate of Austrian population growth; see Fischer, W., "Wirtschaft und Gesellschaft Europas 1850-1914", *Handbuch der europäischen Wirtschafts- und Sozialgeschichte*, vol. 5: *Europäische Wirtschafts- und Sozialgeschichte von der Mitte des 19. Jahrhunderts bis zum ersten Weltkrieg*, ed. W. Fischer (Stuttgart, 1985), Table 3, p.14.

[14] Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), p.143.

economy. The revisionist thesis, which postulates steady and uninterrupted growth in the Austrian economy from the 1870 to 1913, implies that no significant differences in the rate of machinery investment existed between the subperiods in question[15]. When aggregate demand for industrial goods first contracted and then slowly recovered in the 1870s and early 1880s, it was confronted with an enlarged capital stock built up in the preceding boom years. Machinery purchases were thus largely confined to replacements only. Sluggish manufacturing growth led to low levels of net investment in capital goods and a further fall in levels of demand for machinery, which were already depressed due to the collapse in railway construction. This state of the Austrian machinery market in the 1880s is well reflected in the experience of individual machine-building firms. The growth of engineering companies and the related rise of capital requirements were restricted. In response to slow growth of output and insufficient capacity utilization, investment in new production equipment remained low throughout the decade. As a result of very low or even negative rates of net investment the average value of fixed assets and plant equipment actually fell between 1880 and 1890. It was not until the close of the century that Austrian machine-building companies substantially expanded their production capacity to meet the rising demand for their output. All available evidence, whether it be the growth of domestic machinery production, the investment behaviour of machine-building firms, or the changes in machinery imports, points to low levels of demand for machinery during most of the 1870s and 1880s. It was in the last two decades before the First World War that, in response to renewed investment demand, output growth in Austrian engineering accelerated and surpassed

[15] This holds to the extent that similar rates of growth of an economy's output require roughly similar rates of investment, i.e. no abrupt changes in the structure of the economy take place which alter the output-investment ratio.

that in most other sectors of the industrial economy. Austria's machine-building industry, clearly, displayed a pattern of development that is not compatible with the revisionist view.

The consumer goods industries continued to hold a dominant share of total manufacturing output throughout the period under review[16]. As late as 1911, the textiles, clothing, and foodstuffs branches accounted for almost 50 per cent of value added in Austria's manufacturing industry[17]. In Hungary, this share was only slightly lower[18]. But it was, to a large extent, the producer goods sector, including mechanical engineering, that carried industrial expansion forward in the late nineteenth century.

The most striking finding of this thesis is the strength of the machine-building industry's contribution to industrial growth in the Habsburg Monarchy. One might have expected to find faster than average long-run rates of growth in this sector, as both agriculture and industry shifted to increasingly complex and capital-intensive production processes which translated into an acceleration in the growth of demand for capital goods. But expansion of industrial machine-building in fact gained such a momentum that, despite an initially small share in manufacturing value added, this sector became one of the two main sources of growth in industry. This holds especially for Austria after full recovery from the Great Depression had been achieved. Measured over the whole period 1870 to 1913, machinery output grew faster in Hungary than in Austria. But since Hungarian industry as a whole, too, expanded at a higher rate, the impact of engineering growth on total

---

[16] Gross, "Industrialization in Austria", Table 15, p.70.

[17] Ibid.

[18] Fellner, F. v., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.548-556.

manufacturing growth was nevertheless somewhat smaller in Hungary than in the Western half of the Empire during most cycles.

The performance of the capital goods sector appears even more impressive when allowance is made for the severe obstacles placed in its course. Mechanical engineering in Austria-Hungary was struggling with substantial input cost disadvantages vis-à-vis its foreign competitors, which were aggravated by the prevailing tariff structure. The fact that, after the turn of the century, the growth of machinery imports outstripped that of domestic production may serve as an indication of the continuous increase in machinery demand from industry and agriculture. Yet an inept tariff policy which protected the iron and steel industry at the expense of the machine-building sector meant that domestic machinery producers were not able to exploit this increase to the full. Growth in mechanical engineering, remarkable though it was, was thus hampered as the tariff structure effectively re-directed domestic demand for its output to cheaper foreign supplies. In sum, output growth in Austria-Hungary's machine-building industry could have been even faster if the sector had not been subjected to detrimental tariff rates.

Nachum Gross concluded in his thesis that "long-run industrial growth in nineteenth century Austria was not sufficiently rapid to make her economy relatively less backward at the end of the period than it had been in the middle of the century"[19]. Though drawing only on growth rates and thus ignoring the qualitative changes in the composition of total industrial output, this statement refers to some of the core elements of the debate about the path of the Habsburg Monarchy's industrialization. The data that are available show that modern economic growth began during the mid-1820s in the Western regions of the Empire,

---

[19] Gross, "Industrialization", p.96.

yet without displaying any signs of a Gerschenkronian *great spurt* or Rostovian *take-off*[20]. But up to the early 1870s, output growth was not as fast as to keep pace with the more advanced nations of Western Europe. The degree of Austria-Hungary's relative economic backwardness probably increased between 1820 and 1870[21]. Recent comparative research has produced results which suggest that, in relative terms, economic growth in the Habsburg Monarchy accelerated during the four decades under review. Between 1870 and 1910, Austria-Hungary's real per capita product grew faster than in most Western European countries. As a result, the wide gap in per capita output levels to Great Britain, France, Belgium, and, to a lesser extent, Germany, narrowed. "By 1914", David Good remarks, "the Empire's position relative to Western Europe was no better and may have been somewhat worse than a century before, and it had lost out to Germany for political dominance of Central Europe. But in its final four decades the Empire began to 'catch-up'"[22]. Most of this 'catching-up', it should be stressed, took place in the last two decades before World War I, i.e. during the period which the traditionalists in Austrian historiography view as marked by a renewed long-run upswing after the end of the Great Depression. Real per capita output in Austria rose by only 0.9 per cent on annual average between 1870 and 1890, but by more than 2 per cent between 1890 and 1910; similar rates of growth are calculated for Hungary[23]. This acceleration in per capita output matches with the changes in engineering growth and the rising contribution of the machine-building sector to total industrial

---

[20] Good, "Austria-Hungary", pp.221-225; Komlos, *Customs Union*, pp.90-111.

[21] Good, "Austria-Hungary", pp.225-228.

[22] Ibid., p.229.

[23] Ibid., Table 11.3, p.230.

production observed in this thesis[24]. There is evidence suggesting that the improvements in macro-economic productivity measured by Good may have been causally linked to changes in machinery investment, which are reflected in the output series for the machine-building industry.

In a study covering six major industrial countries during the past century, Bradford De Long detected a strong association of machinery investment and per capita income growth[25]. Moreover, his regression results indicate that machinery investment was more strongly associated with GDP per capita growth than investment in general (including non-residential construction investment). Even if allowance is made for political stability and investment in education, two factors often regarded as a key to growth, the magnitude and significance of the coefficient on machinery investment is not reduced. The problem is, of course, whether causation runs from machinery investment to economic growth or from growth to machinery investment. If faster growth causes higher investment because of rising profit expectations, then investment should respond equally to increases in output resulting from improved productivity (higher per capita incomes) and to those caused by population growth. "It should not matter whether larger demand comes from having more consumers or richer consumers"[26]. Testing for causation, De Long regressed machinery investment on output per capita growth and population growth. His results show a strong association

---

[24] The periods containing the largest *increase* in the rate of per capita income growth compared to the previous decade were 1890-1900 for Austria and 1880-1890 for Hungary. For Austria, 1890-1900 marks also the period with the most rapid growth in per capita income, whereas in Hungary per capita income expanded at its fastest rate between 1890 and 1900; Good, "Austria-Hungary", Table 11.3, p.230.

[25] De Long, J.B., "Productivity Growth and Machinery Investment: A Long-Run Look, 1870-1980", *JEH* 32 (1992) No.2, pp.307-324.

[26] Ibid., p.317.

between output per capita growth and machinery investment and a weaker and imprecisely estimated association between population growth and machinery investment. De Long thus argues that "intensive growth that raises productivity and income levels is especially strongly associated with machinery investment"[27]. He estimates that each additional percentage point of total output allocated to machinery investment raises output per worker by more than half a percentage point per annum. This is a high estimate and it may result from the fact that the nations included in the sample are today wealthy and succesfully industrialized countries; the high coefficient may, to some extent, reflect the good luck that these economies had in the past. Yet, irrespectively, those economies that have grown most rapidly in the past have been those that have invested heavily in machinery[28]. Given the temporal coincidence of changes in per capita output and those in machinery production, it seems at least plausible to view the rise in productivity in the Habsburg Monarchy as related to increased machinery investment.

However, the conclusion that mechanical engineering was at the core of industrial expansion in late nineteenth century Austria-Hungary does not amount to a corroboration of Alexander Gerschenkron's hypothesis that the capital goods sector was likely to dominate over the consumer goods industries in the process of industrialization of follower countries, like the Habsburg Empire[29]. Industrialization in Austria started much earlier in the nineteenth century and rested to a large degree on advances in the textile

---

[27] Ibid.. De Long supports this finding with further evidence drawn from the national growth experience of Argentina and post-World War II Germany, see "Productivity", pp.318-320.

[28] Ibid., p.323.

[29] Gerschenkron, A., *Economic Backwardness in Historical Perspective* (Cambridge, Mass., 1962).

industries. In Hungary, the first widespread wave of industrialization in the 1870s and 1880s was dominated by the rise of the flour milling industry. What has been observed here is that the machine-building industry, as part of the capital goods sector, became an increasingly important source of economic growth in a period *after* initial industrialization. This finding could be interpreted as evidence in support of Walter Hoffmann's hypothesis that over the process of industrialization the consumer goods industries lose their dominant position in favour of the capital goods sector, including iron and steel, metals and engineering[30]. However, what has been shown in this thesis is that among those manufacturing branches for which comparable output estimates are available, the machine-building industry belonged to the most rapidly advancing sectors in both Austria and Hungary. It should be kept in mind, though, that these branches do not represent the full range of manufacturing output[31]. Any inference about trend shifts from the consumer goods sector to the capital goods sector would require a more complete coverage of industrial sectors and an analysis of the input-output relationships necessary to allocate outputs between them[32]. For Austria-Hungary, however, the essential data are not available.

---

[30] Hoffmann, W.G., *The Growth of Industrial Economies* (Manchester, 1958), pp.31-41, 145-159. The empirical basis of Hoffmann's concept has been criticized as weak because of insufficient sectoral coverage and arbitrary definitions of consumer goods and capital goods industries; Cf. O'Brien, P.K., "Do We Have a Typology for the Study of European Industrialization in the XIXth Century?", *JEEH* 15 (1986) No.2, pp.310-311.

[31] Komlos' estimates of manufacturing output, which have been used here for comparative purposes and the measurement of the machine-building industry's contribution to industrial growth, are based on eight sub-series (beer, iron, distilled spirits, sugar, cotton textiles, woollen textiles, flour, electricity); Komlos, *Customs Union*, Appendix E, Tables E.5 and E.6.

[32] O'Brien, "Typology", pp.310-311.

The domestic machine-building industry was able to make a major contribution to economic growth in the Habsburg Empire in the face of difficult circumstances. The findings presented in this thesis suggest interpreting the industry's performance largely in terms of its response to the prevailing market conditions. Nathan Rosenberg has shown that the efficient operation of a capital goods sector is critically dependent on a sufficiently high level of demand for capital goods permitting output specialization[33]. Though Rosenberg refers to specialization at the firm level, the concept can also be used to explain the composition of output at industry level. The growth in machinery output, and its variation over time, was associated with changes in the structure of the machine-building industry's output. These changes were determined by changes in the absolute and relative size of product markets. Austria-Hungary's machinery producers focused on the manufacturing of those machines for which the domestic economy provided sufficiently large markets. The available data for Hungary indicate an engineering sector which, by the turn of the century, was capable of providing increasingly diverse and complex outputs. But steam technology, agricultural machinery and implements, and plant and equipment for the food processing industries accounted for particularly high shares in total machinery output. In the early 1870s, at a time of rising demand associated with rapid railway construction, locomotive engineering was probably the most important single branch of Austria's machine-building industry. However, as later in Hungary, its relative importance declined over time as the fall in the rate of new railway building brought with it a decline in demand for railway related output. Operating in a country with a large agricultural sector, both in absolute terms and relative to industry, the

---

[33] Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology* (Cambridge, 1976), p.143.

machine-building industry was increasingly geared to the provision of agricultural machinery, demand for which was secularly rising as a result of mechanization and the spread of more capital intensive farming techniques. Power machines like steam engines and, at a later stage, internal combustion engines were used in virtually all branches of industry. The market for these machines was thus substantially larger than that for highly specialized machinery like machine-tools or spinning machines which found use only in a limited number of industries. Moreover, proximity to the predominantly agricultural economies of Eastern and South-Eastern Europe helped widening the market for machinery producers in the Habsburg Empire. Exports accounted for a substantial share of domestic production of agricultural machinery. Though the argument does not account for the increasing specialization in steam technology, it appears that Austria-Hungary's tariff structure, too, had some bearing on the pattern of output specialization. At least part of the shift towards the production of agricultural equipment, with a relatively low iron and steel content per unit of output, can be explained as a response to high tariffs on iron and steel inputs.

The absolute and relative rise of the machine-building industry under at times adverse conditions bears witness to the underlying dynamism and increasing complexity of the Habsburg economy in the late nineteenth century. Rising macro-economic productivity was, to a considerable extent, facilitated by investment in domestically produced machinery. The results of this thesis thus fit in well with what now seems to emerge as consensus among Habsburg scholars, namely, that the long-held view of Austria-Hungary's economic development as essentially one of failure can no longer be accepted[34].

---

[34] Cf. Good, *Economic Rise*, pp.237-255, and "Austria-Hungary", pp.225-229; Komlos, Review of Good, p.452. The most recent exposition of the failure hypothesis is Alexander Gerschenkron's *An Economic Spurt that Failed* (Princeton, 1977).

APPENDIX A

An Estimate of Output in Austro-Hungarian Machine-Building, 1870 to 1913

I. Austrian Machine-Building Production

1. Earlier Attempts to Approximate Output

Only few contemporary spot estimates of Austrian machine-building output are available. They do not allow the identification of significant changes in either the short or the long run[1]. And the one recent estimate produced by Rudolph is somewhat misleading for several reasons[2].
His index of engineering production - designed as a component of a wider industrial production index - is based solely on iron and steel consumption in this sector. It is an input series composed of Austrian iron and steel production and imports, corrected by rail production.

---

[1] k.k. Handelsministerium, "Statistik der österreichischen Industrie 1870, 1880, 1885", *Nachrichten über Industrie, Handel und Verkehr* (hereafter *NHIV*), vols. 3 (1874) No.2, p.145; 28 (1884), pp.94-97; 38 (1888/89), pp.106-109. Bibliothek der Kammer der gewerblichen Wirtschaft für Wien, Vienna (hereafter HKB Wien), Sign. IV.6316: Handelspolitische Zentralstelle, *Gutachten zum autonomen Zolltarif: Die Entwicklung der österreichischen Maschinenindustrie seit 1905 bis 1913*, typescript, no place, no year, pp.6-8.

[2] Rudolph, R.L., *Banking and Industrialization in Austria-Hungary. The Role of Banks in the Industrialization of the Czech Crownlands, 1873-1914* (Cambridge, 1976), pp.12, 206-207, and "The Pattern of Austrian Industrial Growth from the Eighteenth to the Early Twentieth Century", *Austrian History Yearbook* 11 (1975), Table 2. For a critique of Rudolph's figures see also Komlos, J., *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century* (Princeton, 1983), p.242.

Constant iron and steel prices were applied to convert the sub-series into value data. Three shortcomings, in particular, impair the quality of this index:

1. *Trade flows.* The Monarchy's foreign trade statistics refer to Austria-Hungary as a whole, i.e. they do not differentiate between Austria on the one hand, and Hungary on the other. Rather than looking at the Hungarian material, which, at least partly and for certain periods of time, allows us to distinguish the respective flows, Rudolph utilizes the overall trade data and applies constant ratios to determine Austrian imports and exports. His figures do not account for the internal trade in iron and steel between Austria and Hungary which is important for approximating the total of Austrian net imports.

2. *Content of index.* Despite its importance and large share in total iron and steel output, wrought iron is not included in the series for 1870 to 1899. The neglect of wrought iron output, though, leads to a substantial under-estimation of the level of iron and steel inputs for the 1870s and 1880s, in particular. This holds even more so as at the time rails were still made predominantly of wrought iron rather than steel[3]. No effort has been made to account for Austrian imports of cast iron. But these were, again, particularly important in the 1870s and 1880s, both in absolute terms as well as relative to other inputs[4]. Rudolph's input series is thus heavily biased. The growth of engineering inputs appears faster than it actually was.

3. *Input/output ratios.* Rudolph assumes a constant input/output ratio for 1870 to 1913. This seems reasonable enough unless one has reason to believe that, for example,

---

[3] Schubert, H.R., "The Steel Industry", *A History of Technology*, vol. 5: *The Late Nineteenth Century, c. 1850 to c. 1900*, eds. C. Singer, E.J. Holymard, A.R. Hall, T.I. Williams (Oxford, 1958), p.61. In 1870, Austria produced more than 105,000 metric tons of rails, but only 25,000 tons of steel. Wrought iron output in that year amounted to approximately 203,000 tons; see Tables A.8 and A.11.

[4] See Tables A.8 to A.11.

the ratio declined over time as a consequence of improved production technology that saves on input material or better inventory management that reduces stocks relative to the level of production. If that applies, actual output grows faster than the rise of inputs would suggest. On the other hand, the ratio of inputs to outputs may *increase* in response to shifts towards more iron-and-steel-intensive outputs or the factor substitution of iron and steel for other inputs, e.g. wood. Output growth would then be slower than the growth of iron and steel inputs. However, applying a constant ratio to an input series which is heavily biased leads by necessity to a distorted view of the development of machinery output.

2. The New Output Estimate

a. Iron and Steel Inputs

As a first step in estimating output, a series for iron and steel consumption in Austrian machine-building (in 1000 metric tons) was compiled. This series is composed of ten subseries:

Austrian iron and steel production:

1. cast iron production
2. steel production
3. wrought iron

Austrian net imports of iron and steel:

4. net imports of cast iron
5. net imports of bar iron and steel
6. net imports of sheet metal and plate
7. net imports of smelted iron and ingots

Austrian non-engineering iron and steel consumption:

8. rail production
9. production of railway related materials
10. production of non-engineering iron goods.

Iron and steel production (series 1 to 3)[5]

Data on Austrian production of cast iron and steel are available for the whole period 1870 to 1913[6]. Austria's output of wrought iron, though, had to be estimated for most years between 1870 and 1899. An initial attempt to approximate wrought iron output as a residual proved unsuccessful[7]. Instead, the production of wrought iron was approximated on the basis of the share of steel in total

---

[5] For sources see Table A.8.

[6] For 1885, the arithmetic mean of the 1884 and 1886 values of cast iron output has been used as the figure given in the statistical yearbooks shows an inexplicably sharp rise for 1885 (from 63,189 tons in 1884 to 91,348 tons), only to fall again in 1886 (to 57,415 tons) - possibly the result of a misprint. Neither the data for steel production, nor those for imports suggest that there was a general increase in demand for iron and steel in 1885. The level of Austrian pig iron output actually fell in this year. See Table A.8 for sources.

[7] Total Austro-Hungarian pig iron consumption (including net imports of scrap) was converted into wrought iron and steel terms using a ratio of .70 for 1870 to 1879 and .75 for 1880 to 1900; see Kestner, F., *Die deutschen Eisenzölle 1879 bis 1900* (Leipzig, 1902), Table IX, p.132 and Burn, D.L., *The Economic History of Steelmaking 1867-1939* (Cambridge, 1940), note 2, p.82. Subtracting Austrian and Hungarian steel production from the series obtained in such fashion yielded estimates of wrought iron output. The estimated values are fairly low for the early 1890's and turn negative for all years after 1895, i.e. the estimates of wrought iron output are incompatible with the data on steel production. (Despite using a higher conversion ratio of .80, the results were negative, too, for 1900 to 1913). Alhough the values computed for the 1870s and 1880s are not that obviously implausible, they may nevertheless be flawed. It appears that the method of calculating wrought iron output suffers from two defects: firstly, variations in pig iron stocks are not taken into account; secondly, the use of scrap iron - apart from imports - is not allowed for. Data for Britain suggest that pig iron stocks were both important and extremely volatile. Between 1880 and 1886, the ratio of stocks to pig iron production varied between a minimum of .193 and a maximum of .355; Carr, J.C., Taplin, W., *History of the British Steel Industry* (Oxford, 1962), Table XII, p.106. For Austria and Hungary, however, no data on inventories are available. Similarly, no figures exist on scrap of domestic origin used in the manufacture of wrought iron and steel.

wrought iron and steel production in those years for which output data are available:

Table A.1

PERCENTAGE SHARES OF STEEL IN AUSTRIA-HUNGARY'S TOTAL OUTPUT OF WROUGHT IRON AND STEEL

1870	11.1	1882	48.8	1892	72.8
1873	23.6	1883	54.3	1893	75.1
1879	41.7	1890	72.5	1900	82.9
1880	38.8	1891	71.8		

Sources: See Table A.7.

Shares for the years with missing production data were obtained by interpolation, using annual average rates of change. These shares were then applied to the annual data for Austrian steel production, yielding estimates of total wrought iron and steel output for 1871 to 1872, 1874 to 1878, 1881, 1884 to 1889 and 1894 to 1899. Subtracting the volume of steel produced estimates of Austrian wrought iron output. Iron and steel production is given in Table A.8.

Net imports of iron and steel (series 4 to 7)[8]
In general, Austrian net imports of iron and steel for 1883 to 1913 have been computed directly as all the relevant flows are reported in the trade statistics of the customs union and those of Hungary[9]:

---

[8] For sources see Tables A.9 and A.10.

[9] From 1879 on Bosnia-Herzegovina was integrated in the customs union, see Komlos, *Customs Union*, p.4. Hence her foreign trade data are included in the foreign trade statistics of the Monarchy. Since these trade flows are indistinguishable the figures derived for Austria include also those for Bosnia-Herzegovina. On this problem see also k.k. Handelsministerium, Handelsstatistischer Dienst, *Außenhandel und Zwischenverkehr der im Reichsrathe vertretenen Königreiche und Länder und der Länder der heiligen ungarischen Krone 1909* (Vienna, 1911), p.7.

$$impA = impAH - impH^{ROW} + impA^{H}$$
$$expA = expAH - expH^{ROW} + expA^{H}$$
$$\text{net imports} = impA - expA$$

Key:

impA, expA	total Austrian imports and exports
impAH, expAH	imports and exports of Austria-Hungary
$impH^{ROW}$, $expH^{ROW}$	Hungarian foreign trade with countries *outside* the customs union of Austria-Hungary
$impA^{H}$, $expA^{H}$	Austrian imports from and exports to Hungary (internal trade).

Trade between the two halves of the Habsburg Monarchy is covered in the Hungarian trade statistics and, for 1900 to 1912, in the Austrian "Statistik des Zwischen-verkehrs". The import and export figures produced in these two sources show only minor differences and are fully compatible for the years in which they overlap[10]. Use of the Hungarian data ensured consistency over time[11]; the Austrian source

---

[10] The maximum divergence - observed in a single year - of the Austrian figures from the Hungarian data (in percentage of the latter) between 1900 and 1912 is for

imports of bar iron and steel	-0.9
exports of bar iron and steel	-2.0
imports of sheet metal and plate	8.8
exports of sheet metal and plate	-3.4.

Larger data discrepancies show up in total internal trade in raw iron (which included a variety of iron qualities): imports diverged by a maximum of only 2.5 percent, but exports by a maximum of -36 percent. These totals, however, have not been put to use here. See k.k. Handelsministerium, Zwischenverkehrsstatistisches Amt, *Statistik des Zwischenverkehrs zwischen den im Reichsrathe vertretenen Königreichen und Ländern und den Ländern der ungarischen Krone* (Vienna, 1902-1913), *1901*, pp.48-49; *1903*, pp.56-57; *1905*, pp.56-57; *1906*, pp.53-54; *1908*, pp.100-103; *1910*, pp.100-103; *1912*, pp.100-103. Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1883-1913. Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1923), pp.270, 272, 274.

[11] According to Handelsministerium, *Außenhandel and Zwischenverkehr*, pp.5-7, no independent records on Austria's share in the customs union's foreign trade are available. The figures on Austria's foreign trade (exclusive of her trade with Hungary) produced in this publication have, therefore, been calculated as residuals using the more

was only utilized for isolating internal trade in cast iron (for 1906 to 1912) as this is not reported in the Hungarian material.

The lack of complementary trade data for the period prior to 1883[12] requires a rule for separating the Austrian portion from the overall external trade figures. Austria's 5 year-average share in each category of the Monarchy's iron and steel imports and exports (1883-87) was applied to the data for 1870 to 1882.

Annual exports to Hungary of bar iron and steel (series 5) and sheet metal and plate (series 6) for 1870 to 1882 were approximated by applying the respective average 1883/87 ratios of exports to Austrian steel production to annual steel output. Imports from Hungary were estimated by using the two average 1883/87 shares of Austrian imports (or Hungarian exports) in Hungarian steel production[13]. Net imports of bar iron and steel are given in Table A.9, those of sheet metal and plate in Table A.10.

Insufficient data called for some modification in the procedure of calculating imports of cast iron and smelted iron and ingots.

Austrian net imports of cast iron (series 4) had to be estimated since the available trade statistics do not allow us to isolate them directly. For the Austro-Hungarian customs union, import and export data for cast iron exist for 1888 to 1913. The respective figures for the previous

---

comprehensive Hungarian data - a further reason to turn to the Hungarian statistics.

[12] Though official Hungarian data are available for 1882, these are not used here as contemporaries regarded them as unreliable, see Bokor, G., *Geschichte und Organisation der amtlichen Statistik in Ungarn* (Budapest, 1896), p.188.

[13] As has been shown above, wrought iron output had to be estimated for most years between 1870 and 1899. In order to confine cumulative estimating and the potential for errors associated with it, the 1870 to 1882 estimates for internal trade in bar iron and steel and sheet metal and plate were based on steel production only rather than total wrought iron and steel output.

years were approximated by applying the 5 year-average share (1888-92) of cast iron in total crude iron imports and exports to the crude iron data available for 1870 to 1887. Thus a complete series of Austro-Hungarian cast iron net imports was obtained. In a second step, the portion of Austria had to be determined. It was assumed that Austria's share in the Monarchy's foreign trade in cast iron in each year was the same as the one she had in *total* crude iron imports and exports for each year 1883 to 1913. The latter was calculated on the basis of both Hungarian and overall trade statistics. Austria's net imports from Hungary were taken into account as well. Data on internal trade in cast iron are available for 1906 to 1912[14]. For 1883 to 1905, it was assumed that the structure of Austrian iron exports reflected that of Austrian iron production. The relative share of cast iron in total Austrian cast iron and pig iron production in each year was applied to the figures for Austrian exports of crude iron to Hungary[15]. Imports from Hungary were estimated in identical fashion, using the share of cast iron in Hungarian iron production to determine Hungary's exports to Austria. For 1870 to 1882, the average 1883/87 ratio of (estimated) exports to cast iron production was used to approximate Austrian cast iron exports to Hungary as a constant fraction of Austrian cast iron output. Similarly, imports from Hungary were computed employing Hungarian output data. The series of Austrian cast iron imports is given in Table A.9.

As the available trade data refer only to Austria-Hungary as a whole, Austrian net imports of smelted iron and ingots (series 7) had to be estimated, too. We assumed that Austria's share of imports and exports of smelted iron and

---

[14] For 1913, internal trade in cast iron was estimated using the average 1906/12 share of exports in Austrian cast iron production. Imports from Hungary were approximated on the basis of their share in Hungarian cast iron output.

[15] The Hungarian trade statistics do not differentiate between cast iron and pig iron and, therefore, reproduce only total crude iron imports and exports.

ingots was equivalent to the share she had in the Monarchy's foreign trade in bar iron and steel (disregarding internal trade flows). The ratios computed for each year were then applied to the totals of imports and exports of smelted iron and ingots to derive Austria's net imports. Internal trade for 1900 to 1913 was not taken into account as the available Austrian data are not sufficiently disaggregate and, consequently, no attempt has been made to estimate internal trade for earlier years. Austrian net imports of smelted iron and ingots are reproduced in Table A.10.

Non-engineering iron and steel consumption (series 8 to 10)[16]

In a first step to set apart iron and steel consumption in machine-building from that in other branches of the economy, rail production was substracted from the tonnage-sum of the first seven series for each year. Estimates were needed for the years with missing production figures: 1871 to 1879, 1881 to 1882, 1884 and 1886 to 1889. It was assumed that the volume of Austrian rail production was a function of the growth in Austria-Hungary's railway network and the Monarchy's imports of rails[17]. With substantially

---

[16] For sources see Tables A.11 and A.12.

[17] This procedure requires some further explanation:
(1) Certainly, it would be preferable to take account of Hungarian output of rails, too. Yet no data other than estimates of Hungary's rail production are available for 1870 to 1889 (see below, section II, on Hungarian machine-building production). The use of these rather tentative approximations seems unlikely to improve the accuracy of the estimates for Austria. However, to some extent the effects of a probable increase in Hungarian rail production over time are implicitly allowed for: assuming no technological change, a given *overall* rail-consumption/kilometre-of-track ratio and no change in net imports of rails, a rise in Hungarian rail output will adversely effect the volume of *Austrian* rail production. The ratio of Austrian rail output and Austro-Hungarian rail imports to new track laid will fall in response.
(2) Austria-Hungary's total net imports of rails have been used - rather than Austria's alone - as Austrian rail

smaller iron and steel production capacity than Austria, yet similarly large additions to the domestic railway network, Hungary's import demand for Austrian rails was most certainly important.

Five rail-consumption/kilometre-of-track ratios were computed on the basis of Austrian rail production and Austro-Hungarian rail import figures for 1870, 1880, 1883, 1885 and 1890 (Table A.2)[18]. Interpolation - using arithmetic averages - yielded ratios for the years with missing production data. These ratios were related to new track opened each year, providing estimates of rail consumption. The estimates were then "smoothed" by computing three-year moving averages. This was done to allow for the possibility of repair work and changes in stocks of rails which both seem likely to have dampened to

---

production is related to new track laid throughout the Monarchy. This was done because the lack of production and trade data did not permit a computation of rail consumption for each of the two countries separately. (An approximation of Austria's and Hungary's individual trade in rails is bound to fail. The pronounced and most volatile fluctuations in both external and internal trade during the 1880s would not permit the derivation of meaningful constant shares and coefficients with which to attempt a backward extrapolation; see the section on series 4 to 7 above).

(3) For some years the trade statistics suggest that Hungarian imports and exports alone exceeded the respective totals for the Monarchy. It is not clear whether this incompatibility results from an error in the Hungarian data or the overall trade figures. Hence Austro-Hungarian exports (1885, 1887) and imports (1889) have been calculated as arithmetic averages of the respective 1884-86, 1887-88 and 1888-90 data. See k.k. Statistische Central-Commission "Statistik des auswärtigen Handels der österreichisch-ungarischen Monarchie 1885, 1887, 1889", *Österreichische Statistik* (hereafter *ÖStat*), vol.14 (1886/87), II, p.42, III, p.26; vol.20 (1888/89), II, p.32c, III, p.24c; vol.26 (1890/91), II, p.58, III, p.34; and Központi Statisztikai Hivatal, "Külkereskedelmi Forgalma", p.278.

[18] The difference between the time of rail production and the time of opening of new track was taken into consideration by shifting two thirds of the figures for new track opened in each year into the previous year.

some extent the effects of variations in railway construction on rail consumption. Finally, net imports of rails were subtracted to obtain values for rail production. Austrian rail production is given in Table A.11.

Table A.2

RAIL-CONSUMPTION / KILOMETRE-OF-TRACK RATIOS

	RP	NIR	NT	Ratio
1870	105.27	116.75	1,968.7	.1128
1880	61.03	-24.58	302.3	.1206
1883	165.00	5.12	1,143.7	.1488
1885	83.13	0.08	583.3	.1427
1890	84.97	1.13	862.0	.0999

Key:
RP = Austrian rail production (1000 tons)
NIR = Austro-Hungarian net imports of rails (1000 tons)
NT = new railway track opened, 2/3 shifted back one year (km)
Ratio = (RP+NIR)/NT

Sources: See Table A.10.

The production of miscellaneous railway related materials was important and constituted a considerable fraction of rail production[19]. It was assumed that iron and steel consumption in this branch expanded in line with Austrian output of rails (Table A.10).

Iron and steel were inputs for industries other than machine-building and railway related production. Consequently, as a further step to isolate the engineering input, at least part of the iron and steel used in metal-working was substracted from the total (Table A.11, column

[19] The production of iron sleepers and various (small) railway materials (exclusive of locomotives, wheels and axles) counted for 17,690 tons in 1890 when rail production was at 84,970 tons, Handelsministerium, "Statistik der österreichischen Industrie 1890", *NIHV*, vol.54 (1894), pp.98-99. Unfortunately, this source provides no further details of what "small railway materials" actually were.

(1))[20].

The residual volume series is assumed to reflect roughly the development of material inputs in the Austrian engineering industry (Table A.12, column (2)).

b. The Estimation of Gross Output in Machine-Building

Fellner estimated output of Austrian engineering for 1911/13 within the framework of his national income calculations[21]. He approximated the "raw value of production" by applying a wage-sum/gross output ratio derived from Hungarian data to Austrian figures on wage-sums in industrial engineering. This concept has been utilized here as well. Wage-sum data are given in the Austrian workers' insurance statistics - though only for 1889 to 1911[22].

---

[20] In 1890, Austrian production of tools, wire, rivets, iron furniture, eating utensils and locksmith's items was at 128,332 tons, Handelsministerium, "Statistik der österreichischen Industrie 1890", *NIHV*, vol.54 (1894), pp.98-99. This figure almost certainly represents a minimum since products like sickles, scythes, knifes, weaponry, and fireproof safes are not even included - due to a lack of tonnage data. It was used to calculate estimates for all other years. We assumed that Austrian metal-working expanded in line with Austrian consumption of iron and steel net of rails and railway related materials. However, as a *constant* proportion of iron and steel consumption the resulting series has only notional significance as its inclusion or exclusion does not effect the pattern of change in machine-building inputs and thus the final estimate of output.

[21] Fellner, F.v., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.558-572.

[22] k.k. Ministerium des Innern, *Die Gebarung und die Ergebnisse der Unfallstatistik der Arbeiter-Unfall-Versicherungsanstalten* (henceforth cited *Unfallstatistik*) *1889* (Vienna, 1891), pp. 36-37; *1890* (Vienna, 1892), pp. 66-67; *1892* (Vienna, 1893), pp. 78-79, 127; *1893* (Vienna, 1894), pp. 82-83, 131; *1894* (Vienna, 1895), pp.80-81, 129; *1895* (Vienna, 1896) pp.88-89, 137; *1896* (Vienna, 1897), pp. 98-99, 162; *1896* (Vienna, 1898), pp. 94-95, 160; and

Table A.3

1911 PERCENTAGES OF WAGES IN GROSS OUTPUT

1.	boiler making, machine repair shops:	17.5
2.	general machine-building:	20.5
3.	agricultural machine-building:	25.0
4.	production of sewing machines:	33.8
5.	production of soda-water apparatus:	17.6
6.	other branches of machine-building:	22.1

Source: Fellner, "Volkseinkommen", Table VI, p.621.

Table A.3 provides the (1911) percentage shares of wages in gross output of individual machine-building branches which have been used to derive the value of gross production in these branches 1897 to 1911 (Tables A.12a to A.12e)[23]. For 1889 to 1896, the statistics provide only the *total* wage-bill in machine-building. In these cases, the 1897 weighted average ratio of 20.89 per cent was applied (Table A.12e). Thus a complete series of gross production in Austrian machine-building was obtained for 1889 to 1911 (Table A.13, column (1)).

The assumption of a constant wage-bill/turnover ratio for either the industry as a whole or its individual branches is a simplification necessitated by the lack of more detailed data. Certainly, the ratio varied not only between different branches of machine-building, but within these between different companies and over the business cycle,

Ergebnisse der Unfallstatistik der fünfjährigen Beobachtungsperiode 1897 -1901 (Vienna, 1904), pp. 252-285; *1902 - 1906* (Vienna, 1909), pp. 261-297; *1907 - 1911* (Vienna, 1914), pp. 283-323. Included are Gruppe VI, Titel 166 to 184 (machinery, tools, apparatus) of the *Unfallstatistik* which correspond to the definitions used in HKB Wien, *Gutachten*. Transportmeans (shipbuilding, railway cars, automobiles, etc.) as well electrical engineering are not incorporated in the data used.

[23] The production of soda-water apparatus and siphons has been included in Table A.12e, Gross Production: Other Machine-Building.

too[24]. But there is evidence which indicates that the overall ratio, at least, was not subject to any significant upward or downward trend over time which would seriously affect the new estimates. Deriving an index of production in German metal-working, Hoffmann used labour incomes in the industry as a proxy for output[25]. His evidence shows that the shares of wages, depreciation and profits in output remained fairly constant over the long run.

Dividing the previously derived iron and steel consumption in machine-building (in 1000 metric tons; Table A.11, column (2)) by the value of gross production of machines (in million current crowns; Table A.13, column (1)) yielded a series of annual input/output ratios for 1889 to 1911[26]. This series shows pronounced annual fluctuations and, if anything, a slight upward movement over time (Table A.4)[27].

---

[24] In the branch of general machine-building, for example, the share of wagesum in turnover fluctuated between 14.7 and 36 per cent in 1905 according to the individual company. Six years later the minimum ratio was recorded at 13.8 per cent, the maximum at 33 per cent. For the whole of engineering average ratios of 25 per cent in 1905 and 22 per cent in 1911 were considered representative. See HKB Wien, Sign. IV.6316: *Gutachten*, pp.3-8.

[25] Hoffmann, W.G., *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts* (Berlin, 1965), pp.357-359.

[26] In general, input/output ratios are defined with both inputs and outputs measured in the same units, i.e. either in value or in quantity terms. Here, though, output data are available only in value terms whereas inputs had to be measured in physical quantities since adequate price data, notably for rails, railway materials and non-engineering iron and steel goods are lacking.

[27] The behaviour of the input/output ratio underlines the importance of wrought iron inputs. An alternative computation was prepared to test for the effects of excluding this component for the pre-1900 years, as in Rudolph's estimates. Using otherwise identical data and methods, but accounting for the change in estimated non-engineering iron and steel consumption (which is affected by the exclusion of wrought iron), a new series of input/output ratios was calculated. This procedure reveals

Therefore, the 1889-1894 mean of 2.2912 was used to compute estimates of machinery output for 1870 to 1888 on the basis of the iron and steel input series; the 1907-1911 mean was applied to obtain estimates for 1912 to 1913 (Table A.13,

---

a fluctuating, but persistently rising ratio. With the data entered in reverse chronological order to allow for a backward extrapolation, this input/output ratio (z) was regressed on a time trend (time), producing the following equation based on 23 observations for 1889 to 1911 (t-statistics in parentheses):

$$z = \underset{(21.0586)}{1.4686} + \underset{(7.6217)}{.046175}*time + \underset{(2.1916)}{.4347}*\epsilon(-1)$$

$R^2 = .9054$ $\bar{R}^2 = .8955$ $F(2, 19) = 90.9279$ $DW = 1.9112$

The time variable has been chosen to equal 0 in the base year (1889), to increase by 1 during each successive year and to decrease by 1 during each preceeding year. All test statistics indicate significance of the respective coefficients at either the 1 or 5 percent level. An autoregressive error term was inserted in the equation to correct for the presence of serial correlation in the initial OLS estimation. A plausible explanation for the existence of serially correlated errors may be found in cyclical fluctuations of the ratio for which no explicit allowance has been made. In an upswing, prices are likely to rise and the value of nominal output is likely to rise, too. The actual input/output ratio will then be lower than its longer run trend value; a negative residual results. Similarly, at or near the bottom of a downswing, relatively lower input prices may encourage manufacturers to build-up input stocks in advance, despite the likely presence of relatively low output prices, as they may anticipate an upswing. The volume of inputs increases while the value of output still stagnates: the actual input/output ratio will then be higher than predicted by the trend line (positive residuals). Using the regression equation for a *backward* extrapolation produced estimates of input/output ratios for 1870 to 1888 which rise as time progresses. For 1870, we obtain a ratio of 0.5913 which, when applied to the volume of inputs modified as described above, yields an estimate of output in current prices of 90.31 million crowns. This result is very close to both contemporary estimates and the new estimates of output presented in this appendix (see Table A.6). However, if we were to apply a constant ratio instead, for example the average 1889/1911 ratio of 1.9634 (based on the modified input series), estimated output for 1870 would amount to less than 30 million crowns. The point is to show that use of a heavily biased input series, in this case a series which does not include wrought iron, is bound to lead to very substantial estimation errors if a constant ratio is used.

column (1)).

Table A.4

INPUT / OUTPUT RATIO				
	mean	maximum	minimum	var. coeff.
1889-1894	2.2912	2.4238	2.1596	.0485
1895-1900	2.5943	2.7659	2.3342	.0616
1901-1906	2.5036	2.6866	2.3416	.0461
1907-1911	2.6018	2.7425	2.4526	.0429
1889-1911	2.4932	2.7659	2.1596	.0701

input = iron and steel consumption in engineering (1000 tons)
output = value of gross production (million current crowns)

Sources: Calculations based on data given in Tables A.11 and A.13.

Finally, an input price index was constructed (Table A.14) and used to calculate gross production in constant (1913) prices (Table A.13, column (2)).

c. The Input Price Index

The construction of a price index of machinery is hampered by both methodological as well as practical obstacles. Because of a generally high rate of technological progress, notably over longer periods of time, it is difficult to compare engineering products qualitatively. Structural shifts within the machine-building industry add to the problem of adequate weighting of individual price subseries. Moreover, price data for machines are rare and most often discontinuous[28].
The almost complete lack of suitable machinery price data for both Austria and Hungary necessitates to base a price

[28] Hoffmann, *Wachstum*, p.571.

index on input rather than output prices[29]. Information on the most important input prices and weights is available from contemporary sources.

A Laspeyres index was constructed as a weighted arithmetic average of price relatives for material and labour inputs. The base year is 1913. Six series of price relatives are included[30]:

ACI_t	average price per ton of Austrian cast iron at place of production in year t (1913=100);
HCI_t	average price per ton of Hungarian cast iron at place of production in year t (1913=100);
ICI_t	price per ton of imported cast iron *inclusive* of tariff in year t (1913=100)[31];
ABI_t	wholesale price of bar iron in Vienna in year t

[29] Tinbergen, Cairncross and Feinstein faced similar difficulties in their attempts to construct price indices for British engineering. As part of his computation of a price index of investment goods, Tinbergen approximated machine prices on the basis of trade data and pig iron prices; Tinbergen, J., "Business Cycles in the United Kingdom", *Verhandelingen der koninklijke Akademie van Wetenschappen*, n.s. LII (1951), no.4, pp.12-15, Table I A. Cairncross' calculation of the average value of machinery per ton is based on iron and steel prices; Cairncross, A.K., *Home and Foreign Investment, 1870-1913*, (reprint, Nr Brighton, 1975), pp.158-167. Feinstein designed a price index for engineering by combining indices of iron and steel prices and of wages in engineering and shipbuilding; Feinstein, C.H., *National Income, Expenditure and Output of the United Kingdom, 1855-1965* (Cambridge, 1972), p.188, Table 63.

[30] The lack of adequate price data does not permit the construction of a separate price index for Hungarian engineering; bar iron prices, for example, are available only for Austria. The same holds for wage data in mechanical engineering. The input price index is, therefore, used for deflating estimated machine-building output in both Austria and Hungary. Hence Hungarian cast iron prices have been included as well. Import prices for cast iron apply to both countries alike because of their common customs border.

[31] The tariff rate applied is an arithmetic average of the (lower) negotiated tariff and the (higher) autonomous tariff on cast iron imports.

(1911/12/13=100; the 1911 price was used also for 1912 and 1913 as no prices are available or both these years);

ACO_t average price per ton of Austrian coal at place of production in year t (1913=100);

WPA_t average wage per annum in Austrian machine-building in year t (1913=100)[32].

Material input prices - represented by the first five price relatives listed above - and the series for wages are combined with equal weights[33]. According to a study by the Verein Deutscher Maschinenbau-Anstalten (German Machine-Builders' Association), approximately half of production costs in machine-building accrued to expenses on material inputs. Raw materials, largely iron, accounted for 80 per cent and fuels for 20 per cent of material expenditure. On average, cast iron and bar iron - by far the two most important engineering material inputs - had a share of 40 to 50 per cent and 30 to 35 per cent, respectively, in the

[32] In a first step, the average annual wage per worker in Austrian mechanical engineering was computed on the basis of wagesums paid in the industry and the number of workers for 1889 to 1911 and converted into index form. The data are given in the Austrian workers' insurance statistics. The series correlates highly with time. A trend line was fitted (OLS) after transformation of the wage data into logarithmic form. Forward and backward extrapolation of the trend yielded estimates of the trend values of wages. These were then used as proxies for actual wages in machine-building as the latter are not available. A major shortcoming of this procedure is, of course, that cyclical variations in wage rates are not taken into account. Similar German data - which may be of some significance here given the high degree of exchange between the two economies - suggest that these variations were particularly pronounced in the early 1870s. Yet a comparison with the German figures for 1870 to 1913 shows, too, that the assumption of a secular increase in wages is likely to be adequate. For a series of average annual labour incomes in German metal-working see Hoffmann, *Wachstum*, pp.468-471.

[33] Cf. Feinstein, *National Income*, p.188.

total volume of iron used in machines[34]. These percentages have been used to compute weights with which to combine the five material input price series (Table A.5). As no continuous price data for other raw materials and semi-finished inputs are available, the weight share of cast iron has been raised to 55 per cent, that of bar iron to 45 per cent[35]. The three prices for cast iron have been weighted according to the average 1870 to 1913 shares of Austrian cast iron, Hungarian cast iron and imported cast iron, respectively, in total Austro-Hungarian cast iron consumption. The price relative of coal is used to represent changes in fuel prices.

Table A.5

WEIGHTS USED IN INPUT PRICE INDEX

price relative	weight in price index
ACI_t	0.50*0.80*0.55*0.505 = 0.111
HCI_t	0.50*0.80*0.55*0.079 = 0.017
ICI_t	0.50*0.80*0.55*0.416 = 0.092
ABI_t	0.50*0.80*0.45 = 0.180
ACO_t	0.50*0.20 = 0.100
WPA_t	0.50 = 0.500
	1.000

Source: See text.

[34] Verein Deutscher Maschinenbau-Anstalten, *Denkschrift über die Maschinenindustrie der Welt. Bestimmt für das Kommitte B des vorbereitenden Ausschusses der internationalen Wirtschaftskonferenz des Völkerbundes* (Berlin, 1926), p.39.

[35] Prices for support iron (profiles) and sheet metal, for example, are available only for the post-1889 period; see Appendix C, Tables C.2 and C.3. They have not been included in the price index in order to ensure its consistency over time.

d. An Evaluation of the New Output Estimates

As a consequence of changes in the data collection procedures, the three Austrian industrial surveys of 1870, 1880 and 1885 do not present fully compatible sets of information[36]. Nachum Gross has pointed out that "they cannot be utilized for determining short-run trends of development"[37]. But the results of these surveys nevertheless prove useful in evaluating the new estimates derived here. If the quality of the survey data suffers mainly from incomplete coverage of the various industries, it seems quite likely that the reported output levels in each industry represent *minima*[38]. The contemporary spot estimates of production in Austrian machine-building can thus be seen as lower limits against which to measure the new output estimates (Table A.6).

---

[36] Gross, N.T., "Industrialization in Austria in the Nineteenth Century" (unpublished doctoral thesis, University of California, Berkeley, 1966), pp.167-185, and "Austrian Industrial Statistics 1880/85 and 1911/13", *Zeitschrift für die gesamte Staatswissenschaft* 124 (1968), pp.39-48.

[37] Gross, "Industrialization in Austria", p.173.

[38] In general, a firm had to pay more than 42 florins business tax for inclusion in the 1880 industrial survey. In the 1885 survey, the limit was lowered to 21 florins in Vienna and 10.5 florins anywhere else. Both surveys stress that the reported output figures are minimum values. Similarly, the value of output reported in the 1870 survey is largely that of "factory establishments" only, though some small-scale manufacturers had been included in the survey, too. See Handelsministerium, "Statistik der österreichischen Industrie 1870, 1880, 1885", *NIHV*, vols. 3, (1874) No.2, p.173; 28 (1884), pp. VIII-X, 94-97; 38 (1888/89), pp. VII-VIII, 106-109. Cf. Gross, "Industrialization", p. 170.

Table A.6

A COMPARISON OF OUTPUT LEVELS (MILLION CURRENT CROWNS)

	(1) Contemporary Estimates	(2) New Estimates
1870	89.78	92.38
1880	59.83	91.28
1885	86.09	107.98

Sources: (1) Handelsministerium, "Statistik der österreichischen Industrie 1870, 1880, 1885", *NIHV*, vols. 3 (1874) No.2, p.145; 28 (1884), pp.94-97; 38 (1888/89), pp.106-109). (2) Table A.13, column (1).

Estimated output is very close to the probable minimum level for 1870. The value of production is, clearly, not over-estimated and one may thus assume that no downward bias has been introduced into computed long run growth of output. For 1880 and 1885 the new estimates are well above the benchmarks. Though the divergence may to some extent be explained by cyclical variations in the actual input/output ratio, it seems more likely that the contemporary approximations are indeed reflecting only a part of total output in the industry[39].

Due to changes in the input structure which are not allowed for in the estimates, output probably rose somewhat slower during the 1870's and 1880's than implied in the new figures. Mosser points out that, at the time, wood was

[39] This holds especially for 1880. An inexplicably high input/output ratio of 3.50 would result from dividing the machine-building inputs derived here by the contemporary output estimate of 59.83 million crowns. This ratio is far above the maximum observed for 1889 to 1911 (see Table A.4). In any case, assuming the difference between the output estimates were to originate from an over-estimation of input (and thus output) levels for 1880 and 1885, the argument put forward in this thesis, namely that the rate of expansion during this period was considerably slower than assumed so far, would be strengthened further. For the survey data imply a fall in nominal output between 1870 and 1885.

still an important input of the machine-building industry[40]. He emphasizes that failure to account for this - as implied in a constant ratio of iron and steel inputs to value of output - must necessarily lead to an over-estimation of output growth. For the volume of material inputs in the early years is under-estimated relative to the volume of inputs in later years when wood had eventually been substituted by iron and steel. Unfortunately, no sufficiently detailed and continuous records on the machine-building industry's material inputs are available. But data on Austro-Hungarian foreign trade indicate that wood was indeed a significant input material at the time. In 1870, for example, machines and equipment largely made of wood accounted for more than 17 per cent of Austro-Hungarian machinery exports in terms of both weight and value. Ten years later, more than 9 per cent of exports still consisted of wooden machinery[41]. The respective shares were substantially higher for imports and exports of agricultural machines[42]. Thus a gradually rising

---

[40] Mosser, A., *Die Industrieaktiengesellschaft in Österreich: Versuch einer historischen Bilanz- und Betriebsanalyse* (Vienna, 1980), p.173.

[41] Machinery made of wood in percent of Austro-Hungarian foreign trade in machinery:

	imports		exports	
	weight	value	weight	value
1870	5.7	4.7	17.9	17.4
1875	8.9	9.5	3.7	3.7
1880	8.8	8.4	9.1	10.4
1885	6.6	4.6	7.3	5.0

See K.k. Statistische Central-Commission, *Ausweise über den auswärtigen Handel Österreichs 1870*, pp. 56-57, 98-99; *1875*, pp. 58-59, 100-101; *1880*, II, pp. 64-67, III, pp.42-43 (Vienna, 1873-1881) and "Statistik des auswärtigen Handels 1885", *ÖStat*, vol.14 (1886/87), II, pp. 48-51; III, pp.30-31.

[42] Agricultural machinery made of wood in percent of total Austro-Hungarian imports and exports of agricultural implements:

	imports		exports	
	weight	value	weight	value

input/output ratio for the 1870s and early 1880s - accounting for shifts in the composition of inputs towards a larger share of iron and steel - would probably allow for a more accurate approximation of output than the constant ratio used here. For the later decades, however, this argument cannot hold. According to the foreign trade statistics, wood had probably lost its significance as an engineering material by 1890. One would, therefore, rather expect a longer run *decline* of the input/output ratio as a result of technological progress. Hoffmann has shown that in the capital goods industries, in particular, the metal weight per unit of output of machines declined during the late nineteenth century[43]. But here, it seems, the ratio of material inputs to the value of output remained more or less constant or even rose somewhat in the longer term. To some extent, the volume of iron and steel inputs associated with mechanical engineering is probably still over-estimated. At least some of the growth in iron and steel consumption of other expanding industries like construction, ship-building and armaments has been attributed to machine-building. For apart from rails, railway related materials and a minimum portion of iron and steel used in metal-working, no further allowances for iron and steel use in other branches of industry have been made due to a lack of data[44]. It seems indeed implausible that - throughout the late nineteenth century - Austrian

---

1880	36.5	40.8	29.9	34.9
1885	52.6	47.2	22.7	18.1

See Statistische Central-Commission, *Ausweise über den auswärtigen Handel 1880*, II, pp.64-67; III, pp. 42-43 and "Statistik des auswärtigen Handels 1885", *ÖStat*, vol.14 (1886/87), II, pp. 48-51; III, pp.30-31.

[43] Hoffmann, *Wachstum*, p.64.

[44] Cf. Sandgruber, R., *Die Anfänge der Konsumgesellschaft: Kosumgüterverbrauch, Lebensstandard und Alltagskultur in Österreich im 18. und 19. Jahrhundert* (Munich, 1982) p. 103, who points to the importance of iron and steel inputs in construction and metal-working with reference to Rudolph's engineering consumption series.

engineering should have made no progress with respect to production techniques or inventory management and that - in contrast to the experience in other countries - there was an increase rather than decrease in the average metal weight per value unit of machinery output. With an upwardly biased input series, however, productivity improvements are not necessarily expressed in terms of an absolute fall in the input/output ratio, but in a constant ratio.

Table A.7

AUSTRIAN IRON AND STEEL PRODUCTION
(1000 TONS)

	cast iron	steel	wrought iron
1913	273.43	1,781.36	59.07
1912	286.66	1,888.75	64.46
1911	266.25	1,600.87	75.79
1910	264.16	1,504.32	79.63
1909	250.54	1,325.90	79.37
1908	199.19	1,392.89	120.63
1907	191.25	1,249.60	117.98
1906	177.82	1,143.45	114.22
1905	172.58	1,041.49	109.98
1904	168.31	913.84	102.46
1903	162.20	833.59	108.48
1902	160.28	837.72	115.31
1901	145.36	787.75	150.79
1900	121.07	808.82	158.51
1899	124.03	784.39	175.80
1898	120.07	722.69	174.50
1897	125.26	626.25	162.20
1896	123.78	582.71	161.30
1895	117.96	497.64	146.70
1894	122.31	453.48	142.00
1893	108.28	380.45	126.20
1892	100.74	352.29	131.60
1891	99.16	334.07	131.30
1890	91.56	342.88	130.38
1889	61.50	308.99	135.40
1888	69.30	292.19	145.70
1887	66.26	233.94	131.40
1886	57.42	202.92	129.00
1885	60.31	206.13	143.50
1884	63.19	197.85	151.80
1883	47.65	233.48	196.50
1882	43.31	198.68	208.45
1881	41.80	150.01	196.40
1880	33.98	113.34	186.60
1879	29.89	99.55	139.50
1878	29.45	108.92	178.60
1877	34.36	91.97	174.90
1876	40.17	90.77	198.80
1875	41.19	84.50	211.90
1874	41.49	77.86	222.40

cont. Table A.7

	cast iron	steel	wrought iron
1873	50.45	71.22	230.70
1872	61.95	66.03	293.80
1871	41.20	40.84	245.20
1870	37.26	25.36	203.00

Sources: (1) cast iron: annual issues of k.k. Statistische Central-Commission, *Statistisches Jahrbuch der österreichischen Monarchie* (Vienna, 1870-1882), and *Österreichisches Statistisches Handbuch für die im Reichsrathe vertretenen Königreiche und Länder* (Vienna, 1883-1915). (2) steel and wrought iron (1900-1913): Kupelwieser, F., "Die Erzeugung von Flusseisen und Stahl im XIX. Jahrhundert in Oesterreich-Ungarn", *Österreichische Zeitschrift für Berg- und Hüttenwesen* (hereafter *ÖZBH*) XLIX (1900), pp.656-657. Schuster, F., "Die Stahlproduktion Österreich-Ungarns", *ÖZBH* LVII (1910), pp.378-379. *ÖZBH* LIX (1911), p.227, LX (1912), p.292; LXI (1913), p.196; LXII (1914),p.95. (3) wrought iron (1870-1899): estimates based on data given in Beck, L., *Die Geschichte des Eisens in technischer und kulturgeschichtlicher Beziehung*, 5. Abteilung: *Das XIX. Jahrhundert* (Braunschweig, 1903), pp.1143-1144, 1376.

Table A.8

AUSTRIAN NET IMPORTS OF CAST IRON AND BAR IRON
(1000 TONS)

	cast iron	bar iron
1913	134.90	-52.00
1912	172.96	-10.79
1911	47.72	-50.80
1910	78.21	-47.40
1909	98.98	-9.80
1908	141.49	26.91
1907	127.60	-34.46
1906	60.98	-41.70
1905	43.07	-18.38
1904	21.54	-22.46
1903	33.70	-20.40
1902	27.32	-21.10
1901	56.70	-10.71
1900	65.15	-19.59
1899	99.34	-18.08
1898	121.01	0.47
1897	124.89	-6.24
1896	98.33	1.82
1895	97.23	-1.15
1894	73.39	-0.86
1893	48.39	-5.40
1892	35.31	-5.01
1891	33.51	-2.14
1890	45.24	-10.32
1889	72.53	-11.72
1888	55.54	-8.64
1887	37.45	-10.41
1886	42.89	-9.83
1885	37.35	-8.27
1884	71.68	-7.32
1883	105.35	-7.39
1882	84.40	-10.91
1881	63.40	-13.28
1880	39.28	-11.99
1879	36.71	-10.58
1878	31.77	-9.79
1877	30.36	-9.86
1876	29.53	-8.22
1875	43.68	-5.73
1874	38.13	-3.43

cont. Table A.8

	cast iron	bar iron
1873	147.51	13.65
1872	182.19	29.85
1871	161.26	23.74
1870	134.36	13.06

Sources: (a) k.k. Statistische Central-Commission, *Ausweise über den auswärtigen Handel Österreichs* (Vienna, 1871-1882), *1870*, pp.28, 86; *1871*, pp.28, 86; *1872*, pp.28, 86; *1873*, pp.30, 88; *1874*, pp.LXVIII-LXIX, 30, 88; *1875*, pp.30, 88; *1876*, pp.30, 88; *1877*, pp.30, 88; *1878*, II, p.40, III, p.30; *1879*, II, pp.56-58, III, p.38; *1880*, II, pp.56-58, III, p.38; *1881*, II, pp.56-58, III, p.38.
(b) Statistische Central-Commission, "Statistik des auswärtigen Handels", *ÖStat,* vol. 4 (1883/84), II, p.186, III, p.62; vol. 7 (1884), II, p.42, III, p.27; vol. 10 (1885/86), II, p.42, III, p.26; vol. 14 (1886/87), II, p.42, III, p.26; vol. 17 (1887/88), II, p.42, III, p.26; vol. 20 (1888/89), II, p.32c, III, p.24c; vol. 23 (1889/90), II, pp.56, 58, III, p.34; vol. 26 (1890/91), II, p.58, III, p.34; vol. 29 (1891/92), II, p.58, III, p.34.
(c) k.k. Handelsministerium, Statistisches Departement, *Statistik des auswärtigen Handels des österreichisch-ungarischen Zollgebiets* (Vienna, 1893-1916), *1896* (I1), pp.498-499, 527; *1901* (I2), pp.22, 51-52; *1905* (I2), pp.22, 51-52; *1911* (IV), pp.152-153, 209-210; *1915* (IV), pp.71-72, 130.
(d) k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XXXVIII: Eisen und Eisenwaren* (Vienna, 1912), pp.3, 16.
(e) Handelsministerium, *Statistik des Zwischenverkehrs 1906*, p.53; *1908*, pp.100-101; *1910*, pp.100-101; *1912*, pp.100-101.
(f) Központi Statisztikai Hivatal, "Külkereskedelmi Forgalma", pp.270, 272.
(g) For sources on iron and steel production data used to approximate internal trade for 1870 to 1882 (bar iron) and 1870 to 1905 and 1913 (cast iron) see Tables A.7 and A.16.

Table A.9

AUSTRIAN NET IMPORTS OF SHEET METAL AND INGOTS
(1000 TONS)

	sheet metal and plate	smelted iron and ingots
1913	-34.50	27.98
1912	-19.72	14.21
1911	-11.40	6.61
1910	-6.10	6.05
1909	12.80	3.15
1908	9.95	46.09
1907	-4.79	18.96
1906	-7.62	8.54
1905	-1.62	2.23
1904	10.32	-3.60
1903	8.18	-3.99
1902	5.81	0.94
1901	6.57	1.35
1900	12.60	-10.35
1899	3.59	-4.94
1898	5.93	6.56
1897	2.32	3.89
1896	2.62	8.88
1895	3.89	1.76
1894	7.24	1.90
1893	6.05	0.57
1892	4.49	1.72
1891	3.27	2.94
1890	1.13	0.95
1889	0.51	1.56
1888	-3.76	1.25
1887	-4.37	2.30
1886	-5.57	1.89
1885	-5.96	0.40
1884	-5.66	2.10
1883	-8.81	3.18
1882	-5.12	3.45
1881	-4.51	0.25
1880	-5.14	-0.82
1879	-4.92	-0.26
1878	-4.71	-2.84
1877	-4.40	-2.53
1876	-4.16	-2.19
1875	-3.94	-2.57
1874	-3.63	-2.96

cont. Table A.9

	sheet metal and plate	smelted iron and ingots
1873	0.93	-1.92
1872	1.69	-1.80
1871	2.60	-1.75
1870	1.03	-1.98

Sources: (a) Statistische Central-Commission, *Ausweise über den auswärtigen Handel 1870*, pp.28, 86; *1871*, pp.28, 86; *1872*, pp.28, 86; *1873*, pp.30, 88; *1874*, pp.LXVIII-LXIX, 30, 88; *1875*, pp.30, 88; *1876*, pp.30, 88; *1877*, pp.30, 88; *1878*, II, p.40, III, p.30; *1879*, II, pp.56, 58, III, p.38; *1880*, II, pp.56, 58, III, p.38; *1881*, II, pp.56, 58, III, p.38.
(b) Statistische Central-Commission, "Statistik des auswärtigen Handels", *ÖStat,* vol. 4 (1883/84), II, pp.40, 120, 186, III, pp.20, 62; vol. 7 (1884), II, p.42, III, p.27; vol. 10 (1885/86), II, p.42, III, p.26; vol. 14 (1886/87), II, p.42, III, p.26; vol. 17 (1887/88), II, p.42, III, p.26; vol. 20 (1888/89), II, p.32c, III, p.24c; vol. 23 (1889/90), II, p.58, III, pp.34, 36; vol. 26 (1890/91), II, pp.58, 60, III, pp.34, 36; vol. 29 (1891/92), II, pp.58, 60, III, pp.34, 36.
(c) Handelsministerium, *Statistik des auswärtigen Handels 1896* (I1), pp.498-499, 528; 1901 (I2), pp.22-23, 52; 1905 (I2), pp.22-23, 52; 1911 (IV), pp.152-153, 210-211; 1915 (IV), pp.71-72, 130-131.
(d) Handelsministerium, *Statistische Materialien Eisen*, pp.10-15, 22.
(e) Központi Statisztikai Hivatal, "Külkereskedelmi Forgalma", p.274.
(f) See sources given in Table A.8 for bar iron import data used for approximating Austria's share in the Monarchy's net imports of smelted iron and ingots.

Table A.10

AUSTRIAN PRODUCTION OF RAILS AND RAILWAY MATERIALS (1000 TONS)

	rails	railway materials
1913	114.23	23.78
1912	103.77	21.60
1911	113.77	23.66
1910	93.46	19.46
1909	113.95	23.72
1908	149.20	31.06
1907	108.83	22.66
1906	85.68	17.84
1905	87.13	18.14
1904	81.11	16.89
1903	94.24	19.62
1902	87.78	18.28
1901	85.36	17.77
1900	83.07	17.30
1899	98.14	20.43
1898	116.39	24.23
1897	91.28	19.00
1896	82.96	17.27
1895	75.36	15.69
1894	64.41	13.41
1893	64.60	13.45
1892	48.89	10.18
1891	66.98	13.95
1890	84.97	17.69
1889	87.23	18.16
1888	100.51	20.93
1887	119.64	24.91
1886	113.67	23.67
1885	83.13	17.31
1884	119.75	24.93
1883	165.00	34.35
1882	121.03	25.20
1881	79.87	16.63
1880	61.03	12.71
1879	28.70	5.98
1878	29.87	6.23
1877	55.44	11.54
1876	64.72	13.47
1875	81.77	17.02
1874	82.76	17.23

cont. Table A.10

	rails	railway materials
1873	79.37	16.52
1872	125.91	26.21
1871	128.62	26.78
1870	105.27	21.92

Sources: (1) rails: (a) production 1870, 1880, 1885: Handelsministerium, "Statistik der österreichischen Industrie 1870, 1880, 1885", *NIHV*, vols. 3 (1874) No.1, pp.35-38; 28 (1884), pp.76-77; 38 (1888/89), pp.88-89. (b) production 1883: *Stahl und Eisen* 4 (1884) No.1, p.64 (quoted in Rudolph, Banking and Industrialization, p.223); (c) production 1890-1913: *Stahl und Eisen* 32 (1912) No.38, p.1587; 34 (1914) No.9, p.383. (d) rail imports: Statistische Central-Commission, *Ausweise über den auswärtigen Handel 1870*, pp.28, 86; *1871*, pp.28, 86, *1872*, 28, 86; *1873*, pp.30, 88; *1874*, pp.LXVIII-LXIX, 30, 88; *1875*, pp.30, 88; *1876*, pp.30, 88; *1877*, pp.30, 88; *1878*, II, p.40, III, p.30; *1879*, II, p.56, III, p.38; *1880*, II, p.56, III, p.38; *1881*, II, p.56, III, p.38; and "Statistik des auswärtigen Handels", *ÖStat,* vol. 4 (1883/84), II, pp.40, 120, 186, III, p.62; vol. 7 (1884), II, p.42, III, p.27; vol. 10 (1885/86), II, p.42, III, p.26; vol. 14 (1886/87), II, p.42, III, p.26; vol. 17 (1887/88), II, p.42, III, p.26; vol. 20 (1888/89), II, p.32c, III, p.24c; vol. 23 (1889/90), II, p.58, III, p.34; vol. 26 (1890/91), II, p.58, III, p.34; vol. 29 (1891/92), II, p.58, III, p.34.
(e) new track opened: Statistische Central-Commission, *Statistisches Jahrbuch 1873*, IV, pp.4-5, 13; *1874*, IV, pp.2-3, 8-9; and Statistisches Handbuch im 1882, p.192; 1914, p.191. Magyar Kir. Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv 1912*, p.245.
(2) railway materials: Handelsministerium, "Statistik der österreichischen Industrie 1890", *NIHV*, vol.54 (1894), pp.98-99, and the data for rail production given in this table.

Table A.11

AUSTRIAN CONSUMPTION OF IRON AND STEEL
(1000 TONS)

	(1) in metal-working	(2) in machine-building
1913	527.63	1,524.60
1912	583.91	1,687.20
1911	462.20	1,335.60
1910	454.03	1,311.90
1909	417.35	1,206.00
1908	451.69	1,305.20
1907	397.02	1,147.20
1906	347.64	1,004.50
1905	319.86	924.23
1904	280.85	811.53
1903	259.13	748.77
1902	262.30	757.92
1901	266.02	768.66
1900	266.32	769.53
1899	268.81	776.74
1898	259.83	750.78
1897	238.66	689.62
1896	226.04	653.16
1895	198.73	574.25
1894	185.53	536.11
1893	150.79	435.70
1892	144.51	417.56
1891	134.00	387.19
1890	128.33	370.83
1889	119.13	344.24
1888	110.59	319.55
1887	80.22	231.80
1886	72.34	209.02
1885	85.62	247.40
1884	84.58	244.39
1883	95.28	275.32
1882	96.68	279.36
1881	86.79	250.78
1880	72.38	209.14
1879	65.61	189.60
1878	75.93	219.39
1877	63.71	184.10
1876	68.52	197.99
1875	69.48	200.76
1874	69.38	200.49

cont. Table A.11

	(1) in metal-working	(2) in machine-building
1873	107.12	309.53
1872	123.82	357.77
1871	91.96	265.73
1870	73.25	211.65

Sources: (1) metal-working: Handelsministerium, "Statistik der österreichischen Industrie 1890", *NIHV*, vol.54 (1894), pp.98-99, and Tables A.7 to A.10. (2) machine-building: Tables A.7 to A.11, column (1).

Table A.12a

GROSS PRODUCTION: BOILER-MAKING AND MACHINE-SHOPS (1000 CURRENT CROWNS)

1911	122,702.3	1903	70,864.0
1910	114,141.7	1902	69,838.9
1909	108,468.6	1901	60,488.0
1908	108,755.4	1900	59,973.1
1907	94,099.4	1899	41,941.1
1906	86,590.9	1898	38,554.9
1905	80,296.6	1897	34,047.4
1904	74,676.0		

Sources: (1) wage-sum data: Ministerium des Innern, *Unfallstatistik 1897-1901, 1902-1906, 1907-1911*, Gruppe VIa, Titel 166, 170, 170a, 170a & 170, 170a & 147, 170a & 205 & 210, 176 and 177. (2) wage-sum/production ratio: Table A.3. Ratio used here: 17.5 per cent.

Table A.12b

GROSS PRODUCTION: LOCOMOTIVE ENGINEERING AND GENERAL MACHINE-BUILDING (1000 CURRENT CROWNS)

1911	264,260.5	1903	173,007.8
1910	255,341.5	1902	175,404.9
1909	286,441.5	1901	211,721.5
1908	294,290.2	1900	213,218.0
1907	272,166.3	1899	208,889.3
1906	231,624.4	1898	190,761.5
1905	194,922.0	1897	171,286.8
1904	178,004.4		

Sources: (1) wage-sum data: Ministerium des Innern, *Unfallstatistik 1897-1901, 1902-1906, 1907-1911*, Gruppe VIa, Titel 174, 175, 175 & 170a, 175 & 170 & 170a, 175 & 170a & 190 & 170 and 183. (2) wage-sum/production ratio: Table A.3. Ratio used here: 20.5 per cent.

Table A.12c

GROSS PRODUCTION: AGRICULTURAL MACHINERY (1000 CURRENT CROWNS)

1911	62,271.6	1903	32,629.2
1910	58,788.4	1902	28,922.0
1909	51,489.2	1901	25,187.6
1908	48,463.2	1900	26,852.0
1907	45,905.2	1899	26,139.6
1906	41,500.0	1898	23,214.0
1905	35,956.4	1897	20,085.2
1904	35,369.2		

Sources: (1) wage-sum data: Ministerium des Innern, *Unfallstatistik 1897-1901, 1902-1906, 1907-1911*, Gruppe VIa, Titel 173. (2) wage-sum/production ratio: Table A.3. Ratio used here: 25 per cent.

Table A.12d

GROSS PRODUCTION: SEWING- AND KNITTING MACHINES
(1000 CURRENT CROWNS)

1911	7,671.6	1903	5,265.7
1910	7,277.5	1902	4,763.9
1909	5,909.5	1901	4,755.0
1908	6,763.0	1900	3,784.9
1907	6,126.6	1899	5,716.9
1906	6,057.1	1898	6,200.0
1905	5,320.4	1897	6,050.3
1904	6,059.8		

Sources: (1) wage-sum data: Ministerium des Innern, *Unfallstatistik 1897-1901, 1902-1906, 1907-1911* Gruppe VIa, Titel 180. (2) wage-sum/production ratio: Table A.3. Ratio used here: 33.8 per cent.

Table A.12e

GROSS PRODUCTION: OTHER MACHINE-BUILDING
(1000 CURRENT CROWNS)

1911	47,289.2	1899	25,236.9
1910	42,812.8	1898	23,643.9
1909	39,404.8	1897	20,789.3
1908	37,764.0	1896	236,152.1
1907	34,478.4	1895	225,152.1
1906	29,729.5	1894	221,187.5
1905	27,522.0	1893	201,748.7
1904	26,829.9	1892	186,831.1
1903	25,779.8	1891	176,224.1
1902	25,404.6	1890	159,580.9
1901	26,110.1	1889	142,949.5
1900	25,843.6		

Note: The figures given for 1889 to 1896 represent the *total* of Austrian machine-building production

Sources: (1) wage-sum data: Ministerium des Innern, *Unfallstatistik 1889*, Gruppe IVa, pp.36-37; *1890*, Gruppe VIa, pp.66-67; *1893*, Gruppe VIa, pp.80-81; *1896*, Gruppe VIa, pp.94-95; *1897-1901, 1902-1906, 1907-1911*, Gruppe VIa, Titel 167, 168, 169, 171, 172, 178, 179, 181, 182 and 184. (2) wage-sum/production ratios: Table A.3. Ratios used here: 22.1 per cent (1897-1911); 17.6 per cent for Titel 181 only (1897-1911); 20.89 per cent for total (1889-1896).

Table A.13

GROSS OUTPUT OF AUSTRIAN MACHINE-BUILDING INDUSTRY
(1000 CROWNS)

	(1) in current prices	(2) in constant (1913) prices
1913	585,978.8	585,978.8
1912	648,489.9	656,921.6
1911	504,195.2	517,811.4
1910	478,361.9	496,150.9
1909	491,713.5	510,933.7
1908	496,035.9	506,489.0
1907	452,776.1	465,195.4
1906	395,501.9	421,915.0
1905	344,017.3	386,730.0
1904	320,939.2	363,715.7
1903	307,546.5	349,523.2
1902	304,334.2	346,871.8
1901	328,262.3	363,375.2
1900	329,671.7	349,779.8
1899	307,923.8	335,797.2
1898	282,374.1	318,385.3
1897	252,259.1	286,979.9
1896	236,152.1	271,775.6
1895	225,152.1	266,916.4
1894	221,187.5	258,543.7
1893	201,748.7	237,080.8
1892	186,831.1	221,675.2
1891	176,224.1	203,314.9
1890	159,580.9	183,736.2
1889	142,949.5	168,954.8
1888	139,468.4	167,130.1
1887	101,168.0	122,508.0
1886	91,225.6	111,352.8
1885	107,979.4	129,542.2
1884	106,663.3	125,711.2
1883	120,165.8	137,018.9
1882	121,925.2	139,742.8
1881	109,453.4	128,530.9
1880	91,278.1	106,561.3
1879	82,749.5	94,559.0
1878	95,752.8	109,173.5
1877	80,350.7	88,416.8
1876	86,411.9	95,220.3
1875	87,623.1	91,220.6
1874	87,504.4	86,288.9

cont. Table A.13

	(1) in current prices	(2) in constant (1913) prices
1873	135,094.4	123,126.0
1872	156,150.6	139,957.7
1871	115,979.5	108,243.3
1870	92,377.0	88,594.8

Sources: Estimates based on Tables A.7 to A.12e. See Table A.14 for price index used.

Table A.14

INPUT PRICE INDEX (1913=100)

1913	100.00	1891	86.68
1912	98.72	1890	86.85
1911	97.37	1889	84.61
1910	96.41	1888	83.45
1909	96.24	1887	82.58
1908	97.94	1886	81.92
1907	97.33	1885	83.35
1906	93.74	1884	84.85
1905	88.96	1883	87.70
1904	88.24	1882	87.25
1903	87.99	1881	85.16
1902	87.74	1880	85.66
1901	90.34	1879	87.51
1900	94.25	1878	87.71
1899	91.70	1877	90.88
1898	88.69	1876	90.75
1897	87.90	1875	96.06
1896	86.89	1874	101.41
1895	84.35	1873	109.72
1894	85.55	1872	111.57
1893	85.10	1871	107.15
1892	84.28	1870	104.27

Sources: (1) prices of Austrian cast iron, bar iron and imported cast iron: Appendix C, Tables C.1 and C.3. (2) prices of Hungarian cast iron: Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv 1879*, IV, p.26; *1889*, IV, p.26; *1893*, pp.120-121: *1895*, p.151; *1897*, p.131; *1898*, p.97; *1903*, p.145; *1911*, p.153; *1913*, p.117. (3) coal prices: Statistische Central-Commission, *Statistisches Jahrbuch 1870*, pp.68-69; *1871*, pp.72-73; *1872*, II, pp.38-39; *1873*, II, pp.38-39; *1874*, II, pp.38-39; *1875*, II, pp.34-35; *1876*, II, pp.34-35; *1877*, II, pp.34-35; *1878*, II, pp.34-35; and *Statistisches Handbuch 1885*, pp.120-121; *1895*, pp.152-153; *1900*, p.162; *1904*, p.150; *1909*, p.221; *1913*, p.110. (4) wages: see sources given in Tables A.12a to A.12e. (5) weights: Table A.5.

II. Hungarian Machine-Building Production

1. Contemporary Output Data

As a consequence of lacking data, the estimation of output in Hungary's machine-building industry had to rely on a considerably thinner statistical basis than that for Austrian production. Though fairly comprehensive spot estimates of output are available for 1898 and 1906, wage-bill data - which could be used for further approximations of output - do exist only for 1909 to 1912. A summary is given below (Table A.15).

2. The New Output Estimate

a. Iron and Steel Inputs

Starting point for the estimation of output was, again, a series of iron and steel inputs based on ten subseries. These were derived as a means to obtain the consumption of iron and steel in Hungarian machine-building as a residual (Table A.20, column (2)).

Data for Hungarian *cast iron and steel production* are available from contemporary sources for the whole period discussed here. No estimates or adjustments were necessary. As for Austria, production of *wrought iron* had to be estimated for most years between 1870 and 1899. An estimate was prepared in identical fashion, using the shares of steel in total Hungarian wrought iron and steel production in those years for which data are available as a means to derive wrought iron output (see Table A.1). Hungarian iron and steel production is reproduced in Table A.16.

Hungarian *net imports of iron and steel* have been computed in exact correspondence to the respective trade flows for Austria, using the same sources and methods (Table A.17 to A.18).

Hungary's *output of rails* had to be estimated for 1870 to 1889 as rail production figures are available only for 1890 to 1913. The iron works of the Austro-Hungarian State Railway Company in Anina and Resicza introduced the production of iron rails in Hungary in 1866. Manufacturing of steel rails began during the early 1870s[45]. At the iron and steel works in Diósgyőr, explicitly set up by the government to cater for railway needs, rail production commenced in 1871[46]. In brief, Hungarian production of rails was in its initial stages at the time and output seems likely to have been low relative to Austrian levels. For 1870 to 1889, Hungarian output of rails was estimated as a function of iron and steel consumption. In 1890, the volume of rail production accounted for 26 per cent of Hungary's consumption of iron and steel (exclusive of net imports of sheet metal). This share was used to compute estimates of rail production for the earlier years[47]. Rail production is given in Table A.19.

In a further step to isolate machine-building iron and steel inputs, both the production of *railway related*

---

[45] Matlekovits, A. v., *Das Königreich Ungarn*, vol. II (Leipzig, 1900), pp.178-197.

[46] The Diósgyőr works introduced the Siemens-Martin process in 1878/79 and phased out the production of iron rails. By 1882, almost all rails were made of steel; Matlekovits, *Königreich Ungarn*, pp.179-181, 330-331. As the very low production levels for 1880, 1881 and 1882 indicate, the transformation of the plant took time and effected output.

[47] Though based on the simplifying assumption of a constant ratio, the results obtained look plausible. In the early 1890s, the Diósgyőr plant's output of rails accounted on average for approximately 60 percent of Hungary's total output of rails. However, the share fluctuated from year to year between 35 and 90 percent. (It is because of this volatility that the output data for Diósgyőr - available from 1880 - have not been put to use in the approximation of total rail output.) Comparisons with estimated rail output for 1883 to 1889 indicate an average share of 59 percent of Diósgyőr in total rail output with variations between 39 and 73 percent. See Matlekovits, *Königreich Ungarn*, vol. II, pp.180-181, and Table A.18.

materials and the use of iron and steel in other *metal-working industries* had to be estimated. It was assumed that output of railway materials grew in proportion to Hungarian rail production. The use of iron and steel in metal-working was approximated as a constant share of overall iron and steel consumption (net of rails and railway materials). The two calculations had to be based on Austrian 1890 ratios since, again, no adequate Hungarian figures are available (Tables A.19 and A.20, column (1))[48].

Subtracting the volume of rails and railway materials and the iron and steel used in metal-working from the previously derived series for production and imports of iron and steel (Tables A.16 to A.18) yielded a residual volume series of *iron and steel used in Hungarian machine-building* (Table A.20, column(2)). This was taken to roughly represent material inputs in Hungarian machine-building.

b. The Approximation of Gross Production

The very small number of observations for the value of Hungarian engineering production does not permit the compilation of a meaningful series of input/output ratios. The Austrian input/output ratios were, therefore, used as a proxy to estimate Hungary's machine-building output for 1870 to 1908[49]. For 1909 to 1912, production was estimated on the basis of wage-sum data given in the Hungarian workers' accident insurance statistics (see Table A.15). The output figures so derived allowed the computation of an average 1909-1912 input/output ratio which was then used to

---

[48] Cf. this Appendix, notes 19 and 20.

[49] As in the estimate for Austria, the average 1889 to 1894 ratio was used to approximate output for the 1870s and 1880s. For 1890 to 1908, a three-year moving average of the Austrian ratio was used (rather than the unmodified ratio) to reduce at least part of the impact of cyclical and random fluctuations on the estimate for Hungarian machine-building.

approximate the value of machinery production for 1913. In this way, we obtained a complete series of gross output in Hungarian mechanical engineering for 1870 to 1913 (Table A.21, column (1)). Finally, output in constant (1913) prices was computed, using the input price index given in Table A.14 (Table A.21, column (2)).

c. An Evaluation of the New Output Estimate

As a result of both lacking output figures and incomplete information on inputs, the estimates for Hungarian machine-building rely heavily on Austrian data. Possibly significant differences in the output development of the two countries' engineering sectors are thus not fully taken into account. Alternative output estimates for the early years, which would permit an evaluation of the new estimates' accuracy, do not exist. However, a comparison is possible with the contemporary accounts of production for 1898 and 1906.

Though in the right order of magnitude, estimated output levels (98.14 and 132.12 million crowns, respectively) seem somewhat off the mark when compared with the contemporary approximations of production in mechanical engineering (see Tables A.15 and A.21, column (1)). Possible errors in the input series and short run fluctuations in the *actual* (Hungarian) input/output ratio may account for part of the divergence. But to a large extent, the difference can be explained with the techniques of data gathering and processing employed in the industrial surveys of 1898 and 1906. In 1898, only establishments employing more than 20 people were surveyed[50]. Eight years later, an even more restrictive definition of factory establishment was used[51].

---

[50] Kereskedelmügyi Miniszter, "Gép-gyártás 1898", pp.4-5.

[51] Though no further details about the criteria applied are provided, some smaller establishments included in the 1898 survey were omitted from the 1906 survey as a result of a more narrow definition; Központi Statisztikai Hivatal,

Thus, a presumably significant number of smaller producers were not included in the surveys and, as a result, their output was not recorded. The activity of railway repair shops - which employed about one-third of the total workforce in engineering - was considered, too. As the surveys emphasize, many of these did not only carry out repair work but were engaged in the production of completely new machinery[52]. Their output, though, is not included in the total for mechanical engineering but recorded separately (see Table A.15). Both factors - the restricted scope of the two surveys and the exclusion of machinery production in railway repair shops - suggest a downward bias in the contemporary output estimates. Viewed in this light, the new output estimates presented here seem quite plausible.

Gyáripar 1906, p.546.

[52] Központi Statisztikai Hivatal, *Gyáripar 1906*, p.546.

Table A.15

GROSS PRODUCTION: HUNGARIAN MACHINE-BUILDING
(MILLION CURRENT CROWNS)

1912	179.76	1910	170.53
1911	159.60	1909	167.93
1906	89.00[a]	1898	61.67[a]
	36.35[b]		29.63[b]
	125.35		91.30

[a] mechanical engineering exclusive of ship-building, arms production and manufacturing of transport means

[b] railway repair shops

Sources: (1) 1898: Kereskedelmügyi Magyar Kir. Miniszter, "Gép-gyártás és Közlekedési Eszközök Gyártása", *A Magyar Korona Országainal Gyáripara az 1898. Évben*, V. part, ed. J. Szterény (Budapest, 1901), pp.93-96. (2) 1906: Magyar Kir. Központi Statisztikai Hivatal, *A Magyar Korona Országainak Gyáripara az 1906. Évben*, II. vol, II. part, ed. A. Edvi Ilés (Budapest, 1911), pp.716-717. (3) 1909-1912: (a) wage-sum data: Magyar Kir. Allami Munkásbiztosítási Hivatal, *A magyar királyi állami munkásbiztosítási hivatalnak az 1907. évi XIX. törvényezikk 177. §-a alapján a kereskedelmügyi magyar királyi minister elé terjesztett jelentesé az országos munkásbetegsegélyzö és baleset-biztosító pénztár müködéseröl 1909-1912* (Szeged, 1912, 1914; Arad, 1913; Budapest, 1917), VIII., tételszáma 199- 214, 219, 254-255. (b) wage-sum-production ratios: Table A.3. Before conversion into gross output, the wage data of the various branches of machine-building were grouped in exactly the same way as the respective Austrian figures, see Tables A.12a to A.12e.

Table A.16

HUNGARIAN IRON AND STEEL PRODUCTION (1000 TONS)

	cast iron	steel	wrought iron
1913	13.99	796.29	12.25
1912	11.18	780.75	12.56
1911	15.99	711.92	11.67
1910	14.64	635.95	17.72
1909	15.58	608.30	22.60
1908	17.41	592.08	45.28
1907	17.10	451.27	64.48
1906	17.16	434.69	71.01
1905	17.56	389.17	74.77
1904	17.20	319.52	81.73
1903	18.87	310.97	61.93
1902	18.57	312.53	81.47
1901	20.64	297.70	76.10
1900	22.74	346.12	80.54
1899	19.63	332.64	74.60
1898	20.78	331.55	80.10
1897	17.97	303.31	78.60
1896	17.12	294.69	81.60
1895	21.46	246.91	72.80
1894	17.84	206.95	64.80
1893	16.64	189.23	62.80
1892	14.48	158.86	59.40
1891	14.10	151.97	59.70
1890	14.00	156.72	59.60
1889	12.86	107.52	47.10
1888	10.02	100.62	50.20
1887	10.66	65.25	36.70
1886	9.17	57.05	36.30
1885	11.51	72.65	50.60
1884	13.08	61.07	46.90
1883	11.36	56.34	47.45
1882	14.85	41.09	43.15
1881	15.03	38.34	50.20
1880	11.11	20.88	34.40
1879	8.66	25.35	35.50
1878	10.37	20.50	33.60
1877	8.05	24.25	46.10
1876	10.33	24.01	52.60
1875	8.59	12.20	30.60
1874	10.20	9.30	26.60

cont. Table A.16

	cast iron	steel	wrought iron
1873	10.01	9.04	29.30
1872	10.28	7.09	31.50
1871	10.59	6.86	41.20
1870	11.82	3.63	29.00

Sources: (1) cast iron: Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv 1879*, IV, p.26; *1889*, IV, p.26; *1893*, pp.120-121,;*1895*, p.151; *1897*, p.131; *1898*, p.97; *1903*, p.145; *1911*; p.153; *1913*, p.117. (2) steel and wrought iron: see Table A.7.

Table A.17

HUNGARIAN NET IMPORTS OF CAST IRON AND BAR IRON
(1000 TONS)

	cast iron	bar iron
1913	43.40	21.45
1912	64.26	47.01
1911	41.73	29.72
1910	36.01	16.25
1909	28.77	10.07
1908	53.62	26.23
1907	27.66	12.66
1906	5.17	-0.79
1905	2.34	-8.19
1904	2.56	-8.71
1903	2.56	-8.11
1902	2.48	-0.38
1901	6.11	-2.92
1900	1.07	-16.78
1899	3.19	-10.73
1898	4.84	3.02
1897	8.22	10.03
1896	12.84	13.91
1895	25.20	14.29
1894	25.93	12.66
1893	5.61	15.48
1892	5.16	8.64
1891	2.13	5.54
1890	3.06	5.83
1889	2.18	6.93
1888	0.71	5.95
1887	1.06	3.82
1886	3.09	6.51
1885	3.76	5.26
1884	10.27	7.32
1883	11.88	4.43
1882	6.64	7.31
1881	5.12	2.94
1880	3.33	2.87
1879	3.08	1.42
1878	2.63	3.19
1877	2.70	1.34
1876	2.68	1.65
1875	3.84	2.98
1874	3.36	3.25

cont. Table A.17

	cast iron	bar iron
1873	11.76	4.53
1872	14.59	5.51
1871	12.59	3.33
1870	10.44	2.43

Sources: See Table A.8.

Table A.18

HUNGARIAN NET IMPORTS OF SHEET METAL AND INGOTS
(1000 TONS)

	sheet metal and plate	smelted iron and ingots
1913	1.90	2.50
1912	14.61	1.21
1911	4.18	0.45
1910	-7.34	0.49
1909	-7.39	-0.15
1908	3.31	4.59
1907	6.15	1.95
1906	-5.76	0.65
1905	-8.33	0.19
1904	-12.41	-1.40
1903	-9.86	-1.18
1902	-5.60	-0.97
1901	-5.24	-0.21
1900	-10.49	-2.68
1899	-5.03	-1.30
1898	-0.50	-0.16
1897	2.00	-0.23
1896	4.76	0.24
1895	7.70	0.13
1894	3.88	0.36
1893	7.07	0.17
1892	2.03	0.02
1891	1.42	0.18
1890	0.94	0.09
1889	-0.03	0.21
1888	4.68	0.06
1887	3.58	-0.06
1886	3.62	0.02
1885	3.45	-0.09
1884	5.16	0.15
1883	6.31	0.23
1882	5.26	0.14
1881	3.77	-0.07
1880	2.95	-0.31
1879	2.44	-0.18
1878	3.13	-0.94
1877	2.07	-0.83
1876	2.00	-0.77
1875	2.31	-0.87
1874	2.25	-0.89

cont. Table A.18

	sheet metal and plate	smelted iron and ingots
1873	5.63	-0.66
1872	6.39	-0.71
1871	5.37	-0.71
1870	3.29	-0.70

Sources: See Table A.9.

Table A.19

HUNGARIAN PRODUCTION OF RAILS AND RAILWAY MATERIALS
(1000 TONS)

	rails	railway materials
1913	141.47	29.45
1912	114.64	23.89
1911	92.03	19.16
1910	62.38	12.99
1909	93.31	19.43
1908	110.67	23.04
1907	54.22	11.29
1906	51.41	10.70
1905	44.00	9.16
1904	29.27	6.09
1903	30.67	6.39
1902	32.90	6.85
1901	35.33	7.36
1900	50.37	10.49
1899	44.40	9.25
1898	75.39	15.70
1897	73.16	15.23
1896	86.89	18.09
1895	69.90	14.55
1894	45.62	9.50
1893	25.86	5.38
1892	28.96	6.03
1891	56.96	11.86
1890	62.88	13.09
1889	46.46	9.67
1888	44.03	9.17
1887	30.86	6.43
1886	29.47	6.14
1885	37.76	7.86
1884	36.47	7.59
1883	34.61	7.21
1882	29.74	6.19
1881	29.32	6.10
1880	18.99	3.95
1879	19.40	4.04
1878	18.23	3.79
1877	21.45	4.47
1876	23.78	4.95
1875	15.07	3.14
1874	13.62	2.84

cont. Table A.19

	rails	railway materials
1873	16.81	3.50
1872	17.94	3.73
1871	19.41	4.04
1870	14.88	3.10

Sources: (1) rails: (a) 1870-1889: estimates based on Hungarian iron and steel consumption (Tables A.16 to A.18). (b) 1890-1913: *Stahl und Eisen* 32 (1912) No.38, p.1587; 34 (1914) No.9, p.383. (2) railway materials: estimates based on Austrian 1890 railway materials/rail production ratio (Table A.10) and the data for Hungarian rail production given in this table, column (1).

Table A.20

HUNGARIAN CONSUMPTION OF IRON AND STEEL
(1000 TONS)

	(1) in metal-working	(2) in machine-building
1913	185.33	535.52
1912	203.90	589.17
1911	181.12	523.35
1910	164.12	474.23
1909	145.27	419.77
1908	156.52	452.28
1907	132.60	383.16
1906	118.27	341.75
1905	106.53	307.82
1904	93.36	269.77
1903	86.93	251.19
1902	94.70	273.65
1901	89.86	259.64
1900	92.47	267.19
1899	92.38	266.93
1898	89.61	258.93
1897	85.23	246.28
1896	82.32	237.86
1895	78.17	225.87
1894	71.29	206.00
1893	68.33	197.43
1892	54.92	158.68
1891	42.74	123.49
1890	42.23	122.04
1889	31.01	89.62
1888	30.60	88.43
1887	21.53	62.20
1886	20.61	59.55
1885	26.10	75.42
1884	25.68	74.20
1883	24.73	71.46
1882	21.21	61.29
1881	20.54	59.36
1880	13.44	38.84
1879	13.58	39.25
1878	12.97	37.49
1877	14.85	42.92
1876	16.39	47.37
1875	10.66	30.79
1874	9.67	27.95

cont. Table A.20

	(1) in metal-working	(2) in machine-building
1873	12.67	36.62
1872	13.62	39.36
1871	14.34	41.44
1870	10.78	31.15

Sources: (1) metal-working: estimates based on Austrian 1890 share of metal-working in iron and steel consumption (net of rails and railway materials) and the data given in Tables A.16 to A.19. (2) machine-building: Tables A.16 to A.20, column (1).

Table A.21

GROSS OUTPUT OF HUNGARIAN MACHINE-BUILDING INDUSTRY
(1000 CROWNS)

	(1) in current prices	(2) in constant (1913) prices
1913	180,963.0	180,963.0
1912	179,755.0	182,092.2
1911	159,602.9	163,913.2
1910	170,529.2	176,870.5
1909	167,930.0	174,494.1
1908	178,122.9	181,876.5
1907	149,189.1	153,281.3
1906	132,115.0	140,938.2
1905	119,078.0	133,862.5
1904	105,792.7	119,893.3
1903	101,101.2	114,900.4
1902	112,973.2	128,763.8
1901	108,692.2	120,318.6
1900	111,356.0	118,148.1
1899	106,550.7	116,195.7
1898	98,141.2	110,657.1
1897	90,560.2	103,024.8
1896	88,642.5	102,014.2
1895	87,544.9	103,783.9
1894	86,628.9	101,259.6
1893	86,866.8	102,079.8
1892	72,219.4	85,688.3
1891	54,834.9	63,264.6
1890	52,836.4	60,834.2
1889	39,114.2	46,229.8
1888	38,596.7	46,251.8
1887	27,146.8	32,873.1
1886	25,989.1	31,723.2
1885	32,915.7	39,488.8
1884	32,385.8	38,169.3
1883	31,187.6	35,561.6
1882	26,751.0	30,660.3
1881	25,909.4	30,425.4
1880	16,951.3	19,789.6
1879	17,128.9	19,573.5
1878	16,361.3	18,654.5
1877	18,730.6	20,610.9
1876	20,675.2	22,782.7
1875	13,437.7	13,989.4
1874	12,196.8	12,027.3

cont. Table A.21

	(1) in current prices	(2) in constant (1913) prices
1873	15,983.6	14,567.5
1872	17,177.1	15,395.8
1871	18,085.6	16,879.2
1870	13,596.2	13,039.5

Sources: (1) 1909-1912: Table A.15. (2) All other years: estimates based on Tables A.16 to A.20. See Table A.14 for price index used.

APPENDIX B

Balance-Sheets of Austro-Hungarian Machine-Building Companies, 1880 to 1913

1. Annual Statements of Eight Engineering Firms

The following tables present annual balance-sheet data of six Austrian and two Hungarian machine-building firms for 1880 to 1912/13 (Sample I). The companies included are[1]:

1. Aktien-Gesellschaft der Lokomotivfabrik, vorm. G.Sigl in Wiener Neustadt, Vienna (1875);
2. Maschinen- und Waggonbau-Fabriks-Aktiengesellschaft in Simmering, vorm. H.D.Schmid, Vienna (1869);
3. Erste Brünner Maschinen-Fabriks-Gesellschaft, Brno (1872);
4. Maschinenbau-Actien-Gesellschaft, vorm. Breitfeld, Daněk & Co. (Akciová společnost strojírny dříve Breitfeld, Daněk i spol.), Prague (1872);
5. První česko-moravská továrna na stroje v Praze (Erste böhmisch-mährische Maschinenfabrik in Prag), Prague (1871);
6. Prager Maschinenbau-Actiengesellschaft, vorm. Ruston, Bromovsky und Ringhoffer (Prazská akciová strjírma), Prague (1869);
7. Ganz & Comp. - Danubius, Maschinen-, Waggon- und Schiffbau-Actien-Gesellschaft (Ganz és társa -

[1] Unless otherwise stated, all numerical data and results presented in the following are either taken directly or derived from the respective annual accounts published in *Compass. Finanzielles Jahrbuch für Österreich-Ungarn* (Vienna, 1870-1916) and *Jahrbuch der österreichischen Berg- und Hüttenwerke, Maschinen- und Metallwarenfabriken* (Vienna, 1905-1912). Companies' names are reproduced as given in *Compass* 1914.

Danubius, gép-, waggon- és hajógyár részvénytársaság), Budapest (1869);

8. Schlick-Nicholson Maschinen-, Waggon- und Schiffsbau - Aktien-Gesellschaft (Schlick-Nicholson gép-, waggon- és hajógyár részvénytársaság), Budapest (1869).

Tables B.1 and B.2 provide *average* data for the six Austrian and two Hungarian firms, respectively. The balance-sheet indicators for each of the eight companies are reproduced separately in Tables B.3a to B.10d. The following indicators have been taken or derived from the companies' annual statements (short notation in parentheses):

balance-sheet total (BST)	share capital (SHC)
equity capital (EQC)[2]	equity reserves (RES)[3]
borrowed capital (BOC)	contingent reserves (CRS)[4]
fixed assets (FXA)[5]	netinvestment (INV)[6]
material stocks (STO)[7]	depreciation (DEP)[8]

---

[2] EQC = SHC + RES. Equity capital (EQC) has been adjusted, i.e. profits forwarded from the previous years are included whilst losses forwarded are subtracted from equity reserves (RES).

[3] Equity reserves have been adjusted for profits or losses forwarded.

[4] Contingent reserves are part of borrowed capital as they generally constitute a liability.

[5] This category refers to the value of machinery, tools, buildings and other real estate.

[6] Netinvestment represents the absolute change in the value of fixed assets (plant and equipment).

[7] Under this heading, the value of stocks of raw materials, semi-finished products and finished goods is summed up.

[8] Depreciation allowances include only the annual allowances made for lost usefulness of fixed capital.

annual surplus (SPL)[9] annual dividend (DIV)[10]
return on equity (RET)[11] turnover (TOV)[12]
RATIO1 = (EQC/BST)*100 RATIO2 = (EQC/SHC)*100
RATIO3 = (FXA/BST)*100 RATIO4 = (EQC/FXA+STO)*100
RATIO5 = (TOV/BST)*100 RATIO6 = (STO/TOV)*100
RATIO7 = (annual, absolute dividend/SPL)*100.

All absolute figures are reproduced in 1000 current crowns, while annual dividends, return on equity and all ratios are given as percentages. The ratios produced in Tables B.1 and B.2 are based on *absolute average* data. They are *not* the mean of the individual companies' ratios.
In order to ensure a consistent classification of the balance-sheet data, some general principles of definition and standardization had to be applied[13]. As a rule, though, all adjustments of the original data were kept to a minimum.
Own funds are composed of share capital, reserves, and balance-sheet profit. They constitute that amount of the value of all assets which exceeds the value of borrowed funds. In this study, however, only those parts of the annual surplus which were assigned to the reserves or which were carried forward from the previous year are added to equity capital. For only these non-distributed parts of the surplus remain in the company and at its disposal. In turn, losses forwarded imply a reduction in equity capital. Nevertheless, the appropriate partition of some of the

---

[9] Annual surplus has been adjusted to account for profits and losses forwarded from the previous year.

[10] Dividend paid on share capital in percent.

[11] Annual return on equity capital in percent:
RET = (SPL/EQC)*100.

[12] Data on turnover are not available for Ruston and the Böhmisch-mährische Maschinenfabrik. Schlick's 1881 to 1883 figures of turnover are taken from Matlekovitz, A. v., *Das Königreich Ungarn*, vol. II (Leipzig, 1900), p.336.

[13] Cf. Mosser, *Industrieaktiengesellschaft*, pp.25-74.

reserves posed a problem. Difficulties arise from the fact that - in some cases - even those reserves nominally intended to cover contingent liabilities were endowed out of undistributed profits rather than treated as expenses. Thus their function can be viewed as that of equity rather than outside capital, at least partly. As Mosser shows, this practice was quite in accordance with contemporary law and habit[14]. Since the actual size of the funds in question is hardly of particular importance[15] this problem has been approached in a simple and pragmatic fashion. Only those funds which were clearly assigned to equity reserves[16] were included in total equity capital. These exceeded by far all those classified here as contingent reserves. So-called tax-reserves, pension funds, other welfare provisions, and allowances made for insecure payments have been allocated to borrowed (credit) capital regardless of the way they were endowed. Only if subsequent inclusion in equity capital took place, were funds originally allocated to contingent reserves classified as equity.

Due to the quality of the source material short term and long term *credit capital* have not been distinguished here. Some companies temporarily stated the volume of long term loans, others did not so at all. In general, all credit capital was lumped together. Hence a consistent series for either short term or long term finance could not be compiled[17].

---

[14] Ibid., p.36.

[15] See the data under heading CRS (contingent reserves) in the following tables. For the *Brünner Maschinenfabrik* these parts of borrowed capital have not been reproduced separately since the contingent reserves inserted in its statements (for 1882 to 1897 only) never amounted to more than 1700 crowns.

[16] This group encompasses the reserves required by law, those established for special purposes (eg. "Baufonds"), and general reserves built up at the companies' own discretion.

[17] Cf. Mosser, *Industrieaktiengesellschaft*, pp.40-41.

Some companies' business year differed from the calendar year. Here, all statements dated within the first half of a given year have been allocated to the previous year, those dated on a month in the second to the given year. Each of the eight companies had a twelve month business year[18].

Contrary to the general practice in Austria, Ganz and Schlick - like most of the Hungarian firms included in Sample II - inserted accumulated depreciation allowances in their annual statements. Accordingly, the *gross* value of fixed assets and equipment was reported on the opposite side of the balance-sheet. To ensure compatibility with the Austrian data, these accumulated depreciation allowances were subtracted from the value of assets (in order to obtain their *net* value) and, of course, from the balance-sheet totals.

Further adjustments of some of the original balance-sheet figures were necessary only in the case of Ganz and the Böhmisch-mährische Maschinenfabrik. The Ratibor (Silesia) and Leobersdorf (Austria) branches of Ganz were, generally, covered with a summary value in Ganz' balance-sheet. For 1883 to 1900 (Ratibor) and 1887 to 1900 (Leobersdorf) additional data allow us to isolate the two branches' value of fixed assets and their annual depreciation allowances. Estimates were then prepared for 1880 to 1882 and 1901 to 1910 (Ratibor)[19], and for 1901 to 1906 (Leobersdorf)[20].

---

[18] The only one exception was Simmering which shifted its statement deadline from end of December to end of March in 1903; the firm thus had a fifteen month business year in 1903/04.

[19] The rate of change of the value of net fixed assets between 1883 and 1884 was used to calculate net fixed assets for 1880 to 1882. The 1884 rate of depreciation was applied to compute annual depreciation allowances for 1880 to 1883. Both the value of net fixed assets and annual depreciation allowances for 1901 to 1910 were approximated by using the respective average annual rates of change between 1900 and 1911. The 1911 depreciation allowance, in turn, was estimated by using Ratibor's share in Ganz'total value of fixed assets in 1911 and applying this ratio to

From 1911 the assets of Ratibor are given again in Ganz' statements. The two branches' reconstructed values of fixed assets and their depreciation allowances were added to the respective totals of Ganz for those years in which they were not recorded as such in the statements. Thus a complete and coherent series for Ganz' fixed assets was obtained for 1880 to 1913.

For almost all years, equity capital funds and annual surplus of the Böhmisch-mährische Maschinenfabrik had to be re-calculated. Only a fraction of the actual balance was inserted as such in the statements. For whatever reason, parts of annual surplus were booked directly into capital reserves and split up into board shares of profit and dividends *before* the residual was listed as "profit". The practice of surplus allocation changed from year to year. To correct for this, annual surplus was recon-structed in accordance with the usual practice employed by the other firms examined here: it was computed as a gross total, i.e. as the balance out of which dividends, equity reserves, directors' bonuses etc. were funded.

---

the company's total depreciation allowances in 1911. The gross value of fixed assets at Ratibor is given in Ganz' 1911 statement.

[20] The Leobersdorf plant of Ganz was transformed into a joint-stock company in 1907. The balance-sheet for this year reports both the annual depreciation allowance and the value of net fixed assets. Again, average annual rates of change were calculated for 1900 to 1907 and used to compute the value of Leobersdorf's fixed assets and its depreciation allowances.

Table B.1a

BALANCE-SHEET INDICATORS: SIX AUSTRIAN FIRMS

	BST	SHC	EQC	RES	BOC
1880	3,826.2	2,286.9	2,379.9	93.0	1,241.0
1881	4,272.1	2,286.9	2,411.6	124.7	1,678.3
1882	4,495.1	2,286.9	2,513.8	226.9	1,772.9
1883	4,700.3	2,286.9	2,403.8	116.8	1,952.1
1884	4,917.0	2,286.9	2,558.1	271.2	2,069.3
1885	4,943.8	2,286.9	2,618.7	331.7	2,103.9
1886	4,484.9	2,286.9	2,645.9	359.0	1,683.4
1887	4,443.3	2,286.9	2,629.6	342.7	1,686.8
1888	4,717.0	2,286.9	2,588.7	301.7	1,911.4
1889	4,569.7	2,386.9	2,728.7	341.7	1,566.3
1890	4,793.6	2,386.9	2,764.9	378.0	1,784.0
1891	4,697.7	2,386.9	2,780.7	393.8	1,657.9
1892	4,571.5	2,386.9	2,825.8	438.9	1,537.2
1893	4,321.8	2,386.9	2,826.8	439.9	1,249.3
1894	4,430.8	2,386.9	2,843.9	457.0	1,342.2
1895	4,460.4	2,386.9	2,851.8	464.9	1,351.8
1896	4,921.6	2,486.9	3,015.3	528.3	1,620.7
1897	5,754.5	2,703.6	3,358.2	654.6	2,085.3
1898	6,260.3	2,870.3	3,528.7	658.4	2,292.4
1899	7,271.4	3,213.6	4,091.9	878.3	2,580.9
1900	9,578.4	3,646.6	4,702.9	1,056.3	4,296.4
1901	8,862.1	3,913.3	5,082.9	1,169.7	3,278.0
1902	7,950.2	4,045.9	5,176.4	1,130.5	2,477.2
1903	8,492.4	4,295.9	5,414.8	1,118.9	2,770.0
1904	8,888.0	4,295.9	5,429.8	1,133.9	2,973.8
1905	10,255.7	4,546.6	5,724.3	1,177.7	4,082.9
1906	12,574.0	4,959.7	6,103.2	1,143.6	5,936.8
1907	14,241.5	4,959.7	6,180.6	1,221.0	7,222.5
1908	13,938.4	5,226.3	6,663.7	1,437.3	6,418.7
1909	13,494.9	5,226.3	6,754.5	1,528.2	5,788.6
1910	14,237.3	5,693.0	7,305.3	1,612.3	6,008.0
1911	17,468.9	6,693.0	8,821.8	2,128.8	7,657.6
1912	21,720.7	7,526.3	9,738.9	2,212.6	10,945.9

Table B.1b

BALANCE-SHEET INDICATORS: SIX AUSTRIAN FIRMS

	CRS	FXA	INV	STO	SPL
1880	10.5	1,614.1	-	909.4	205.3
1881	20.6	1,629.5	15.4	1,198.2	171.9
1882	25.2	1,628.6	-0.9	1,184.9	83.2
1883	26.5	1,602.3	-26.3	1,065.6	344.5
1884	38.9	1,553.1	-49.2	859.4	289.6
1885	52.9	1,482.6	-70.5	639.7	221.2
1886	42.5	1,450.7	-31.9	719.5	155.5
1887	35.5	1,443.4	-7.3	910.2	106.2
1888	55.3	1,406.1	-37.3	1,066.6	191.6
1889	54.9	1,423.8	17.7	1,130.7	274.8
1890	57.5	1,474.1	50.3	1,196.0	244.7
1891	68.4	1,526.0	51.9	1,066.6	259.1
1892	73.8	1,541.1	15.0	1,084.8	208.6
1893	81.6	1,515.1	-26.0	997.3	245.7
1894	100.6	1,483.1	-32.0	920.3	244.7
1895	118.4	1,501.5	18.4	1,068.1	256.7
1896	95.6	1,520.8	19.3	1,137.1	285.6
1897	106.3	1,686.8	166.0	1,350.5	311.0
1898	119.0	1,704.6	17.8	1,619.4	439.2
1899	198.5	1,964.1	259.5	1,883.7	598.5
1900	197.2	2,670.4	706.3	2,644.6	579.2
1901	215.9	2,917.7	247.3	2,007.8	501.2
1902	227.9	2,796.8	-120.9	1,745.4	296.6
1903	229.0	3,133.1	336.3	1,920.5	307.6
1904	139.3	3,138.6	5.5	2,083.7	484.4
1905	138.5	3,217.5	78.9	2,906.2	448.5
1906	143.2	3,743.6	526.1	3,319.5	86.3
1907	143.1	4,444.2	700.6	4,135.5	838.3
1908	167.2	4,542.1	97.9	3,122.8	856.0
1909	184.2	4,547.8	5.7	2,486.8	951.8
1910	212.5	4,984.6	436.8	2,897.3	924.1
1911	226.4	5,547.5	562.9	3,529.8	989.5
1912	239.8	6,690.0	1,142.5	5,189.0	1,035.9

Table B.1c

BALANCE-SHEET INDICATORS: SIX AUSTRIAN FIRMS

	RET	RATIO1	RATIO2	RATIO3	RATIO4
1880	8.6	62.2	104.1	42.2	94.3
1881	7.7	56.4	105.5	38.1	85.3
1882	3.3	55.9	109.9	36.2	89.3
1883	14.3	51.1	105.1	34.1	90.1
1884	11.3	52.0	111.9	31.6	106.0
1885	8.4	53.0	114.5	30.0	123.4
1886	5.9	59.0	115.7	32.3	121.9
1887	4.0	59.2	115.0	32.5	111.7
1888	7.4	54.9	113.2	29.8	104.7
1889	10.1	59.7	114.3	31.2	106.8
1890	8.8	57.7	115.8	30.8	103.6
1891	9.3	59.2	116.5	32.5	107.3
1892	7.4	61.8	118.4	33.7	107.6
1893	8.7	65.4	118.4	35.1	112.5
1894	8.6	64.2	119.1	33.5	118.3
1895	9.0	63.9	119.5	33.7	111.0
1896	9.5	61.3	121.2	30.9	113.4
1897	9.3	58.4	124.2	29.3	110.6
1898	12.4	56.4	122.9	27.2	106.2
1899	14.6	56.3	127.3	27.0	106.3
1900	12.3	49.1	129.0	27.9	88.5
1901	9.9	57.4	129.9	32.9	103.2
1902	5.7	65.1	127.9	35.2	114.0
1903	5.7	63.8	126.0	36.9	107.1
1904	8.9	61.1	126.4	35.3	104.0
1905	7.8	55.8	125.9	31.4	93.5
1906	1.4	48.5	123.1	29.8	86.4
1907	13.6	43.4	124.6	31.2	72.0
1908	12.8	47.8	127.5	32.6	86.9
1909	14.1	50.1	129.2	33.7	96.0
1910	12.6	51.3	128.3	35.0	92.7
1911	11.2	50.5	131.8	31.8	97.2
1912	10.6	44.8	129.4	30.8	82.0

Table B.2a

BALANCE-SHEET INDICATORS: TWO HUNGARIAN FIRMS

	BST	SHC	EQC	RES	BOC
1880	3,670.2	2,370.0	2,529.7	159.7	808.6
1881	4,370.3	2,520.0	2,805.8	285.8	1,187.8
1882	5,476.0	2,920.0	3,320.8	400.8	1,699.3
1883	6,240.9	2,920.0	3,439.8	519.8	2,176.3
1884	6,509.1	3,120.0	3,852.6	732.6	2,006.0
1885	5,986.7	3,120.0	4,014.0	894.0	1,440.3
1886	5,814.9	3,120.0	4,136.3	1,016.3	1,252.6
1887	6,310.2	3,120.0	4,223.9	1,103.9	1,629.4
1888	7,122.5	3,120.0	4,333.4	1,213.4	2,140.4
1889	7,993.4	3,120.0	4,541.8	1,421.8	2,656.4
1890	8,992.6	3,120.0	4,795.2	1,675.2	3,219.6
1891	10,850.3	3,120.0	5,241.1	2,121.1	4,587.6
1892	11,842.2	3,120.0	5,705.9	2,585.9	5,222.1
1893	13,793.6	3,520.0	6,386.2	2,866.2	6,451.4
1894	14,175.7	3,520.0	6,627.4	3,107.4	6,632.4
1895	15,003.0	3,920.0	7,393.2	3,473.2	6,741.5
1896	17,145.8	4,400.0	9,925.3	5,525.3	6,220.7
1897	19,200.2	4,400.0	10,043.2	5,643.2	8,269.2
1898	20,691.6	4,400.0	10,126.4	5,726.4	9,548.8
1899	22,175.8	4,400.0	10,325.5	5,925.5	10,919.7
1900	23,841.5	4,400.0	10,440.7	6,040.7	12,747.4
1901	20,800.5	4,400.0	10,372.0	5,972.0	10,036.2
1902	20,114.0	4,400.0	10,336.3	5,936.3	9,298.2
1903	21,173.9	4,400.0	10,381.9	5,981.9	10,099.0
1904	20,037.8	4,400.0	10,489.1	6,089.1	9,004.6
1905	21,115.4	4,400.0	10,305.8	5,905.8	10,342.6
1906	21,334.9	4,400.0	10,077.9	5,677.9	10,551.9
1907	23,173.1	4,400.0	10,165.0	5,765.0	12,134.4
1908	21,875.5	4,400.0	10,299.1	5,899.1	10,484.9
1909	20,161.3	4,400.0	10,576.8	6,176.8	8,512.0
1910	19,842.5	4,400.0	10,965.0	6,565.0	7,776.6
1911	32,789.4	6,320.0	14,731.9	8,411.9	16,422.3
1912	59,087.7	8,320.0	17,124.4	8,804.4	40,615.1
1913	64,768.9	8,320.0	16,968.6	8,648.6	46,747.5

Table B.2b

BALANCE-SHEET INDICATORS: TWO HUNGARIAN FIRMS

	CRS	FXA	INV	STO	SPL
1880	36.0	1,233.8	-	631.2	331.9
1881	90.0	1,200.1	-33.8	1,030.3	381.7
1882	118.0	1,252.8	52.7	1,079.0	455.8
1883	163.0	1,414.8	162.0	1,394.8	624.1
1884	201.5	1,361.7	-53.1	1,342.0	650.6
1885	253.7	1,285.0	-76.7	965.1	494.4
1886	282.6	1,245.8	-39.2	943.1	426.2
1887	300.3	1,379.4	133.6	1,122.3	456.8
1888	339.5	1,501.7	122.3	1,039.4	648.7
1889	383.7	1,311.7	-190.0	1,362.2	795.3
1890	509.6	1,361.7	50.0	1,149.7	977.9
1891	586.4	1,495.8	134.1	1,172.8	1,021.6
1892	645.8	1,443.0	-52.8	3,117.9	914.3
1893	805.3	1,560.7	117.7	2,202.8	956.0
1894	896.9	1,703.8	143.1	2,838.3	915.3
1895	995.4	2,078.2	374.4	3,687.7	868.1
1896	1,117.2	3,702.7	1,624.5	2,961.5	999.9
1897	1,238.1	5,183.6	1,480.9	4,234.1	887.9
1898	1,355.1	5,379.8	196.2	3,727.1	1,015.6
1899	1,336.3	5,190.9	-188.9	4,396.8	815.4
1900	1,374.3	5,643.5	452.6	4,513.3	491.3
1901	1,298.5	5,503.4	-140.1	3,518.0	392.2
1902	1,334.6	5,310.6	-192.8	4,319.9	475.6
1903	1,341.9	5,128.6	-182.0	3,649.4	692.9
1904	1,325.5	4,950.3	-178.3	3,205.8	544.0
1905	1,412.5	5,473.6	523.3	3,364.4	467.0
1906	1,094.3	4,267.0	-1,206.6	1,976.6	705.1
1907	1,070.7	3,698.6	-568.4	2,910.1	873.6
1908	1,136.0	4,228.3	529.7	3,295.5	1,091.5
1909	1,200.3	4,131.0	-97.3	2,847.9	1,072.3
1910	1,151.6	4,366.8	235.8	2,433.9	1,101.0
1911	4,576.7	6,691.0	2,324.2	7,296.7	1,653.2
1912	8,799.4	13,607.3	6,916.3	16,530.0	1,348.1
1913	17,389.3	15,817.7	2,210.4	21,755.8	848.9

Table B.2c

BALANCE-SHEET INDICATORS: TWO HUNGARIAN FIRMS

	RET	RATIO1	RATIO2	RATIO3	RATIO4
1880	13.1	68.9	106.7	33.6	135.6
1881	13.6	64.2	111.3	27.5	125.8
1882	13.7	60.6	113.7	22.9	142.4
1883	18.1	55.1	117.8	22.7	122.4
1884	16.9	59.2	123.5	20.9	142.5
1885	12.3	67.0	128.7	21.5	178.4
1886	10.3	71.1	132.6	21.4	189.0
1887	10.8	66.9	135.4	21.9	168.8
1888	15.0	60.8	138.9	21.1	170.5
1889	17.5	56.8	145.6	16.4	169.9
1890	20.4	53.3	153.7	15.1	190.9
1891	19.5	48.3	168.0	13.8	196.4
1892	16.0	48.2	182.9	12.2	125.1
1893	15.0	46.3	181.4	11.3	169.7
1894	13.8	46.8	188.3	12.0	145.9
1895	11.7	49.3	188.6	13.9	128.2
1896	10.1	57.9	225.6	21.6	148.9
1897	8.8	52.3	228.3	27.0	106.6
1898	10.0	48.9	230.1	26.0	111.2
1899	7.9	46.6	234.7	23.4	107.7
1900	4.7	43.8	237.3	23.7	102.8
1901	3.8	49.9	235.7	26.5	115.0
1902	4.6	51.4	234.9	26.4	107.3
1903	6.7	49.0	236.0	24.2	118.3
1904	5.2	52.3	238.4	24.7	128.6
1905	4.5	48.8	234.2	25.9	116.6
1906	7.0	47.2	229.0	20.0	161.4
1907	8.6	43.9	231.0	16.0	153.8
1908	10.6	47.1	234.1	19.3	136.9
1909	10.1	52.5	240.4	20.5	151.6
1910	10.0	55.3	249.2	22.0	161.2
1911	11.1	44.9	233.1	20.4	105.3
1912	7.9	29.0	205.8	23.0	56.8
1913	5.0	26.2	203.9	24.4	45.2

Table B.3a

BALANCE-SHEET INDICATORS: SIGL

	BST	SHC	EQC	RES	BOC
1880	6,631.0	3,921.6	3,921.6	0.0	2,694.2
1881	8,412.1	3,921.6	3,921.6	0.0	4,490.5
1882	9,607.0	3,921.6	3,859.7	-61.9	5,746.7
1883	10,019.8	3,921.6	3,109.1	-812.5	6,089.1
1884	11,687.6	3,921.6	3,930.7	9.1	6,980.8
1885	13,045.2	3,921.6	4,255.7	334.1	8,207.9
1886	10,685.3	3,921.6	4,406.9	485.3	6,085.0
1887	9,111.9	3,921.6	4,365.0	443.4	4,589.2
1888	8,061.4	3,921.6	4,287.4	365.8	3,282.8
1889	5,522.0	3,921.6	4,356.9	435.3	679.9
1890	5,487.6	3,921.6	4,421.0	499.4	845.8
1891	4,850.5	3,921.6	4,365.0	443.4	152.9
1892	4,762.2	3,921.6	4,409.4	487.8	197.2
1893	5,096.3	3,921.6	4,368.9	447.3	436.0
1894	5,077.6	3,921.6	4,395.8	474.2	322.2
1895	5,189.5	3,921.6	4,425.3	503.7	346.8
1896	5,395.3	3,921.6	4,467.6	546.0	504.3
1897	6,572.8	3,921.6	4,515.3	593.7	1,612.1
1898	7,359.1	3,921.6	4,543.6	622.0	2,249.0
1899	6,664.1	3,921.6	4,660.9	739.3	1,552.7
1900	7,286.5	3,921.6	4,685.8	764.2	2,521.5
1901	5,592.6	3,921.6	4,608.1	686.5	715.7
1902	5,501.0	3,921.6	4,634.3	712.7	724.9
1903	5,414.0	3,921.6	4,619.2	697.6	610.5
1904	6,345.2	3,921.6	4,639.7	718.1	1,355.3
1905	9,348.0	3,921.6	4,663.4	741.8	4,509.4
1906	16,602.1	5,000.0	4,671.8	-328.2	11,930.3
1907	13,976.0	5,000.0	5,025.1	25.1	8,583.5
1908	12,800.7	5,000.0	5,134.5	134.5	7,156.3
1909	9,372.3	5.000.0	5,273.6	273.6	3,556.8
1910	7,660.0	5,000.0	5,366.7	366.7	1,879.0
1911	7,733.2	5,000.0	5,468.7	468.7	1,841.8
1912	10,273.7	5,000.0	5,576.6	576.6	4,276.4
1913	8,157.7	5,000.0	5,680.3	680.3	2,053.9

Table B.3b

BALANCE-SHEET INDICATORS: SIGL

	CRS	FXA	INV	DEP	STO
1880	10.0	3,517.2	-	15.2	2,154.1
1881	8.0	3,562.3	45.1	84.5	3,013.8
1882	8.0	3,562.3	0.0	0.0	2,722.0
1883	40.0	3,386.3	-176.0	176.0	1,884.9
1884	68.0	3,053.0	-333.3	332.3	1,114.3
1885	120.0	2,755.4	-297.6	297.6	622.2
1886	92.0	2,622.4	-133.0	133.0	615.3
1887	40.0	2,496.4	-126.0	126.0	745.5
1888	90.0	2,377.0	-119.4	119.4	1,280.2
1889	40.0	2,263.8	-113.2	113.1	1,138.2
1890	36.0	2,156.6	-107.2	107.2	1,224.8
1891	40.0	2,098.0	-58.6	101.7	811.9
1892	24.0	2,000.3	-97.7	97.7	1,117.4
1893	22.0	1,907.6	-92.7	92.7	1,498.4
1894	32.0	1,819.7	-87.9	87.9	1,096.2
1895	40.0	1,779.3	-40.4	83.5	1,163.8
1896	34.0	1,794.7	15.4	80.5	1,249.9
1897	64.0	1,812.5	17.8	82.2	1,543.7
1898	84.0	1,728.4	-84.1	84.1	1,694.4
1899	90.0	1,738.7	10.3	84.8	2,609.8
1900	68.0	1,752.2	13.5	86.5	2,998.5
1901	68.0	1,670.3	-81.9	81.9	1,301.6
1902	68.0	1,668.0	-2.3	82.5	1,231.7
1903	68.0	1,589.5	-78.5	78.3	1,011.7
1904	75.0	1,515.5	-74.0	74.3	1,433.3
1905	90.0	1,547.3	31.8	76.9	4,017.9
1906	100.0	3,289.2	1,741.9	97.7	3,089.4
1907	100.0	4,229.1	939.9	141.6	3,451.3
1908	100.0	4,700.1	471.0	216.4	3,166.4
1909	100.0	4,507.6	-192.5	263.9	1,387.9
1910	150.0	4,264.7	-242.9	266.1	1,018.9
1911	150.0	4,418.1	153.4	302.1	1,165.6
1912	150.0	5,579.6	1,161.5	369.9	1,353.8
1913	0.0	5,388.5	-191.1	447.2	1,225.1

Table B.3c

BALANCE-SHEET INDICATORS: SIGL

	SPL	TOV	DIV	RET	RATIO1
1880	15.2	-	0.0	3.9	59.1
1881	-61.9	-	0.0	-1.6	46.6
1882	-750.6	-	0.0	-19.5	40.2
1883	821.6	9,427.2	0.0	26.4	31.0
1884	776.0	7,452.3	10.0	19.7	33.6
1885	581.7	6,059.6	10.0	13.7	32.6
1886	193.4	3,234.8	6.0	4.4	41.2
1887	157.7	3,596.3	6.0	3.6	47.9
1888	491.1	5,774.7	10.0	11.5	53.2
1889	485.2	5,661.9	10.0	11.1	78.9
1890	220.8	5,560.9	7.0	5.0	80.6
1891	332.6	5,036.2	7.0	7.6	90.0
1892	155.6	3,597.9	5.0	3.5	92.6
1893	291.3	5,365.9	6.5	6.7	85.7
1894	359.5	5,702.7	8.0	8.2	86.6
1895	417.3	5,598.2	9.0	9.4	85.3
1896	423.4	6,511.9	9.0	9.5	82.8
1897	445.4	6,906.8	10.0	9.9	68.7
1898	566.5	8,369.5	10.0	12.5	61.7
1899	450.5	7,657.9	10.0	9.7	69.9
1900	79.2	7,925.2	4.0	1.7	64.3
1901	268.7	8,088.0	6.0	5.8	82.4
1902	141.8	3,936.3	4.0	3.1	84.2
1903	184.4	3,886.5	4.0	4.0	85.3
1904	350.2	3,552.1	5.0	7.5	73.1
1905	175.3	4,260.1	4.0	3.8	49.9
1906	-2,685.9	11,082.3	0.0	-57.5	28.1
1907	367.5	10,926.8	5.0	7.3	36.0
1908	510.0	11,521.1	7.0	9.9	40.1
1909	541.9	9,044.1	7.5	10.3	56.3
1910	414.3	5,928.4	6.0	7.7	70.1
1911	422.7	6,413.4	6.0	7.7	70.7
1912	420.7	7,029.9	6.0	7.5	54.3
1913	423.5	7,404.7	6.0	7.5	69.6

Table B.3d

BALANCE-SHEET INDICATORS: SIGL

	RATIO2	RATIO3	RATIO4	RATIO5	RATIO6	RATIO7
1880	100.0	53.0	69.2	-	-	0.0
1881	100.0	42.4	59.6	-	-	0.0
1882	98.4	37.1	61.4	-	-	0.0
1883	79.3	33.8	59.0	94.1	20.0	0.0
1884	100.2	26.1	94.3	63.8	15.0	50.5
1885	108.5	21.1	126.0	46.5	10.3	67.4
1886	112.4	24.5	136.1	30.3	19.0	121.7
1887	111.3	27.4	134.7	39.5	20.7	149.2
1888	109.3	29.5	117.2	71.6	22.2	79.8
1889	111.1	41.0	128.1	102.5	20.1	80.8
1890	112.7	39.3	130.7	101.3	22.0	124.3
1891	111.3	43.3	150.0	103.8	16.1	82.5
1892	112.4	42.0	141.4	75.6	31.1	126.0
1893	111.4	37.4	128.3	105.3	27.9	87.5
1894	112.1	35.8	150.8	112.3	19.2	87.3
1895	112.8	34.3	150.4	107.9	20.8	84.6
1896	113.9	33.3	146.7	120.7	19.2	83.4
1897	115.1	27.6	134.5	105.1	22.4	88.0
1898	115.9	23.5	132.8	113.7	20.2	69.2
1899	118.9	26.1	107.2	114.9	34.1	87.1
1900	119.5	24.1	98.6	108.8	37.8	198.0
1901	117.5	29.9	155.1	144.6	16.1	87.6
1902	118.2	30.3	159.8	71.6	31.3	110.6
1903	117.8	29.4	177.6	71.8	26.0	85.1
1904	118.3	23.9	157.4	56.0	40.4	56.0
1905	118.9	16.6	83.8	45.6	94.3	89.5
1906	93.4	19.8	73.2	66.8	27.9	0.0
1907	100.5	30.3	65.4	78.2	31.6	68.0
1908	102.7	36.7	65.3	90.0	27.5	68.6
1909	105.5	48.1	89.5	96.5	15.3	69.2
1910	107.4	55.7	101.6	77.4	17.2	72.4
1911	109.4	57.1	97.9	82.9	18.2	71.0
1912	111.5	54.3	80.4	68.4	19.3	71.3
1913	113.6	66.1	85.9	90.8	16.5	70.8

Table B4.a

BALANCE-SHEET INDICATORS: SIMMERING

	BST	SHC	EQC	RES	BOC
1880	2,616.0	2,000.0	2,000.6	0.6	534.9
1881	3,196.4	2,000.0	2,001.1	1.1	1,048.5
1882	3,167.3	2,000.0	2,007.0	7.0	1,059.9
1883	3,219.2	2,000.0	2,008.3	8.3	1,035.7
1884	3,134.3	2,000.0	2,020.8	20.8	894.3
1885	3,093.6	2,000.0	2,032.8	32.8	840.8
1886	3,086.3	2,000.0	2,045.6	45.6	818.5
1887	3,617.6	2,000.0	2,060.5	60.5	1,680.8
1888	3,891.0	2,000.0	1,936.8	-63.2	2,043.5
1889	3,808.3	2,000.0	1,847.5	-152.5	1,669.1
1890	4,037.5	2,000.0	2,019.2	19.2	1,680.8
1891	4,066.2	2,000.0	2,137.7	137.7	1,609.9
1892	3,979.9	2,000.0	2,239.2	239.2	1,539.9
1893	3,439.4	2,000.0	2,234.8	234.8	1,029.7
1894	3,030.4	2,000.0	2,237.9	237.9	725.8
1895	3,428.7	2,000.0	2,204.5	204.5	1,166.6
1896	3,905.0	2,000.0	2,202.1	202.1	1,556.2
1897	4,407.4	2,000.0	2,208.7	208.7	2,029.3
1898	5,262.9	3,000.0	3,413.2	413.2	1,548.5
1899	5,188.2	3,000.0	3,429.2	429.2	1,422.9
1900	6,488.6	3,000.0	3,446.7	446.7	2,705.0
1901	4,585.9	3,000.0	3,464.9	464.9	861.8
1902	4,622.5	3,000.0	3,488.1	488.1	1,202.7
1903	10,215.6	4,500.0	4,919.8	419.8	5,102.9
1904	11,567.8	4,500.0	4,932.7	432.7	6,410.5
1905	13,985.4	6,000.0	6,568.5	568.5	7,376.7
1906	16,205.0	6,000.0	6,608.7	608.7	9,412.5
1907	21,405.1	6,000.0	6,612.5	612.5	13,429.5
1908	18,406.1	6,000.0	6,775.8	775.8	10,112.3
1909	18,005.2	6,000.0	6,926.9	926.9	9,504.4
1910	18,303.2	6,000.0	7,078.4	1,078.4	9,870.3
1911	22,300.7	8,000.0	10,552.3	2,552.3	10,530.7
1912	25,931.3	8,000.0	10,653.1	2,653.1	13,974.8

Table B.4b

BALANCE-SHEET INDICATORS: SIMMERING

	CRS	FXA	INV	DEP	STO
1880	-	1,130.2	-	68.4	842.3
1881	-	1,180.6	50.4	27.9	923.6
1882	-	1,246.2	65.7	32.1	1,270.1
1883	-	1,268.9	22.7	33.2	1,015.4
1884	-	1,283.3	14.4	33.9	924.5
1885	-	1,293.2	9.9	34.4	710.2
1886	-	1,281.4	-11.8	33.9	870.9
1887	-	1,322.2	40.8	35.1	1,471.4
1888	-	1,298.8	-23.4	34.2	1,697.2
1889	-	1,292.0	-6.8	34.1	1,349.4
1890	-	1,277.5	-14.4	33.8	1,251.3
1891	-	1,271.1	-6.4	33.4	892.9
1892	-	1,549.5	278.4	37.6	1,402.6
1893	-	1,571.6	22.1	36.0	666.1
1894	-	1,510.2	-61.4	68.9	855.7
1895	-	1,466.0	-44.2	38.1	1,333.4
1896	-	1,439.5	-26.5	37.1	1,635.9
1897	-	1,566.9	127.4	66.2	1,613.5
1898	-	1,634.4	67.5	44.1	1,393.1
1899	60.0	1,604.7	-29.7	42.7	1,746.3
1900	60.0	1,637.6	32.9	43.7	2,092.8
1901	60.0	1,663.6	26.0	44.9	1,567.4
1902	60.0	1,628.8	-34.9	43.5	1,653.8
1903	80.0	3,766.8	2,138.0	200.8	3,515.0
1904	80.0	4,104.4	337.6	200.0	3,847.4
1905	60.0	4,983.3	878.8	179.4	5,223.8
1906	60.0	5,910.9	927.6	363.6	6,587.3
1907	60.0	7,500.1	1,589.2	738.5	8,638.1
1908	200.0	6,725.6	-774.5	738.9	3,319.3
1909	300.0	6,874.8	149.2	750.0	2,655.6
1910	300.0	6,690.0	-184.8	509.3	4,284.2
1911	300.0	7,031.3	341.3	528.0	5,458.8
1912	300.0	8,242.3	1,211.0	613.7	5,988.7

Table B.4c

BALANCE-SHEET INDICATORS: SIMMERING

	SPL	TOV	DIV	RET	RATIO1
1880	80.5	1,917.0	4.0	4.0	76.5
1881	146.8	2,965.1	7.0	7.3	62.6
1882	100.4	2,973.8	5.0	5.0	63.4
1883	175.2	4,017.9	8.0	8.7	62.4
1884	219.2	3,265.8	10.0	10.8	64.5
1885	220.0	4,440.8	10.0	10.8	65.7
1886	222.3	2,095.5	10.0	10.9	66.3
1887	-123.6	2,423.5	0.0	-6.0	57.0
1888	-89.3	3,654.6	0.0	-4.6	49.8
1889	291.7	5,427.5	6.0	15.8	48.5
1890	337.5	5,523.2	10.0	16.7	50.0
1891	318.5	6,250.3	10.0	14.9	52.6
1892	200.9	5,170.3	10.0	9.0	56.3
1893	175.0	4,757.0	10.0	7.8	65.0
1894	66.7	2,931.2	5.0	3.0	73.8
1895	57.6	2,505.6	3.0	2.6	64.3
1896	146.6	4,352.9	7.0	6.7	56.4
1897	169.3	5,695.8	8.0	7.7	50.1
1898	301.1	6,485.1	9.0	8.8	64.9
1899	336.1	6,315.6	10.0	9.8	66.1
1900	336.8	6,515.6	10.0	9.8	53.1
1901	259.1	5,027.9	7.5	7.5	75.6
1902	-68.3	3,920.8	0.0	-2.0	75.5
1903	192.9	3,526.0	4.0	3.9	48.2
1904	224.6	-	5.0	4.6	42.6
1905	40.2	-	0.0	0.6	47.0
1906	183.8	-	3.0	2.8	40.8
1907	1,363.1	-	5.0	20.6	30.9
1908	1,518.0	-	8.0	22.4	36.8
1909	1,573.8	-	9.0	22.7	38.5
1910	1,354.5	-	9.0	19.1	38.7
1911	1,217.7	-	7.0	11.5	47.3
1912	1,303.4	-	7.0	12.2	41.1

Table B.4d

BALANCE-SHEET INDICATORS: SIMMERING

	RATIO2	RATIO3	RATIO4	RATIO5	RATIO6	RATIO7
1880	100.0	43.2	101.4	73.3	43.9	99.4
1881	100.1	36.9	95.1	92.8	31.1	95.4
1882	100.4	39.3	79.8	93.9	42.7	99.5
1883	100.4	39.4	87.9	124.8	25.3	91.3
1884	101.0	40.9	91.5	104.2	28.3	91.3
1885	101.6	41.8	101.5	143.5	16.0	90.9
1886	102.3	41.5	95.0	67.9	41.6	90.0
1887	103.0	36.5	73.8	67.0	60.7	0.0
1888	96.8	33.4	64.6	93.9	46.4	0.0
1889	92.4	33.9	69.9	142.5	24.9	41.1
1890	101.0	31.6	79.8	136.8	22.7	59.3
1891	106.9	31.3	98.8	153.7	14.3	62.8
1892	112.0	38.9	75.8	129.9	27.1	99.6
1893	111.7	45.7	99.9	138.3	14.0	114.3
1894	111.9	49.8	94.6	96.7	29.2	150.0
1895	110.2	42.8	78.7	73.1	53.2	104.2
1896	110.1	36.9	71.6	111.5	37.6	95.5
1897	110.4	35.6	69.4	129.2	28.3	94.5
1898	113.8	31.1	112.7	123.2	21.5	89.7
1899	114.3	30.9	102.3	121.7	27.7	89.3
1900	114.9	25.2	92.4	100.4	32.1	89.1
1901	115.5	36.3	107.2	109.6	31.2	86.8
1902	116.3	35.2	106.3	84.8	42.2	0.0
1903	109.3	36.9	67.6	34.5	99.7	93.3
1904	109.6	35.5	62.0	-	-	100.2
1905	109.5	35.6	64.4	-	-	0.0
1906	110.1	36.5	52.9	-	-	97.9
1907	110.2	35.0	41.0	-	-	22.0
1908	112.9	36.5	67.5	-	-	31.6
1909	115.4	38.2	72.7	-	-	34.3
1910	118.0	36.6	64.5	-	-	39.9
1911	131.9	31.5	84.5	-	-	46.0
1912	133.2	31.8	74.9	-	-	43.0

Table B.5a

BALANCE-SHEET INDICATORS: BRÜNNER MASCHINENFABRIK

	BST	SHC	EQC	RES	BOC
1880	1,777.3	1,200.0	1,246.6	46.6	453.5
1881	2,081.8	1,200.0	1,249.2	49.2	750.2
1882	2,486.9	1,200.0	1,297.1	97.1	966.9
1883	2,656.3	1,200.0	1,343.4	43.4	1,058.6
1884	2,509.9	1,200.0	1,390.8	190.8	984.3
1885	2,201.7	1,200.0	1,390.6	190.6	686.0
1886	2,352.3	1,200.0	1,394.7	194.7	845.2
1887	2,606.8	1,200.0	1,400.6	200.6	1,024.4
1888	2,920.8	1,200.0	1,438.0	238.0	1,303.7
1889	3,790.6	1,800.0	2,268.7	468.7	1,374.0
1890	3,767.9	1,800.0	2,219.0	419.0	1,383.9
1891	3,668.7	1,800.0	2,225.8	425.8	1,264.9
1892	3,749.4	1,800.0	2,242.2	442.2	1,354.5
1893	3,411.5	1,800.0	2,247.4	447.4	927.4
1894	3,502.3	1,800.0	2,274.8	474.8	1,059.3
1895	3,929.7	1,800.0	2,283.4	483.4	1,254.8
1896	4,226.9	2,400.0	3,203.8	803.8	585.0
1897	4,555.9	2,400.0	3,282.3	882.3	823.7
1898	4,945.6	2,400.0	3,368.3	968.3	1,025.2
1899	5,131.8	2,400.0	3,497.9	1,097.9	1,042.0
1900	10,381.5	3,200.0	4,835.5	1,635.5	4,572.8
1901	10,924.2	4,000.0	6,400.6	2,400.6	3,541.2
1902	9,805.4	4,000.0	6,562.4	2,562.4	2,637.2
1903	9,594.4	4,000.0	6,623.1	2,623.1	2,511.4
1904	9,624.3	4,000.0	6,655.1	2,655.1	2,372.9
1905	10,511.6	4,000.0	6,714.5	2,714.5	3,106.7
1906	11,685.6	4,000.0	6,786.8	2,786.8	4,025.1
1907	12,135.8	4,000.0	6,903.4	2,903.4	4,168.0
1908	11,645.5	4,000.0	7,066.9	3,066.9	3,821.3
1909	11,677.8	4,000.0	7,205.2	3,205.2	3,502.6
1910	12,211.4	4,000.0	7,357.2	3,357.2	3,817.2
1911	13,224.9	4,000.0	7,521.2	3,521.2	4,568.8
1912	20,970.6	4,000.0	7,717.1	3,717.1	12,087.0

Table B.5b

BALANCE-SHEET INDICATORS: BRÜNNER MASCHINENFABRIK

	FXA	INV	STO	TOV	SPL
1880	713.5	-	583.5	-	77.2
1881	713.5	0.4	698.7	-	164.8
1882	800.1	86.6	885.1	-	222.9
1883	850.7	50.6	965.5	-	254.3
1884	868.2	17.5	849.9	-	134.8
1885	880.7	12.5	727.8	1,679.9	125.0
1886	878.0	-2.8	816.4	1,591.6	112.0
1887	920.5	42.6	750.5	2,047.2	181.8
1888	981.9	61.4	987.5	2,181.9	179.1
1889	1,120.8	138.9	1,321.4	2,148.0	147.9
1890	1,310.1	189.3	1,189.7	2,985.3	165.0
1891	1,352.4	42.3	1,205.2	3,124.9	177.9
1892	1,333.7	-18.7	1,090.9	2,760.2	152.7
1893	1,334.8	1.0	1,035.3	3,123.9	236.7
1894	1,372.6	37.8	1,112.3	3,206.1	168.3
1895	1,608.5	235.9	898.0	3,725.9	391.6
1896	1,795.6	187.1	847.7	3,513.5	438.1
1897	1,906.9	111.3	891.3	3,698.0	450.0
1898	2,061.2	154.3	1,075.7	4,588.3	552.1
1899	2,125.2	63.9	1,100.3	4,907.3	591.9
1900	3,372.4	1,247.3	3,498.0	8,018.5	973.2
1901	3,439.2	66.8	3,723.3	8,872.5	982.3
1902	3,352.0	-87.2	2,544.4	7,666.1	605.8
1903	3,551.1	199.2	2,238.7	6,777.5	460.0
1904	3,475.0	-76.1	2,506.2	6,887.6	596.3
1905	3,365.2	-109.8	2,591.2	7,900.0	690.3
1906	3,533.1	167.8	3,407.5	-	873.7
1907	3,508.4	-24.7	2,906.6	-	1,064.5
1908	3,406.4	-102.0	2,601.0	-	757.3
1909	3,348.1	-58.3	2,281.1	-	970.0
1910	3,241.7	-106.4	2,549.8	-	1,037.0
1911	3,089.9	-151.8	3,313.1	-	1,134.9
1912	3,899.4	809.5	6,614.3	-	1,166.6

Table B.5c

BALANCE-SHEET INDICATORS: BRÜNNER MASCHINENFABRIK

	DIV	RET	RATIO1	RATIO2	RATIO3
1880	6.0	6.2	70.1	103.9	40.1
1881	8.0	13.2	60.0	104.1	34.3
1882	12.0	17.2	52.2	108.1	32.2
1883	14.0	18.9	50.6	111.9	32.0
1884	10.0	9.7	55.4	115.9	34.6
1885	9.0	9.0	63.2	115.9	40.0
1886	8.0	8.1	59.3	116.2	37.3
1887	10.0	13.0	53.7	116.7	35.3
1888	10.0	12.5	49.2	119.8	33.6
1889	10.0	6.5	59.9	126.0	29.6
1890	8.0	7.4	58.9	123.3	34.8
1891	8.0	8.0	60.7	123.7	36.9
1892	7.5	6.8	59.8	124.6	35.6
1893	10.0	10.5	65.9	124.9	39.1
1894	8.0	7.4	65.0	126.4	39.2
1895	12.0	17.1	58.1	126.9	40.9
1896	12.0	13.7	75.8	133.5	42.5
1897	12.0	13.7	72.0	136.8	41.9
1898	14.0	16.4	68.1	140.4	41.7
1899	15.0	16.9	68.2	145.7	41.4
1900	16.0	20.1	46.6	151.1	32.5
1901	16.0	15.3	58.6	160.0	31.5
1902	11.0	9.2	66.9	164.1	34.2
1903	9.0	6.9	69.0	165.6	37.0
1904	11.0	9.0	69.1	166.4	36.1
1905	12.5	10.3	63.9	167.9	32.0
1906	15.0	12.9	58.1	169.7	30.2
1907	16.0	15.4	56.9	172.6	28.9
1908	12.0	10.7	60.7	176.7	29.3
1909	16.0	13.5	61.7	180.1	28.7
1910	17.0	14.1	60.2	183.9	26.5
1911	18.0	15.1	56.9	188.0	23.4
1912	18.0	15.1	36.8	192.9	18.6

Table B.5d

BALANCE-SHEET INDICATORS: BRÜNNER MASCHINENFABRIK

	RATIO4	RATIO5	RATIO6	RATIO7
1880	96.1	-	-	93.2
1881	88.5	-	-	116.5
1882	77.0	-	-	64.6
1883	74.0	-	-	66.1
1884	80.9	-	-	89.0
1885	86.5	76.3	43.3	86.4
1886	82.3	67.7	51.3	85.4
1887	83.8	78.5	36.7	66.0
1888	73.0	74.7	45.3	67.0
1889	92.9	56.7	61.5	121.7
1890	88.8	79.2	39.9	87.3
1891	87.0	85.2	38.6	80.9
1892	92.5	73.6	39.5	88.4
1893	94.8	91.6	33.1	76.0
1894	91.5	91.5	34.7	85.6
1895	91.1	94.8	24.1	55.2
1896	121.2	83.1	24.1	65.7
1897	117.3	81.2	24.1	64.0
1898	107.4	92.8	23.4	60.9
1899	108.4	95.6	22.4	60.8
1900	70.4	77.2	43.6	52.6
1901	89.4	81.2	42.0	65.2
1902	111.3	78.2	33.2	72.6
1903	114.4	70.6	33.0	78.3
1904	111.3	71.6	36.4	73.8
1905	112.7	75.2	32.8	72.4
1906	97.8	-	-	68.7
1907	107.6	-	-	60.1
1908	117.6	-	-	63.4
1909	128.0	-	-	66.0
1910	127.0	-	-	65.6
1911	117.5	-	-	63.4
1912	73.4	-	-	61.7

Table B.6a

BALANCE-SHEET INDICATORS: BREITFELD-DANĚK

	BST	SHC	EQC	RES	BOC
1880	6,277.8	3,000.0	3,358.5	358.5	2,357.2
1881	5,801.8	3,000.0	3,391.2	391.2	1,846.0
1882	5,777.4	3,000.0	3,431.9	431.9	1,787.1
1883	6,035.7	3,000.0	3,467.9	467.9	1,976.3
1884	5,628.9	3,000.0	3,524.6	524.6	1,761.3
1885	5,532.5	3,000.0	3,529.6	529.6	1,829.5
1886	4,878.7	3,000.0	3,535.7	535.7	1,194.8
1887	5,260.5	3,000.0	3,535.0	535.0	1,526.4
1888	6,056.3	3,000.0	3,540.9	540.9	2,198.5
1889	6,593.6	3,000.0	3,572.5	572.5	2,604.8
1890	7,975.3	3,000.0	3,588.7	588.7	3,995.9
1891	8,486.0	3,000.0	3,602.6	602.6	4,473.5
1892	7,649.8	3,000.0	3,696.8	696.8	3,528.4
1893	7,567.4	3,000.0	3,725.7	725.7	3,445.1
1894	7,713.7	3,000.0	3,754.7	754.7	3,472.9
1895	7,276.3	3,000.0	3,779.8	779.8	3,111.4
1896	8,136.5	3,000.0	3,798.5	798.5	3,932.5
1897	11,444.7	4,300.0	5,713.3	1,413.3	5,233.7
1898	10,937.6	4,300.0	5,410.7	1,110.7	4,670.1
1899	15,404.5	5,160.0	6,921.6	1,761.6	6,771.2
1900	19,123.1	6,200.0	8,250.6	2,050.6	9,240.4
1901	18,248.1	7,000.0	9,006.5	2,006.5	8,205.4
1902	15,496.8	7,000.0	8,487.5	1,487.4	6,234.9
1903	14,519.5	7,000.0	8,500.8	1,500.8	5,394.7
1904	14,868.5	7,000.0	8,503.8	1,503.8	5,233.0
1905	16,323.1	7,000.0	8,509.5	1,509.5	6,662.6
1906	19,091.4	8,400.0	10,625.9	2,225.9	7,056.4
1907	24,251.0	8,400.0	10,624.3	2,224.3	12,205.2
1908	26,304.9	10,000.0	13,004.3	3,004.3	11,968.9
1909	26,067.1	10,000.0	12,991.3	2,991.3	11,547.6
1910	21,413.6	10,000.0	13,022.8	3,022.8	6,848.0
1911	25,365.4	10,000.0	13,029.2	3,029.2	10,747.0
1912	31,242.0	11,000.0	14,034.4	3,034.4	15,312.0

Table B.6b

BALANCE-SHEET INDICATORS: BREITFELD-DANĚK

	CRS	FXA	INV	DEP	STO
1880	38.9	2,050.1	-	-	899.7
1881	94.5	2,020.6	-29.5	-	1,061.6
1882	118.2	1,897.6	-123.0	124.0	1,161.0
1883	96.5	1,794.8	-102.7	124.2	1,267.4
1884	118.0	1,813.8	18.9	125.0	1,364.8
1885	140.9	1,708.2	-105.6	131.9	1,037.3
1886	99.2	1,600.8	-107.4	125.2	1,174.9
1887	97.3	1,623.3	22.5	28.5	1,251.9
1888	165.3	1,479.3	-144.0	155.3	1,130.9
1889	186.5	1,483.4	4.1	19.8	1,496.6
1890	199.7	1,976.7	493.4	36.5	2,110.8
1891	227.2	2,313.2	336.4	45.3	1,804.1
1892	247.5	2,291.8	-21.4	44.7	1,458.0
1893	268.0	2,256.0	-35.8	43.4	1,694.7
1894	288.3	2,226.0	-30.0	41.7	1,283.5
1895	309.7	2,235.6	9.6	40.7	1,622.3
1896	333.9	2,193.6	-42.0	41.5	1,443.7
1897	355.3	2,947.8	754.2	59.5	2,339.3
1898	375.9	2,894.9	-52.9	60.3	3,280.8
1899	405.9	3,828.2	933.2	79.9	4,066.3
1900	487.1	4,086.9	258.7	76.8	4,311.7
1901	569.3	5,245.5	1,158.6	90.5	3,278.8
1902	632.2	4,714.8	-530.6	100.1	3,167.3
1903	584.0	4,704.5	-10.3	107.5	3,229.9
1904	581.8	4,712.9	8.4	108.0	3,482.1
1905	582.7	4,722.8	9.9	103.7	4,273.5
1906	578.9	5,402.4	679.6	112.7	4,734.7
1907	575.4	7,493.4	2,091.0	126.7	6,255.9
1908	573.0	8,834.4	1,341.0	205.0	6,047.3
1909	571.7	9,017.0	182.6	250.0	5,804.3
1910	571.5	8,912.0	-104.9	266.2	5,043.5
1911	571.5	8,989.8	77.8	273.5	5,831.0
1912	571.5	9,821.3	831.5	285.9	8,515.6

Table B.6c

BALANCE-SHEET INDICATORS: BREITFELD-DANĚK

	SPL	TOV	DIV	RET	RATIO1
1880	562.1	6,794.9	14.0	16.7	53.5
1881	564.6	3,968.9	15.0	16.7	58.5
1882	558.4	5,304.8	15.0	16.3	59.4
1883	591.5	6,601.2	15.0	17.1	57.5
1884	343.0	5,887.4	8.0	9.7	62.6
1885	173.5	3,683.7	5.5	4.9	63.8
1886	148.2	3,159.0	5.0	4.2	72.5
1887	199.1	3,536.5	6.0	5.6	67.2
1888	316.9	6,158.9	8.0	8.9	58.5
1889	416.3	5,887.3	10.0	11.7	54.2
1890	390.7	6,367.6	10.0	10.9	45.0
1891	409.9	7,304.9	10.0	11.4	42.5
1892	424.6	6,350.4	10.0	11.5	48.3
1893	396.5	5,440.4	10.0	10.6	49.2
1894	486.1	7,182.0	11.0	12.9	48.7
1895	385.1	6,523.5	10.0	10.2	51.9
1896	405.6	6,473.5	10.0	10.7	46.7
1897	497.7	9,308.9	10.0	8.7	49.9
1898	856.8	10,684.0	11.0	15.8	49.5
1899	1,711.7	16,536.0	15.0	24.7	44.9
1900	1,632.1	20,009.0	15.0	19.8	43.1
1901	1,036.1	16,209.0	10.0	11.5	49.4
1902	774.5	11,441.0	8.0	9.1	54.8
1903	624.0	12,008.0	7.0	7.3	58.5
1904	1,131.7	12,845.0	10.0	13.3	57.2
1905	1,151.0	15,312.0	12.0	13.5	52.1
1906	1,409.1	17,868.0	13.0	13.3	55.7
1907	1,421.5	19,435.0	13.0	13.4	43.8
1908	1,331.7	23,279.0	11.0	10.2	49.4
1909	1,528.3	21,831.0	12.0	11.8	49.8
1910	1,542.8	19,359.0	12.0	11.8	60.8
1911	1,589.2	20,450.0	12.0	12.2	51.4
1912	1,895.6	26,017.0	12.0	13.5	44.9

Table B.6d

BALANCE-SHEET INDICATORS: BREITFELD-DANĚK

	RATIO2	RATIO3	RATIO4	RATIO5	RATIO6	RATIO7
1880	112.0	32.7	113.9	108.2	13.2	74.7
1881	113.0	34.8	110.0	68.4	26.7	79.7
1882	114.4	32.8	112.2	91.8	21.9	80.6
1883	115.6	29.7	113.2	109.4	19.2	76.1
1884	117.5	32.2	110.9	104.6	23.2	70.0
1885	117.7	30.9	128.6	66.6	28.2	95.1
1886	117.9	32.8	127.4	64.8	37.2	101.2
1887	117.8	30.9	122.9	67.2	35.4	90.4
1888	118.0	24.4	135.7	101.7	18.4	75.7
1889	119.1	22.5	119.9	89.3	25.4	72.1
1890	119.6	24.8	87.8	79.8	33.1	76.8
1891	120.1	27.3	87.5	86.1	24.7	73.2
1892	123.2	30.0	98.6	83.0	23.0	70.7
1893	124.2	29.8	94.3	71.9	31.1	75.7
1894	125.2	28.9	107.0	93.1	17.9	67.9
1895	126.0	30.7	98.0	89.7	24.9	77.9
1896	126.6	27.0	104.4	79.6	22.3	74.0
1897	132.9	25.8	108.2	81.3	25.1	86.4
1898	125.8	26.5	87.6	97.7	30.7	55.2
1899	134.1	24.9	87.7	107.3	24.6	45.2
1900	133.1	21.4	98.2	104.6	21.5	57.0
1901	128.7	28.7	105.7	88.8	20.2	67.6
1902	121.2	30.4	107.7	73.8	27.7	72.3
1903	121.4	32.4	107.1	82.7	26.9	78.5
1904	121.5	31.7	103.8	86.4	27.1	61.9
1905	121.6	28.9	94.6	93.8	27.9	73.0
1906	126.5	28.3	104.8	93.6	26.5	77.5
1907	126.5	30.9	77.3	80.1	32.2	76.8
1908	130.0	33.6	87.4	88.5	26.0	82.6
1909	129.9	34.6	87.7	83.7	26.6	78.5
1910	130.2	41.6	93.3	90.4	26.1	77.8
1911	130.3	35.4	87.9	80.6	28.5	75.5
1912	127.6	31.4	76.5	83.3	32.7	69.6

Table B.7a

BALANCE-SHEET INDICATORS: BÖHMISCH-MÄHRISCHE MASCH.FABRIK

	BST	SHC	EQC	RES	BOC
1880	1,781.6	1,200.0	1,273.9	73.9	260.3
1881	1,687.8	1,200.0	1,374.0	174.0	195.5
1882	1,842.3	1,200.0	1,387.1	187.1	325.4
1883	1,939.3	1,200.0	1,407.2	207.2	393.7
1884	2,062.1	1,200.0	1,429.0	229.0	529.2
1885	1,788.1	1,200.0	1,441.7	241.7	276.4
1886	1,896.0	1,200.0	1,428.6	228.6	377.5
1887	2,146.9	1,200.0	1,435.0	235.0	621.5
1888	3,068.8	1,200.0	1,441.8	241.8	1,482.8
1889	3,190.0	1,200.0	1,457.3	257.3	1,587.2
1890	3,340.1	1,200.0	1,463.5	263.5	1,705.9
1891	2,910.7	1,200.0	1,462.1	262.1	1,302.0
1892	3,106.7	1,200.0	1,473.9	273.9	1,482.0
1893	2,407.1	1,200.0	1,489.4	289.4	723.2
1894	3,364.9	1,200.0	1,503.7	303.7	1,667.5
1895	2,974.8	1,200.0	1,517.2	317.2	1,341.5
1896	3,503.5	1,200.0	1,523.0	323.0	1,860.8
1897	3,252.6	1,200.0	1,529.6	329.6	1,582.0
1898	4,049.5	1,200.0	1,537.7	337.7	2,366.0
1899	6,093.3	2,400.0	3,137.8	737.8	2,653.5
1900	8,334.4	3,158.0	4,091.6	933.6	3,958.7
1901	8,163.9	3,158.0	4,111.5	953.5	3,752.1
1902	7,519.5	3,158.0	4,183.3	1,025.3	3,187.9
1903	6,412.3	3,158.0	4,120.2	962.2	1,993.3
1904	6,042.5	3,158.0	4,141.1	983.1	1,477.5
1905	6,365.2	3,158.0	4,178.8	1,020.8	1,694.4
1906	6,744.3	3,158.0	4,215.9	1,057.9	1,970.4
1907	7,356.4	3,158.0	4,206.1	1,048.1	2,564.5
1908	8,872.4	3,158.0	4,283.8	1,125.8	3,782.9
1909	10,076.1	3,158.0	4,412.6	1,254.6	4,760.2
1910	11,154.3	3,158.0	4,473.2	1,315.2	5,879.1
1911	11,629.9	3,158.0	4,494.5	1,336.5	6,230.4
1912	12,033.7	3,158.0	4,543.5	1,385.5	6,580.7

Table B.7b

BALANCE-SHEET INDICATORS: BÖHMISCH-MÄHRISCHE MASCH.FABRIK

	CRS	FXA	INV	STO	SPL	DIV
1880	9.8	750.4	-	161.5	247.4	10.0
1881	12.6	729.5	-20.9	199.6	118.4	7.5
1882	15.2	699.4	-30.1	315.4	129.8	7.5
1883	4.1	683.7	-15.7	127.4	138.4	7.5
1884	27.8	669.3	-14.4	82.9	103.9	6.0
1885	23.6	637.3	-32.0	70.3	70.0	6.0
1886	26.9	738.7	101.4	191.8	89.9	6.0
1887	29.4	717.8	-20.9	445.8	90.4	6.0
1888	27.2	715.9	-1.9	350.1	144.2	7.5
1889	50.7	852.9	137.0	473.2	145.5	7.5
1890	49.5	853.6	0.7	487.8	170.7	8.0
1891	76.0	851.6	-2.0	469.2	146.7	8.0
1892	96.0	801.2	-50.4	341.6	150.8	8.0
1893	116.0	750.8	-50.4	302.4	194.6	8.0
1894	184.6	700.3	-50.5	353.4	193.7	8.0
1895	251.1	649.9	-50.4	350.2	116.1	7.5
1896	84.0	631.5	-18.4	304.0	119.7	7.5
1897	84.0	613.7	-17.8	328.3	141.0	7.5
1898	108.0	642.7	29.0	478.6	145.7	7.5
1899	460.8	1,207.1	564.4	521.6	302.1	10.0
1900	568.4	3,826.2	2,619.1	1,511.1	284.1	10.0
1901	598.4	4,005.5	179.3	766.1	300.3	8.0
1902	607.3	3,869.7	-135.8	794.6	148.2	6.0
1903	642.3	3,596.9	-272.8	494.7	298.8	7.0
1904	98.9	3,451.0	-145.9	136.2	423.9	10.0
1905	98.6	3,007.7	-443.3	245.2	492.0	12.0
1906	120.6	2,646.1	-361.6	740.8	558.1	13.0
1907	123.5	2,216.2	-429.9	1,620.9	585.8	13.0
1908	130.0	1,872.0	-344.2	2,248.4	805.8	15.0
1909	133.8	1,831.5	-40.5	1,535.2	903.3	16.0
1910	253.5	1,476.1	-355.4	1,219.0	802.1	16.0
1911	336.8	1,119.1	-357.0	610.6	905.0	18.0
1912	417.3	1,113.0	-6.1	950.9	909.5	19.0

Table B.7c

BALANCE-SHEET INDICATORS: BÖHMISCH-MÄHRISCHE MASCH.FABRIK

	RET	RATIO1	RATIO2	RATIO3	RATIO4	RATIO7
1880	19.4	71.5	106.2	42.1	139.7	48.5
1881	8.6	81.4	114.5	43.2	147.9	76.0
1882	9.4	75.3	115.6	38.0	136.7	69.3
1883	9.8	72.6	117.3	35.3	173.5	65.0
1884	7.3	69.3	119.1	32.5	190.0	69.3
1885	4.9	80.6	120.1	35.6	203.8	102.8
1886	6.3	75.3	119.0	39.0	153.5	80.1
1887	6.3	66.8	119.6	33.4	123.3	79.7
1888	10.0	47.0	120.2	23.3	135.3	62.4
1889	10.0	45.7	121.4	26.7	109.9	61.9
1890	11.7	43.8	122.0	25.6	109.1	56.2
1891	10.0	50.2	121.8	29.3	110.7	65.5
1892	10.2	47.4	122.8	25.8	129.0	63.7
1893	13.1	61.9	124.1	31.2	141.4	49.3
1894	12.9	44.7	125.3	20.8	142.7	49.6
1895	7.7	51.0	126.4	21.8	151.7	77.5
1896	7.9	43.5	126.9	18.0	162.8	75.2
1897	9.2	47.0	127.5	18.9	162.4	63.8
1898	9.5	38.0	128.1	15.9	137.1	61.8
1899	9.6	51.5	130.7	19.8	181.5	79.5
1900	6.9	49.1	129.6	45.9	76.7	111.2
1901	7.3	50.4	130.2	49.1	86.2	84.1
1902	3.5	55.6	132.5	51.5	89.7	127.8
1903	7.3	64.3	130.5	56.1	100.7	74.0
1904	10.2	68.5	131.1	57.1	115.4	74.5
1905	11.8	65.7	132.3	47.3	128.5	77.0
1906	13.2	62.5	133.5	39.2	124.5	73.6
1907	13.9	57.2	133.2	30.1	109.6	70.1
1908	18.8	48.3	135.6	21.1	104.0	58.8
1909	20.5	43.8	139.7	18.2	131.1	55.9
1910	17.9	40.1	141.6	13.2	166.0	63.0
1911	20.1	38.6	142.3	9.6	259.8	62.8
1912	20.1	37.8	143.9	9.2	220.1	66.0

Table B.8a

BALANCE-SHEET INDICATORS: RUSTON

	BST	SHC	EQC	RES	BOC
1880	3,873.5	2,400.0	2,478.2	78.2	1,145.8
1881	4,452.8	2,400.0	2,532.8	132.8	1,739.1
1882	4,089.6	2,400.0	3,100.2	700.2	751.3
1883	4,331.7	2,400.0	3,086.7	686.7	1,159.1
1884	4,479.4	2,400.0	3,052.7	652.7	1,265.8
1885	4,001.8	2,400.0	3,061.6	661.6	782.8
1886	4,010.6	2,400.0	3,064.1	664.1	779.5
1887	3,915.8	2,400.0	2,981.6	581.6	802.1
1888	4,303.8	2,400.0	2,887.0	487.0	1,309.4
1889	4,513.7	2,400.0	2,869.1	469.1	1,482.7
1890	4,153.0	2,400.0	2,878.0	478.0	1,091.7
1891	4,204.4	2,400.0	2,891.2	491.2	1,144.2
1892	4,181.0	2,400.0	2,893.3	493.3	1,121.0
1893	4,009.3	2,400.0	2,894.6	494.6	934.6
1894	3,895.9	2,400.0	2,896.7	496.7	805.3
1895	3,963.2	2,400.0	2,900.9	500.9	889.9
1896	4,362.4	2,400.0	2,896.7	496.7	1,285.5
1897	4,293.7	2,400.0	2,899.9	499.9	1,231.0
1898	5,007.1	2,400.0	2,898.6	498.6	1,895.8
1899	5,146.1	2,400.0	2,904.1	504.1	2,043.3
1900	5,856.6	2,400.0	2,906.9	506.9	2,780.1
1901	5,658.1	2,400.0	2,906.0	506.0	2,591.6
1902	4,755.9	3,196.0	3,703.0	507.1	875.4
1903	4,798.5	3,196.0	3,705.9	509.9	1,007.1
1904	4,879.7	3,196.0	3,706.7	510.7	993.7
1905	5,001.0	3,200.0	3,711.1	511.1	1,147.5
1906	5,115.8	3,200.0	3,710.4	510.4	1,226.4
1907	6,324.3	3,200.0	3,712.5	512.5	2,384.1
1908	5,600.9	3,200.0	3,716.8	516.8	1,670.6
1909	5,771.0	3,200.0	3,717.7	517.7	1,860.2
1910	14,681.1	6,000.0	6,533.2	533.2	7,754.1
1911	24,559.1	10,000.0	11,864.8	1,864.8	12,026.7
1912	29,872.9	14,000.0	15,909.0	1,909.0	13,444.4

Note: The sharp rise of equity reserves in 1882 resulted from a one-off endowment of reserve funds. The board of directors bought shares of the firm on own account and, by their allocation to the reserves, put them at the company's disposal. See *Compass* 1882, pp.684-685.

Table B.8b

BALANCE-SHEET INDICATORS: RUSTON

	CRS	FXA	INV	STO	SPL	DIV
1880	4.1	1,523.6	-	815.2	249.4	8.3
1881	8.5	1,570.7	47.1	1,291.8	181.0	7.5
1882	9.0	1,565.9	-4.8	755.9	238.1	7.5
1883	17.9	1,629.2	63.3	1,133.0	85.9	5.0
1884	18.9	1,630.9	1.7	819.8	161.0	5.0
1885	28.4	1,621.0	-9.9	670.4	157.3	5.0
1886	36.3	1,583.0	-38.0	648.0	167.0	5.0
1887	45.2	1,580.0	-3.0	796.2	132.1	5.5
1888	48.4	1,583.5	3.5	953.8	107.4	5.0
1889	51.4	1,529.7	-53.9	1,005.3	162.0	5.5
1890	58.5	1,270.0	-259.7	911.5	183.4	6.0
1891	66.3	1,270.0	0.0	1,216.1	169.0	6.0
1892	74.2	1,270.0	0.0	1 098.4	166.6	6.0
1893	82.5	1,270.0	0.0	787.2	180.0	6.0
1894	97.0	1,270.0	0.0	820.9	193.9	6.5
1895	108.3	1,270.0	0.0	1,040.8	172.5	6.5
1896	120.4	1,270.0	0.0	1,341.6	180.2	6.5
1897	132.8	1,273.2	3.2	1,386.9	162.8	6.0
1898	146.1	1,265.9	-7.3	1,793.9	212.8	6.5
1899	174.1	1,281.0	15.1	1,257.8	198.7	7.5
1900	-	1,347.1	66.1	1,455.8	169.5	6.5
1901	-	1,481.8	134.7	1,409.6	160.5	6.0
1902	-	1,547.9	66.1	1,080.6	177.6	5.0
1903	-	1,590.0	42.1	1,032.7	85.6	2.5
1904	-	1,572.9	-17.1	1,096.9	179.3	5.0
1905	-	1,678.6	105.7	1,085.3	142.4	4.0
1906	-	1,680.1	1.5	1,357.4	179.1	5.0
1907	-	1,717.8	37.7	1,940.5	227.7	6.0
1908	-	1,713.9	-3.9	1,354.3	213.5	6.0
1909	-	1,707.5	-6.4	1,256.6	193.2	5.0
1910	-	5,323.1	3,615.6	3,268.6	393.8	6.0
1911	-	8,636.7	3,313.6	4,799.8	667.6	6.0
1912	-	11,484.1	2,847.4	7,710.7	519.5	5.0

Table B.8c

BALANCE-SHEET INDICATORS: RUSTON

	RET	RATIO1	RATIO2	RATIO3	RATIO4	RATIO7
1880	10.1	64.0	103.3	39.3	106.0	80.2
1881	7.1	56.9	105.5	35.3	88.5	99.5
1882	7.7	75.8	129.2	38.3	133.5	75.6
1883	2.8	71.3	128.6	37.6	111.7	139.7
1884	5.3	68.1	127.2	36.4	124.6	74.5
1885	5.1	76.5	127.6	40.5	133.6	76.3
1886	5.5	76.4	127.7	39.5	137.3	71.9
1887	4.4	76.1	124.2	40.4	125.5	99.9
1888	3.7	67.1	120.3	36.8	113.8	111.7
1889	5.6	63.6	119.5	33.9	113.2	81.5
1890	6.4	69.3	119.9	30.6	131.9	78.5
1891	5.8	68.8	120.5	30.2	116.3	85.2
1892	5.8	69.2	120.6	30.4	122.2	86.4
1893	6.2	72.2	120.6	31.7	140.7	80.0
1894	6.7	74.4	120.7	32.6	138.5	80.5
1895	5.9	73.2	120.9	32.0	125.5	90.4
1896	6.2	66.4	120.7	29.1	110.9	86.6
1897	5.6	67.5	120.8	29.7	109.0	88.5
1898	7.3	57.9	120.8	25.3	94.7	73.3
1899	6.8	56.4	121.0	24.9	114.4	90.6
1900	5.8	49.6	121.1	23.0	103.7	92.0
1901	5.5	51.4	121.1	26.2	100.5	89.7
1902	4.8	77.9	115.9	32.5	140.9	90.0
1903	2.3	77.2	116.0	33.1	141.3	93.4
1904	4.8	76.0	116.0	32.2	138.8	89.1
1905	3.8	74.2	116.0	33.6	134.3	89.9
1906	4.8	72.5	115.9	32.8	122.2	89.3
1907	6.1	58.7	116.0	27.2	101.5	84.3
1908	5.7	66.4	116.1	30.6	121.1	89.9
1909	5.2	64.4	116.2	29.6	125.4	82.8
1910	6.0	44.5	108.9	36.3	76.0	91.4
1911	5.6	48.3	118.6	35.2	88.3	89.9
1912	3.3	53.3	113.6	38.4	82.9	134.8

Table B.9a

BALANCE-SHEET INDICATORS: GANZ

	BST	SHC	EQC	RES	BOC
1880	5,880.5	3,840.0	4,156.6	316.6	1,135.7
1881	7,171.0	3,840.0	4,408.1	568.1	2,117.7
1882	8,678.6	3,840.0	4,627.0	787.0	3,288.7
1883	9,569.0	3,840.0	4,847.1	1,007.1	3,701.6
1884	9,400.5	3,840.0	5,210.0	1,370.0	3,136.4
1885	8,319.5	3,840.0	5,516.5	1,676.5	1,738.3
1886	7,792.9	3,840.0	5,832.1	1,992.1	1,273.9
1887	8,674.3	3,840.0	5,916.0	2,076.0	1,909.1
1888	9,946.1	3,840.0	6,129.4	2,289.4	2,660.0
1889	11,712.0	3,840.0	6,529.8	2,689.8	3,820.2
1890	12,575.0	3,840.0	6,970.9	3,130.9	3,886.2
1891	16,951.9	3,840.0	7,818.4	3,978.4	7,294.4
1892	18,421.7	3,840.0	8,729.2	4,889.2	8,072.8
1893	20,677.5	3,840.0	9,258.1	5,418.1	9,775.0
1894	19,304.4	3,840.0	9,711.7	5,871.7	8,016.1
1895	21,085.7	3,840.0	10,253.6	6,413.6	9,431.7
1896	24,941.3	4,800.0	15,241.8	10,441.8	8,010.8
1897	28,836.0	4,800.0	15,431.5	10,631.5	11,929.7
1898	31,895.1	4,800.0	15,548.9	10,748.9	14,605.3
1899	35,756.9	4,800.0	15,905.7	11,105.7	17,989.9
1900	39,622.0	4,800.0	16,340.7	11,540.7	21,974.3
1901	35,252.4	4,800.0	16,517.5	11,717.5	17,952.6
1902	33,431.9	4,800.0	16,432.5	11,632.5	16,247.4
1903	36,058.4	4,800.0	16,461.1	11,661.1	18,412.0
1904	34,558.5	4,800.0	16,647.8	11,847.8	17,001.5
1905	36,836.3	4,800.0	16,262.2	11,462.2	19,801.6
1906	34,709.7	4,800.0	15,798.5	10,998.5	17,728.2
1907	35,600.8	4,800.0	15,909.1	11,109.1	18,217.1
1908	34,478.0	4,800.0	16,146.2	11,346.2	16,541.2
1909	31,164.2	4,800.0	16,595.6	11,795.6	12,821.5
1910	30,291.9	4,800.0	17,266.4	12,466.4	11,226.9
1911	54,645.8	8,640.0	24,684.0	16,044.0	27,096.2
1912	94,345.8	8,640.0	24,949.3	16,309.3	67,097.4
1913	106,366.9	8,640.0	24,877.9	16,237.9	79,572.4

Table B.9b

BALANCE-SHEET INDICATORS: GANZ

	CRS	FXA	INV	DEP	STO
1880	0.0	1,737.0	0.0	53.5	970.5
1881	176.0	1,648.0	-89.0	52.1	1,738.3
1882	236.0	1,481.3	-166.7	150.1	1,821.7
1883	326.0	1,357.4	-123.9	158.4	2,105.7
1884	396.0	1,246.4	-111.0	157.3	1,657.0
1885	507.3	1,106.0	-140.4	157.9	873.3
1886	550.2	1,083.9	-22.1	160.2	834.1
1887	600.5	1,375.7	291.8	67.2	1,091.9
1888	678.9	1,533.1	157.4	87.7	1,117.6
1889	767.3	1,571.7	38.6	82.9	1,614.5
1890	967.7	1,605.4	33.7	167.6	1,290.2
1891	1,077.3	1,781.4	176.0	231.0	1,144.7
1892	1,204.3	1,658.0	-123.4	159.4	4,939.4
1893	1,510.0	1,516.5	-141.5	157.8	2,674.7
1894	1,736.8	1,512.4	-4.1	156.4	3,322.8
1895	1,970.7	1,727.8	215.4	146.7	5,178.1
1896	2,214.4	4,881.3	3,153.5	141.0	4,017.3
1897	2,446.2	7,865.9	2,984.6	332.9	7,102.5
1898	2,680.2	8,261.5	395.6	343.5	5,791.3
1899	2,642.7	7,933.8	-327.7	352.7	6,989.6
1900	2,604.7	8,831.4	897.6	373.8	7,633.0
1901	2,567.1	8,597.7	-233.7	375.3	5,932.1
1902	2,639.2	8,292.1	-305.6	371.0	6,879.3
1903	2,653.8	8,028.2	-263.9	369.8	6,178.6
1904	2,621.1	7,735.3	-292.9	367.1	5,510.1
1905	2,794.9	8,882.0	1,146.7	418.7	5,838.6
1906	2,158.7	6,338.5	-2,543.5	291.0	1,895.9
1907	2,141.3	4,859.6	-1,478.9	259.5	3,386.4
1908	2,272.0	5,561.6	702.0	293.2	4,441.5
1909	2,400.5	5,554.7	-6.9	304.8	3,579.3
1910	2,303.2	5,715.6	160.9	340.0	3,021.0
1911	9,153.4	10,409.1	4,693.5	527.5	12,153.0
1912	16,844.4	24,100.7	13,691.6	100.0	26,749.0
1913	34,145.9	26,710.4	2,609.7	148.7	38,826.3

Table B.9c

BALANCE-SHEET INDICATORS: GANZ

	SPL	TOV	DIV	RET	RATIO1
1880	588.2	6,870.9	8.75	14.2	70.7
1881	655.2	8,389.9	10.00	14.9	61.5
1882	762.9	12,511.1	12.50	16.5	53.3
1883	1,018.4	17,207.4	15.00	21.0	50.7
1884	1,054.1	20,261.8	16.25	20.2	55.4
1885	1,065.3	16,737.6	16.25	19.3	66.3
1886	686.9	9,219.1	13.75	11.8	74.8
1887	849.1	10,635.2	13.75	14.4	68.2
1888	1,156.8	14,483.4	16.25	18.9	61.6
1889	1,362.0	19,510.6	17.50	20.9	55.8
1890	1,717.9	23,858.4	18.75	24.6	55.4
1891	1,839.2	26,866.9	20.00	23.5	46.1
1892	1,619.7	23,064.2	20.00	18.6	47.4
1893	1,644.3	25,790.3	21.25	17.8	44.8
1894	1,575.4	25,852.8	21.25	16.2	50.3
1895	1,400.1	26,131.8	25.00	13.7	48.6
1896	1,688.7	30,000.0	27.50	11.1	61.1
1897	1,474.9	24,258.0	25.00	9.6	53.5
1898	1,740.9	34,000.0	25.00	11.2	48.8
1899	1,861.2	26,000.0	25.00	11.7	44.5
1900	1,307.5	34,500.0	20.00	8.0	41.2
1901	782.2	28,500.0	12.50	4.7	46.9
1902	744.0	21,000.0	12.50	4.5	49.2
1903	1,185.3	26,114.7	17.50	7.2	45.7
1904	909.1	26,411.8	16.25	5.5	48.2
1905	772.5	23,700.0	13.75	4.8	44.1
1906	1,183.0	-	17.50	7.5	45.5
1907	1,474.6	-	20.00	9.3	44.7
1908	1,790.5	-	22.50	11.1	46.8
1909	1,747.1	-	22.50	10.5	53.3
1910	1,798.7	-	22.50	10.4	57.0
1911	2,865.5	-	22.50	11.6	45.2
1912	2,299.1	-	22.50	9.2	26.4
1913	1,916.5	-	18.75	7.7	23.4

Table B.9d

BALANCE-SHEET INDICATORS: GANZ

	RATIO2	RATIO3	RATIO4	RATIO5	RATIO6	RATIO7
1880	108.2	29.5	153.5	116.8	14.1	57.1
1881	114.8	23.0	130.2	117.0	20.7	58.6
1882	120.5	17.1	140.1	144.2	14.6	62.9
1883	126.2	14.2	140.0	179.8	12.2	56.6
1884	135.7	13.3	179.4	215.5	8.2	59.2
1885	143.7	13.3	278.7	201.2	5.2	58.6
1886	151.9	13.9	304.1	118.3	9.1	76.9
1887	154.1	15.9	239.8	122.6	10.3	62.2
1888	159.6	15.4	231.2	145.6	7.7	53.9
1889	170.1	13.4	204.9	166.6	8.3	49.3
1890	181.5	12.8	240.7	189.7	5.4	41.9
1891	203.6	10.5	267.2	158.5	4.3	41.8
1892	227.3	9.0	132.3	125.2	21.4	47.4
1893	241.1	7.3	220.9	124.7	10.4	49.6
1894	252.9	7.8	200.9	133.9	12.9	51.8
1895	267.0	8.2	148.5	123.9	19.8	68.6
1896	317.5	19.6	171.3	120.3	13.4	78.2
1897	321.5	27.3	103.1	84.1	29.3	81.4
1898	323.9	25.9	110.6	106.6	17.0	68.9
1899	331.4	22.2	106.6	72.7	26.9	64.5
1900	340.4	22.3	99.3	87.1	22.1	73.4
1901	344.1	24.4	113.7	80.9	20.8	76.7
1902	342.3	24.8	108.3	62.8	32.8	80.6
1903	342.9	22.3	115.9	72.4	23.7	70.9
1904	346.8	22.4	125.7	76.4	20.9	85.8
1905	338.8	24.1	110.5	64.4	24.6	85.5
1906	329.1	18.3	191.9	-	-	71.0
1907	331.4	13.7	192.9	-	-	65.1
1908	336.4	16.1	161.4	-	-	60.3
1909	345.7	17.8	181.7	-	-	61.8
1910	359.7	18.9	197.6	-	-	60.0
1911	285.7	19.1	109.4	-	-	67.8
1912	288.8	25.5	49.1	-	-	84.6
1913	287.9	25.1	38.0	-	-	84.5

Table B.10a

BALANCE-SHEET INDICATORS: SCHLICK

	BST	SHC	EQC	RES	BOC
1880	1,459.8	900.0	902.8	2.8	481.4
1881	1,569.6	1,200.0	1,203.4	3.4	257.9
1882	2,273.4	2,000.0	2,014.6	14.6	110.0
1883	2,912.9	2,000.0	2,032.4	32.4	650.9
1884	3,617.6	2,400.0	2,495.1	95.1	875.5
1885	3,653.9	2,400.0	2,511.5	111.5	1,142.4
1886	3,837.0	2,400.0	2,440.4	40.4	1,231.3
1887	3,946.1	2,400.0	2,531.9	131.9	1,349.7
1888	4,298.9	2,400.0	2,537.4	137.4	1,620.9
1889	4,274.8	2,400.0	2,553.7	153.7	1,492.6
1890	5,410.2	2,400.0	2,619.5	219.5	2,552.9
1891	4,748.6	2,400.0	2,663.8	263.8	1,880.7
1892	5,262.7	2,400.0	2,682.6	282.6	2,371.4
1893	6,909.8	3,200.0	3,514.3	314.3	3,127.8
1894	9,046.9	3,200.0	3,543.1	343.1	5,248.7
1895	8,920.3	4,000.0	4,532.8	532.8	4,051.3
1896	9,350.3	4,000.0	4,608.8	608.8	4,430.6
1897	9,564.4	4,000.0	4,654.9	654.9	4,608.6
1898	9,488.1	4,000.0	4,703.8	703.8	4,492.4
1899	8,594.7	4,000.0	4,745.2	745.2	3,849.5
1900	8,061.1	4,000.0	4,540.6	540.6	3,520.5
1901	6,348.6	4,000.0	4,226.6	226.6	2,119.8
1902	6,796.0	4,000.0	4,240.1	240.1	2,348.9
1903	6,289.3	4,000.0	4,302.7	302.7	1,786.1
1904	5,517.0	4,000.0	4,330.5	330.5	1,007.7
1905	5,394.4	4,000.0	4,349.4	349.1	883.6
1906	7,960.1	4,000.0	4,357.3	357.3	3,375.6
1907	10,745.3	4,000.0	4,421.0	421.0	6,051.7
1908	9,273.1	4,000.0	4,452.0	452.0	4,428.6
1909	9,158.3	4,000.0	4,558.1	558.1	4,202.6
1910	9,393.0	4,000.0	4,663.5	663.5	4,326.2
1911	10,933.0	4,000.0	4,779.7	779.7	5,748.4
1912	23,829.6	8,000.0	9,299.5	1,299.5	14,132.8
1913	23,171.0	8,000.0	9,059.2	1,059.2	13,922.6

Table B.10b

BALANCE-SHEET INDICATORS: SCHLICK

	CRS	FXA	INV	DEP	STO
1880	72.0	730.7	-	9.6	291.9
1881	4.0	752.2	21.5	32.0	322.2
1882	0.0	1,024.3	272.1	24.4	336.3
1883	0.0	1,472.3	448.0	34.4	683.8
1884	7.0	1,476.9	4.6	61.3	1,027.0
1885	0.0	1,464.1	-12.8	30.0	1,056.8
1886	15.0	1,407.7	-56.4	50.0	1,052.1
1887	0.0	1,383.1	-24.6	48.4	1,152.8
1888	0.0	1,470.2	87.1	50.0	961.3
1889	0.0	1,051.6	-418.6	81.0	1,109.9
1890	51.5	1,118.0	66.4	84.0	1,009.2
1891	95.4	1,210.1	92.1	70.0	1,201.0
1892	87.2	1,228.0	17.9	60.0	1,296.4
1893	100.5	1,604.9	376.9	60.0	1,731.0
1894	57.0	1,895.3	290.4	60.0	2,353.8
1895	20.0	2,428.6	533.3	80.0	2,197.2
1896	20.0	2,524.0	95.4	80.0	1,905.7
1897	30.0	2,501.4	-22.6	100.0	1,365.8
1898	30.0	2,498.1	-3.3	100.0	1,662.9
1899	30.0	2,448.1	-50.0	50.0	1,804.0
1900	144.0	2,455.7	7.6	50.0	1,393.6
1901	30.0	2,409.0	-46.7	40.0	1,103.9
1902	30.0	2,329.0	-80.0	80.0	1,760.4
1903	30.0	2,229.0	-100.0	100.0	1,120.1
1904	30.0	2,165.3	-63.7	100.0	901.4
1905	30.0	2,065.3	-100.0	100.0	890.1
1906	30.0	2,195.5	130.2	100.0	2,057.3
1907	0.0	2,537.5	342.0	100.0	2,433.7
1908	0.0	2,895.0	357.5	100.0	2,149.5
1909	0.0	2,707.3	-187.7	150.0	2,116.4
1910	0.0	3,018.0	310.7	150.0	1,846.9
1911	0.0	2,972.9	-45.1	150.0	2,440.4
1912	754.4	3,113.9	141.0	120.0	6,311.1
1913	632.6	4,925.0	1,811.1	0.0	4,685.2

Table B.10c

BALANCE-SHEET INDICATORS: SCHLICK

	SPL	TOV	DIV	RET	RATIO1
1880	75.5	1,234.0	7.0	8.4	61.8
1881	108.2	1,657.1	8.0	9.0	76.7
1882	148.7	2,345.5	6.0	7.4	88.6
1883	229.7	2,870.7	10.0	11.3	69.8
1884	247.1	3,718.0	9.0	9.9	69.0
1885	-76.5	2,561.5	0.0	-3.0	68.7
1886	165.4	3,408.7	3.0	6.8	63.6
1887	64.5	4,000.7	2.5	2.6	64.2
1888	140.6	3,880.7	5.0	5.5	59.0
1889	228.5	4,205.2	6.0	9.0	59.7
1890	237.9	4,920.9	7.0	9.1	48.4
1891	204.1	4,465.7	7.0	7.7	56.1
1892	208.8	4,882.9	7.0	7.8	51.0
1893	267.7	5,648.5	6.2	7.6	50.9
1894	255.1	7,010.6	7.0	7.2	39.2
1895	336.1	9,806.6	6.5	7.4	50.8
1896	311.0	9,682.8	6.5	6.8	49.3
1897	300.8	10,752.1	6.5	6.5	48.7
1898	290.2	9,608.4	6.5	6.2	49.6
1899	-230.5	6,011.1	0.0	-4.9	55.2
1900	-324.9	5,688.0	0.0	-7.2	56.3
1901	2.1	4,793.0	0.0	5.0	66.6
1902	207.1	5,295.0	3.5	4.9	62.4
1903	200.5	5,126.0	4.0	4.7	68.4
1904	178.8	-	4.0	4.1	78.5
1905	161.4	-	4.0	3.7	80.6
1906	227.1	-	5.0	5.2	54.7
1907	272.6	-	6.0	6.2	41.1
1908	392.4	-	7.0	8.8	48.0
1909	397.6	-	7.0	8.7	49.8
1910	403.3	-	7.0	8.7	49.7
1911	404.9	-	7.0	8.5	43.7
1912	397.2	-	5.0	4.3	39.0
1913	-218.8	-	0.0	-2.4	39.1

Table B.10d

BALANCE-SHEET INDICATORS: SCHLICK

	RATIO2	RATIO3	RATIO4	RATIO5	RATIO6	RATIO7
1880	100.3	50.1	88.3	84.5	23.7	83.4
1881	100.3	47.9	112.0	105.6	19.4	89.7
1882	100.7	45.1	148.1	103.2	14.3	80.7
1883	101.6	50.5	94.3	98.6	23.8	87.1
1884	104.0	40.8	99.7	102.8	27.6	87.4
1885	104.7	40.1	99.6	70.1	41.3	0.0
1886	101.7	36.7	99.2	88.8	30.9	43.5
1887	105.5	35.1	99.8	101.4	28.8	93.0
1888	105.7	34.2	104.4	90.3	24.8	85.4
1889	106.4	24.6	118.1	98.4	26.4	63.0
1890	109.2	20.7	123.1	91.0	20.5	70.6
1891	111.0	25.5	110.5	94.0	26.9	82.3
1892	111.8	23.3	106.3	92.8	26.6	80.5
1893	109.8	23.2	105.4	81.8	30.6	73.5
1894	110.7	21.0	83.4	77.5	33.6	87.8
1895	113.3	27.2	98.0	109.9	22.4	77.4
1896	115.2	27.0	104.0	103.6	19.7	83.6
1897	116.4	26.2	120.4	112.4	12.7	86.4
1898	117.6	26.3	113.0	101.3	17.3	89.6
1899	118.6	28.5	111.6	69.9	30.0	0.0
1900	113.5	30.5	118.0	70.6	24.5	0.0
1901	105.7	38.0	120.3	75.5	23.0	0.0
1902	106.0	34.3	103.7	77.9	33.3	67.6
1903	107.6	35.4	128.5	81.5	21.9	79.8
1904	108.3	39.3	141.2	-	-	89.5
1905	108.7	38.3	147.2	-	-	99.1
1906	108.9	27.6	102.5	-	-	88.1
1907	110.5	23.6	88.9	-	-	88.0
1908	111.3	31.2	88.3	-	-	71.4
1909	114.0	29.6	94.5	-	-	70.4
1910	116.6	32.1	95.9	-	-	69.4
1911	119.5	27.2	88.3	-	-	69.2
1912	116.2	13.1	98.7	-	-	100.7
1913	113.2	21.3	94.3	-	-	0.0

2. The Machine-Building Companies in Sample II

Tables B.11 and B.12 below present summary balance-sheet data of the machine-building firms included in Sample II. All definitions and methods used in the derivation of balance-sheet indicators are identical to those described in the previous section. In addition to the original six companies of Sample I, Sample II of Austrian engineering companies encompasses the following firms:

a. *1890/91, 1900/01, 1912/13*

1. Stabilimento Tecnico Triestino, Trieste (1857);
2. Wiener Locomotiv-Fabriks-AG, Vienna (1869);
3. Pilsener Maschinen- und Waggonbau-AG, Pilsen/Plzeň (1872);

b. *1900/01, 1912/13*

4. Grazer Waggon- und Maschinen-Fabriks-AG, vorm. Joh. Weitzer, Vienna (1895);
5. Aktiengesellschaft für Maschinenbau, vorm. Brand & Lhuillier, Brno (1895);
6. Nesselsdorfer Wagenbau-Fabriks-Gesellschaft, Vienna (1891);
7. Maschinenfabrik Andritz AG, Vienna (1900);
8. Skodawerke AG, Pilsen/Plzeň (1899);

c. *1912/13*

9. Maschinenfabriks-AG N. Heid, Stockerau (1901);
10. Österreichische Maschinenbau-AG "Körting", Vienna (1903);
11. Staudinger Waggonfabrik, Stauding (1900);
12. Erste Galizische Waggon- und Maschinenbau-AG in Sanok, Lemberg/Lwów (1895);
13. Gaswerksbau und Maschinen-Fabriks-AG Franz Manoschek, Vienna (1907);
14. Maschinenfabrik L. Zieleniewski, Cracow (1906);
15. Hofherr-Schrantz-Clayton-Shuttleworth, Landwirtschaftliche Maschinen-Fabrik AG, Vienna (1908);
16. Leobersdorfer Maschinenfabriks-AG, Vienna (1906);
17. Proßnitzer Maschinen- und Motorenfabrik AG F.& J.Kovárik, Proßnitz/Prostějov (1910);
18. Actiengesellschaft Alfa Separator, Vienna (1898);
19. Wiener Dampfkessel-, Apparate- und Maschinenfabriks-AG, vorm. Jos. Pauker & Sohn, Vienna (1911);
20. Filter- und brautechnische Maschinen-Fabrik AG, vorm. B.H. Hellmann, Prague (1912);
21. Fr. Melichar Sämaschinen-Fabriks-AG, Prague (1911);
22. Novák & Jahn, Maschinenfabrik-AG, Prague (1911);
23. Landwirtschaftliche Aktien-Maschinenfabrik, Eisen-

giesserei und Kesselschmiede Ed. Kokora & Comp., Prerau/Přerov (1912);
24. Webstuhl- und Weberei-Maschinen-Fabriks-AG, Troppau/Opava (1905).

Besides Ganz and Schlick, Sample II for Hungary includes:

a. *1900, 1912*

1. Budapester Pumpen- und Maschinen-AG, Budapest (1893);
2. "Nicholson" Maschinenfabriks-AG, Budapest (1895)[21];
3. Vulkan Maschinenfabriks-AG, Budapest (1893);
4. "Danubius" Schiffbau- und Maschinenfabriks-AG, Budapest (1890)[22];
5. Erste ungarische Landwirtschafts-Maschinenfabriks-AG, Budapest (1889);
6. C. Teudloff & Th. Dittrich Maschinenfabriks-AG, Budapest (1895);
7. Hirsch és Frank Budapest-Salgó-Tarjáni gépgyár és vasöntő részvénytársulat, Budapest (1898);
8. Erste Ungarische Nähmaschinen- und Fahrradfabriks-AG, Budapest (1893);
9. Johann Weitzer Maschinen-, Waggonfabrik und Eisengiesserei, Budapest/Arad (1891);
10. Ungarische Waggon- und Maschinenfabriks-AG, Budapest (1896);

b. *1912*

11. Nicolaus Fehér, Maschinen-Fabriks-AG, Budapest (1901);
12. Alfa-Separator részvénytársaság, Budapest (1903);
13. Fabrik für Maschinen- und Eisenbahnausrüstung AG, Budapest/Kistarcsa (1907);
14. Hofherr-Schrantz & Clayton-Shuttleworth AG, Budapest (1908);
15. L. Láng Maschinenfabriks-AG, Budapest (1911);
16. Stefan Röck und Erste Brünner Maschinenfabrik AG, Budapest (1909);
17. Ungarische Allgemeine Maschinenfabriks-AG, Budapest (1911);
18. Ungarische Maschinenfabrik für chemische Industrie AG, Budapest (1908);
19. Dr. Wagner & Comp. Vereinigte Fabriken AG, Budapest (1912);
20. Debreczeni mezőgazdasági gépgyár részvénytársaság, Debreczen (1908);
21. Kaposvári vasöntőde és gépgyár részvénytársaság, Kaposvár (1906);
22. Losonczer landwirtschaftliche Maschinenfabrik AG,

[21] Because of its merger with Schlick (1912), Nicholson is not included as a separate company in Sample II for 1912.

[22] Danubius merged with Ganz in 1911; the firm is, therefore, not included as an indidvidual company in Sample II for 1912.

Losoncz (1911);
23. Ungarische Motoren- und Maschinenbau AG, Szombathely (1902);
24. Nagyvárader Eisengießerei und Maschinenfabriks-AG, Nagyvárad (1911);
25. Oscar Révai, Heizapparate- und Metallwaren-Fabriks-AG, Budapest (1904).

Table B.11

SELECTED BALANCE-SHEET DATA: SAMPLE II, AUSTRIA
(1000 CROWNS OR PER CENT)

	1890 9 comp.	1900 14 comp.	1912 30 comp.
BST	5,137.5	10,149.5	14,891.6
SHC	2,333.5	4,697.1	4,878.6
EQC	2,703.9	5,291.7	6,018.3
BOC	2,192.3	4,296.6	8,057.7
FXA	1,508.1	3,584.7	4,217.3
STO	1,966.8	3,173.3	4,285.0
RATIO1	52.6%	52.1%	40.4%
RATIO2	115.9%	112.7%	123.8%
RATIO3	29.4%	35.3%	28.3%
RATIO4	77.8%	78.3%	70.8%

Table B.12

SELECTED BALANCE-SHEET DATA: SAMPLE II, HUNGARY
(1000 CROWNS OR PER CENT)

	1900 12 comp.	1912 25 comp.
BST	9,655.4	9,149.9
SHC	3,066.7	2,430.8
EQC	4,236.4	3,312.8
BOC	5,255.6	5,591.9
FXA	2,535.6	2,488.0
STO	2,108.6	2,561.9
RATIO1	48.9%	36.2%
RATIO2	138.1%	136.3%
RATIO3	26.3%	27.2%
RATIO4	91.2%	65.6%

APPENDIX C

A Compilation of Austrian and German Iron Prices 1870 to 1913

The following tables present data on the development of iron prices in Austria and - in order to facilitate comparisons - Germany, too. Sixteen prices are given in crowns per metric ton[1]:

1. average price of Austrian cast iron at place of production (ACI; Table C.1);
2. average unit price of imported cast iron at Austro-Hungarian border (ICI; Table C.1);
3. unit price of imported cast inclusive of negotiated tariff: ICI + negotiated tariff (ICITa; Table C.1);
4. unit price of imported cast iron inclusive of autonomous (general) tariff: ICI + autonomous tariff (ICITb; Table C.1);
5. average trade price of German cast iron of category I in Germany (GCI1; Table C.1);
6. average trade price of German cast iron of category III in Germany (GCI3; Table C.1);
7. average trade price of Luxembourg cast iron of category III in Germany (LCI3; Table C.1);
8. wholesale price of Austrian support iron (profiles) in Vienna (ASI; Table C.2);
9. wholesale price of German support iron (profiles) in Berlin (GSI; Table C.2);
10. parity of German wholesale price of support iron (profiles) in Vienna inclusive of freight and tariff

[1] German prices in mark (M) have been converted into crowns (K): 1 M = 1.18 K. Prices no. 5 to 16 are annual averages of quarterly figures.

(PSI; Table C.2);

11. wholesale price of Austrian heavy sheet metal (plate) in Vienna (ASM; Table C.3);
12. wholesale price of German heavy sheet metal (plate) in Berlin (GSM; Table C.3);
13. parity of German wholesale price of heavy sheet metal (plate) in Vienna inclusive of freight and tariff (PSM; Table C.3);
14. wholesale price of Austrian bar iron in Vienna (ABI; Table C.4)[2];
15. wholesale price of German bar iron in Berlin (GBI; Table C.4);
16. parity of German wholesale price of bar iron in Vienna inclusive of freight and tariff (PBI; Table C.4).

[2] From 1870 to 1889: final prices for Styrian bar iron in Vienna (annually).

Table C.1

CAST IRON PRICES (CROWNS/TON)							
	ACI	ICI	ICITa	ICITb	GCI1	GCI3	LCI3
1913	94	81	96	100	-	-	-
1912	92	81	96	100	-	-	-
1911	90	69	84	88	79	76	61
1910	91	72	87	91	76	74	64
1909	90	72	87	91	70	69	57
1908	92	73	88	92	89	83	64
1907	92	76	91	95	99	93	84
1906	85	82	97	101	93	84	77
1905	78	75	91	94	79	76	68
1904	82	69	85	88	78	76	61
1903	84	65	81	84	78	75	61
1902	86	65	81	84	76	71	57
1901	93	97	113	116	-	-	71
1900	94	104	120	123	119	114	103
1899	85	95	111	114	90	85	79
1898	80	67	83	86	79	71	61
1897	80	69	85	88	79	71	65
1896	81	64	80	83	77	67	59
1895	83	56	72	75	75	64	53
1894	84	56	72	75	74	63	52
1893	80	60	76	79	73	64	52
1892	80	60	76	79	77	67	57
1891	87	64	83		84	71	58
1890	88	70	89		98	83	76
1889	90	60	79		79	70	60
1888	90	60	79		68	61	50
1887	84	62	81		-	-	-
1886	90	60	79		-	-	-
1885	92	64	83		-	-	-
1884	104	64	83		-	-	-
1883	115	76	95		-	-	-
1882	121	80	99		-	-	-
1881	125	78	90		-	-	-
1880	127	80	92		-	-	-
1879	139	75	87		-	-	-
1878	150	70	82		-	-	-
1877	161	76	86	93	-	-	-
1876	154	84	94	101	-	-	-
1875	160	100	110	117	-	-	-
1874	174	120	130	137	-	-	-
1873	200	110	120	127	-	-	-

cont. Table C.1

	ACI	ICI	ICITa	ICITb	GCI1	GCI3	LCI3
1872	196	100	110	117	-	-	-
1871	210	100	110	117	-	-	-
1870	210	100	110	117	-	-	-

Sources: (1) ACI, ICI: see Appendix A, Tables A.7 and A.8. (2) GCI1, GCI3, LCI3: k.k. Handelsministerium, "Materialien zur Kartellenquete 1912, VIII: Eisenindustrie", *Die Kartellfrage in Österreich* (Vienna, 1897-1912), (hereafter "Eisenkartellenquete"), Abschnitt III: Tabellen und graphische Darstellungen, Figure XXVII. (3) ICITa, ICITb: for tariffs see Handelsministerium, "Eisenkartellenquete", Abschnitt IV: Statistische Materialien, Table 16, p.35; k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XXXVIII: Eisen und Eisenwaren* (Vienna, 1912), p.3.

Table C.2

SUPPORT IRON (PROFILES) PRICES (CROWNS/TON)

	ASI	GSI	PSI
1911	216	159	233
1910	216	159	233
1909	216	159	233
1908	225	165	239
1907	225	177	251
1906	212	165	240
1905	205	153	229
1904	200	153	229
1903	198	153	229
1902	170	152	228
1901	164	160	236
1900	200	192	268
1899	210	166	242
1898	218	157	233
1897	210	153	229
1896	204	143	219
1895	205	129	205
1894	203	130	206
1893	203	131	207
1892	222	131	207

cont. Table C.2

	ASI	GSI	PSI
1891	227	171	247
1890	240	202	278

Source: Handelsministerium, "Eisenkartellenquete", Abschnitt III: Tabellen und graphische Darstellungen, Table XIV, pp.20-21.

Table C.3

PRICES OF HEAVY SHEET METAL (CROWNS/TON)

	ASM	GSM	PSM
1911	236	163	269
1910	236	160	266
1909	239	147	254
1908	253	152	259
1907	260	185	292
1906	242	183	292
1905	235	160	273
1904	235	168	276
1903	230	172	282
1902	201	172	284
1901	197	249	362
1900	227	253	366
1899	240	211	324
1898	244	184	297
1897	241	183	296
1896	256	168	281
1895	252	152	264
1894	260	168	276
1893	275	183	295
1892	275	191	304
1891	275	203	316
1890	275	279	391

Source: Handelsministerium, "Eisenkartellenquete", Abschnitt III: Tabellen und graphische Darstellungen, Table XVI, pp.23-25.

Table C.4

BAR IRON PRICES (CROWNS/TON)			
	ABI	GBI	PBI
1911	187	144	231
1910	184	150	236
1909	187	139	228
1908	208	144	231
1907	215	187	274
1906	203	173	260
1905	195	147	236
1904	193	148	237
1903	191	146	235
1902	176	145	234
1901	170	149	238
1900	205	236	325
1899	207	203	291
1898	216	160	249
1897	214	172	261
1896	219	156	245
1895	216	133	222
1894	218	132	221
1893	226	137	226
1892	229	-	-
1891	235	-	-
1890	253	-	-
1889	250	-	-
1888	236	-	-
1887	236	-	-
1886	228	-	-
1885	240	-	-
1884	242	-	-
1883	250	-	-
1882	240	-	-
1881	227	-	-
1880	230	-	-
1879	240	-	-
1878	236	-	-
1877	250	-	-
1876	252	-	-
1875	280	-	-
1874	292	-	-
1873	348	-	-
1872	386	-	-

cont. Table C.4

	ABI	GBI	PBI
1871	340	-	-
1870	328	-	-

Source: Handelsministerium, "Eisenkartellenquete", Abschnitt III: Tabellen und graphische Darstellungen, Table XI, pp.16-17; Table XIII, p.19.

APPENDIX D

Austro-Hungarian Foreign Trade in Machinery 1870 to 1913

The data on Austria-Hungary's trade in machinery, presented in the following, refer to mechanical engineering as grouped in "Tarifklasse XL" (and the equivalent earlier classification) of the official Austro-Hungarian and Hungarian foreign trade statistics[1]. Electrical machinery,

---

[1] All data on Austria-Hungary's internal and external trade in machinery presented in this appendix are taken from or derived from these sources:
(a) k.k. Statistische Central-Commission, *Ausweise über den auswärtigen Handel Österreichs* (Vienna, 1871-1882), *1870*, pp.56-57, 98-99; *1871*, pp.56-57, 98-99; *1872*, pp.56-57, 98-99; *1873*, pp.58-59, 100-101; *1874*, pp.58-59, 100-101; *1875*, pp. 58-59, 100-101; *1876*, pp. 58-59, 100-101; *1877*, pp. 58-59, 100-101; *1878*, II, pp.68-69, III, pp. 42-42; *1879*, II, pp. 64-67, III, pp. 42-43; *1880*, II, pp. 64-67, III, pp. 42-43; *1881*, II, pp. 64-67, III, pp. 42-43.
(b) k.k. Statistische Central-Commission, "Statistik des auswärtigen Handels der österreichisch-ungarischen Monarchie", *Österreichische Statistik*, vol.4 (1883/84), II, pp. 48-51, III, pp. 26-27; vol.7 (1884), II, pp. 48-51, III, pp. 30-31; vol.10 (1885/86), II, pp. 48-51, III, pp. 30-31; vol.14 (1886/87), II, pp. 48-51, III, pp.30-31; 1886, vol.17 (1887/88), II, pp. 48-51, III, pp.30-31; vol.20 (1888/89), II, pp. 48a-51a, 66b-69b, III, pp. 30a-31a, 42b-45b; vol.23 (1889/90), II, pp.66-69, III, pp. 42-45; vol.26 (1890/91), II, pp. 68-73, III, pp. 42-45; vol.29 (1891/92), II, pp. 68-73, III, pp.42-45.
(c) k.k. Handelsministerium, Statistisches Department, *Statistik des auswärtigen Handels des österreichisch-ungarischen Zollgebiets* (Vienna, 1893-1916), *1895* (II), pp.244-256, 514-520; *1896* (I2), pp. 502-503, 531-532; *1899* (I2), pp. 25-26, 54-55; *1900* (II), pp.241-252, 525-532; *1905* (I2), pp. 26-27, 56-57; *1905* (II), pp.230-242, 512-520; *1907* (III), pp. 176-177; 203-205; *1912* (IV), pp. 166-169, 224-227; *1915* (IV), pp.83-87, 142-145.
(d) k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XL: Maschinen, Apparate und Bestandteile derselben* (Vienna, 1913), pp. 1-

included in the statistics under the heading of *machinery* between 1887 and 1905, is not covered here. The totals are reduced by the respective figures for electrical equipment to allow compatibility with the data sets for the later years. Prior to 1887 electrical goods are not separately listed in the statistics and thus not deductible. Judged on the basis of the 1887 trade figures, however, the volume of trade in electrical machinery seems most likely to have been insignificant in the early years.

The Hungarian trade statistics have been used to isolate Austrian (as distinct from total Austro-Hungarian) trade and the respective flows between Austria and Hungary (internal trade). In order to derive Austrian imports and exports, Hungarian imports and exports (exclusive of those from and to Austria, i.e. regardless of internal trade) were subtracted from the respective totals for the Monarchy:

$$impA = impAH - impH^{ROW} + impA^{H}$$
$$expA = expAH - expH^{ROW} + expA^{H}$$

Notation:

impA, expA	total Austrian imports and exports
impAH, expAH	imports and exports of Austria- Hungary
$impH^{ROW}$, $expH^{ROW}$	Hungary's foreign trade with countries *outside* the customs union of Austria-Hungary
$impA^{H}$, $expA^{H}$	Austrian imports from and exports to Hungary (internal trade).

Changes in the classification scheme of the foreign trade statistics were, generally, associated with alterations of the tariff structure[2]. Until the late-1870's, the only

192.
(e) Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1882-1913. Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1963), pp.302-314.

[2] Import tariffs were changed in 1878, 1882, 1887, 1892 and 1906; see sources given in note 1.

criteria for classifying machines other than locomotives, locomobiles and brass cylinders for cloth printing were the materials they were made of, i.e. wood, cast iron, wrought iron and steel, and other metals. Classification according to type of machinery was partially introduced in the foreign trade statistics during the 1880s. A substantial change took place in 1887 when, finally, more detailed categories of machinery were used. The number of entries rose from a mere 16 to 43 different types of machinery listed in the official statistics. From 1891, 52 items were distinguished and after 1906 the list of imported machinery included 106 categories[3]. The increasing degree of differentiation necessitated comprising of the data into broader, more representative categories. Several groups were formed, each of them including either similar types of machines (e.g. steam engines) or machinery serving particular purposes (e.g. agricultural implements or textile machines).

In addition to the overall trade figures for Austria-Hungary (Table D.1), Austria and Hungary (Table D.2) and the internal trade between the two halves of the Habsburg Monarchy (Table D.3), the data relating to the most important of these groups are reproduced in the following (Tables D.4 to D.11).

Notes:

a. Unless explicitly noted, the following tables refer to Austria-Hungary as a whole.

b. In 1883 imports and exports of wooden agricultural machinery (included in overall agricultural machinery trade) had to be estimated by using 1884 ratios of their (volume) share in total wooden machinery imports and

---

[3] The classification of machinery exports corresponds to that of imports; but the number of entries in the export statistics is smaller since a wider range of machinery was imported than exported. For 1891 to 1905, 35 export items were listed; from 1906, the number of entries was increased to 95.

exports.

c. From 1870 to 1886 imports and exports of textile machinery include only looms and/or parts for cloth printing equipment. For these years most of textile machinery imports were almost certainly part of imports of non-specified machinery and apparatus. Therefore, the very low figures (Table D.5) do by no means fully represent Austria-Hungary's imports of textile machinery.

Table D.1

AUSTRO-HUNGARIAN FOREIGN TRADE IN MACHINERY
(1000 CURRENT CROWNS)

	Imports	Exports
1913	122,970	54,063
1912	151,959	51,880
1911	118,965	45,611
1910	106,719	38,801
1909	91,844	32,257
1908	102,626	33,678
1907	95,658	38,338
1906	74,116	42,345
1905	62,275	31,184
1904	52,071	25,491
1903	47,757	22,592
1902	43,056	19,375
1901	42,259	27,959
1900	50,710	30,575
1899	44,686	22,500
1898	42,774	16,994
1897	37,934	11,528
1896	41,484	8,902
1895	44,632	9,386
1894	44,780	12,604
1893	38,030	11,464
1892	37,418	8,892
1891	34,794	9,812
1890	35,879	9,053
1889	41,506	11,000
1888	28,300	10,323
1887	22,349	7,627
1886	19,342	7,555
1885	23,703	7,635
1884	34,282	9,008
1883	31,922	15,480
1882	23,921	5,581
1881	27,617	9,472
1880	21,792	9,058
1879	18,795	6,943
1878	16,607	7,751
1877	13,784	7,709
1876	13,319	5,654
1875	19,063	12,659

cont. Table D.1

1874	21,729	17,084
1873	29.782	9,974
1872	35.383	3,545
1871	30.078	5,245
1870	22.803	1.617

Table D.2

AUSTRIAN AND HUNGARIAN FOREIGN TRADE IN MACHINERY[a]
(1000 CURRENT CROWNS)

	Austria		Hungary	
	Imports	Exports	Imports	Exports
1913	87,002	43,841	35,968	10,222
1912	101,911	40,893	50,048	10,987
1911	82,898	32,975	36,067	12,636
1910	74,408	28,312	32,311	10,489
1909	68,940	24,396	22,904	7,861
1908	81,451	25,564	21,175	8,114
1907	72,574	30,745	23,084	7,593
1906	57,003	32,852	17,113	9,493
1905	47,451	23,495	14,824	7,689
1904	41,214	18,740	10,857	6,751
1903	37,591	16,946	10,166	5,646
1902	35,774	13,609	7,282	5,766
1901	33,894	22,095	8,365	5,864
1900	41,681	22,827	9,029	7,748
1899	35,875	16,769	8,811	5,731
1898	33,888	11,442	8,886	5,662
1897	31,863	8,047	6,071	3,481
1896	34,923	5,934	6,561	2,968
1895	36,456	6,328	8,176	3,058
1894	36,154	8,733	8,626	3,871
1893	31,643	8,098	6,387	3,366
1892	30,700	6,584	6,718	2,308
1891	30,912	7,636	3,882	2,176
1890	32,184	6,929	3,695	2,123
1889	34,901	9,033	3,947	1,967
1888	25,361	8,614	2,939	1,709
1887	20,680	5,796	1,669	1,831
1886	17,144	6,033	2,198	1,522
1885	19,138	6,260	4,565	1,375
1884	27,856	5,919	6,426	3,089
1883	23,562	12,491	8,360	2,989

[a] Exclusive of internal trade between Austria and Hungary.

Table D.3

INTERNAL TRADE
AUSTRIAN IMPORTS FROM AND EXPORTS TO HUNGARY
(1000 CURRENT CROWNS)

	Imports	Exports
1913	3,962	55,329
1912	7,851	72,497
1911	5,593	61,612
1910	6,156	51,075
1909	6,554	46,708
1908	6,464	48,357
1907	5,778	46,963
1906	5,690	43,821
1905	6,842	40,437
1904	5,887	35,854
1903	5,959	31,097
1902	5,162	31,250
1901	6,394	32,230
1900	7,860	33,704
1899	5,854	24,886
1898	4,252	24,776
1897	3,302	23,232
1896	2,963	24,755
1895	3,743	29,002
1894	3,610	33,059
1893	3,353	25,794
1892	2,173	24,300
1891	2,189	13,290
1890	2,296	15,298
1889	1,902	15,705
1888	1,934	10,930
1887	1,853	9,704
1886	1,711	7,824
1885	1,744	9,359
1884	3,285	14,426
1883	2,657	14,326

Table D.4

FOREIGN TRADE IN AGRICULTURAL MACHINERY
(1000 CURRENT CROWNS)

	Imports	Exports
1913	23,011	14,909
1912	24,321	18,031
1911	17,440	17,072
1910	15,475	15,932
1909	10,751	11,718
1908	10,216	10,841
1907	11,994	9,517
1906	8,779	10,559
1905	5,490	7,657
1904	3,429	6,673
1903	3,368	7,198
1902	2,449	5,244
1901	2,502	3,221
1900	3,288	2,996
1899	3,404	3,175
1898	3,134	3,060
1897	2,246	1,776
1896	2,604	1,348
1895	2,748	1,452
1894	3,032	1,718
1893	2,942	1,776
1892	3,536	1,628
1891	3,408	1,654
1890	2,941	1,117
1889	2,697	1,157
1888	1,824	1,235
1887	1,359	667
1886	1,652	470
1885	1,972	454
1884	3,761	936
1883	5,316	1,650
1882	4,142	600
1881	5,008	1,582
1880	3,829	1,322
1879	2,436	969

Table D.5

FOREIGN TRADE IN SEWING MACHINES AND TEXTILE MACHINERY
(1000 CURRENT CROWNS)

	Sewing & Knitting Mach.		Textile Machinery	
	Imports	Exports	Imports	Exports
1913	5,505	240	12,320	2,356
1912	6,402	298	24,573	2,501
1911	5,973	289	22,102	2,570
1910	5,102	226	22,466	2,707
1909	5,168	403	22,405	2,076
1908	4,002	591	32,466	1,992
1907	4,554	633	27,853	2,680
1906	4,343	346	17,191	2,510
1905	4,758	485	14,301	1,747
1904	4,053	526	12,896	1,542
1903	4,183	719	12,462	2,071
1902	4,100	513	11,850	1,697
1901	3,591	428	10,013	1,165
1900	3,420	375	15,211	1,296
1899	3,309	366	10,213	2,026
1898	2,932	250	10,222	2,280
1897	2,784	244	9,934	1,432
1896	3,056	242	13,094	1,156
1895	3,026	360	15,863	1,466
1894	2,520	236	18,856	2,196
1893	2,721	275	14,127	1,890
1892	2,506	208	12,792	1,090
1891	2,024	325	13,201	748
1890	1,854	611	14,295	110
1889	1,702	798	19,539	177
1888	992	1,178	13,223	177
1887	1,133	862	7,058	180
1886	1,190	1,207	619	40
1885	1,492	801	1,569	56
1884	1,811	470	2,224	28
1883	1,388	470	1,403	3
1882	8,391	234	196	-
1881	3,899	327	371	3
1880	2,988	319	187	1
1879	2,301	306	107	9
1878	1,629	361	96	-
1877	1,843	313	109	-
1876	-	-	70	-

cont. Table D.5

1875	-	-	163	-
1874	-	-	132	-
1873	-	-	143	-
1872	-	-	59	-
1871	-	-	99	-
1870	-	-	110	-

Table D.6

FOREIGN TRADE IN WORKING-MACHINERY
(1000 CURRENT CROWNS)

	Machine Tools		Wood- & Stone-Working M.	
	Imports	Exports	Imports	Exports
1913	11,659	887	2,890	284
1912	13,635	781	4,506	417
1911	10,064	730	3,926	301
1910	8,846	417	3,556	249
1909	8,186	528	2,898	493
1908	11,589	363	2,740	115
1907	8,889	711	2,687	311
1906	4,867	419	1,773	545
1905	2,793	142	1,921	296
1904	1,745	117	1,251	360
1903	1,340	76	901	68
1902	1,225	130	727	150
1901	1,438	79	1,388	38
1900	2,378	161	1,696	261
1899	2,213	299	1,314	346
1898	1,796	272	946	452
1897	1,424	174	965	248
1896	974	198	1,481	56
1895	1,080	74	1,357	102
1894	1,086	90	1,356	130
1893	661	99	896	294
1892	836	49	926	321
1891	1,491	194	686	154
1890	595	-	591	25
1889	1,873	11	252	32
1888	504	17	139	29
1887	137	3	124	1

Table D.7

FOREIGN TRADE IN STEAM POWERED WORKING MACHINES
(1000 CURRENT CROWNS)

	Imports	Exports		Imports	Exports
1913	4,266	1,533	1909	2,552	501
1912	4,011	1,006	1908	2,120	1,125
1911	3,698	407	1907	1,472	494
1910	1,708	683	1906	643	276

Table D.8

FOREIGN TRADE IN ENGINES (1000 CURRENT CROWNS)

	Steam Engines		Other Engines	
	Imports	Exports	Imports	Exports
1913	1,469	11,102	5,331	1,077
1912	2,466	6,478	7,039	1,323
1911	1,709	6,562	4,721	847
1910	1,715	4,096	3,762	796
1909	1,629	2,085	2,147	751
1908	1,460	1,462	1,474	904
1907	734	1,803	1,646	562
1906	637	1,555	1,424	371
1905	322	224	1,024	342
1904	91	633	794	152
1903	82	68	634	169
1902	126	177	507	176
1901	301	158	395	118
1900	155	316	258	226
1899	549	333	244	166
1898	356	92	214	140
1897	188	164	154	96
1896	284	94	208	112
1895	508	142	288	44
1894	406	80	230	28
1893	402	24	160	32
1892	404	62	103	92
1891	1,192	50	147	30
1890	166	-	58	4
1889	169	10	90	12
1888	130	4	54	59
1887	82	91	21	2

Table D.9

FOREIGN TRADE IN LOCOMOTIVES AND LOCOMOBILES
(1000 CURRENT CROWNS)

	Locomotives		Locomobiles	
	Imports	Exports	Imports	Exports
1913	1,953	511	3,910	2,567
1912	1,124	110	5,485	3,462
1911	746	114	4,472	3,428
1910	883	185	3,322	3,392
1909	1,031	111	3,556	2,471
1908	1,828	1,403	3,112	1,809
1907	816	4,779	3,321	1,428
1906	386	4,781	3,489	2,104
1905	271	1,743	2,838	1,908
1904	427	824	2,363	1,647
1903	228	131	1,992	2,075
1902	304	1,099	1,468	1,038
1901	277	10,957	1,623	464
1900	396	5,509	1,809	458
1899	350	362	2,246	375
1898	252	1,272	2,152	258
1897	384	2	1,644	233
1896	452	-	1,418	137
1895	366	662	1,804	224
1894	177	1,834	2,024	396
1893	178	1,476	2,255	70
1892	58	338	2,922	97
1891	148	222	2,132	114
1890	194	652	1,524	74
1889	485	59	1,261	79
1888	228	-	1,235	87
1887	216	31	818	104
1886	330	114	1,138	94
1885	1,033	13	1,924	72
1884	2,209	250	3,534	40
1883	2,193	6,208	3,819	77
1882	1,047	2,715	1,939	-
1881	410	3,337	2,606	20
1880	-	337	1,780	36
1879	-	864	1,698	55
1878	-	3,583	2,100	2
1877	-	3,383	1,277	15
1876	24	149	439	-

cont. Table D.9

1875	-	5,260	1,422	11
1874	440	10,240	704	8
1873	783	5,212	797	26
1872	891	-	922	-
1871	2,025	1,935	732	21
1870	1,627	6	574	-

Table D.10

AUSTRIAN TRADE IN AGRICULTURAL MACHINERY
(1000 CURRENT CROWNS)

	Imports		Exports	
	ROW[a]	Hungary	ROW[a]	Hungary
1913	15,265	1,651	12,288	10,850
1912	17,195	2,119	13,506	14,559
1911	13,391	1,580	12,234	13,713
1910	11,360	1,651	11,471	12,671
1909	8,283	1,264	8,842	11,128
1908	7,903	1,210	8,661	10,683
1907	8,792	1,072	7,276	11,382
1906	6,052	1,185	7,241	12,928
1905	4,080	1,118	4,591	11,815
1904	2,115	1,162	4,279	11,331
1903	2,368	794	4,433	10,236
1902	1,694	557	3,313	8,595
1901	1,635	541	2,035	7,564
1900	1,922	509	1,900	8,929
1899	1,239	280	1,993	8,983
1898	361	296	1,192	10,025
1897	869	306	535	7,559
1896	1,192	241	220	6,288
1895	1,477	505	443	7,368
1894	1,377	479	538	8,321
1893	1,267	324	494	6,719
1892	2,409	177	1,056	3,177
1891	2,525	195	996	2,726
1890	2,108	227	475	2,580
1889	1,976	146	596	2,470
1888	985	241	647	2,356
1887	939	233	104	2,461
1886	1,004	246	44	1,738
1885	706	308	56	2,669
1884	2,252	239	507	3,399
1883	2,741	239	660	2,989

[a] ROW: rest of the world.

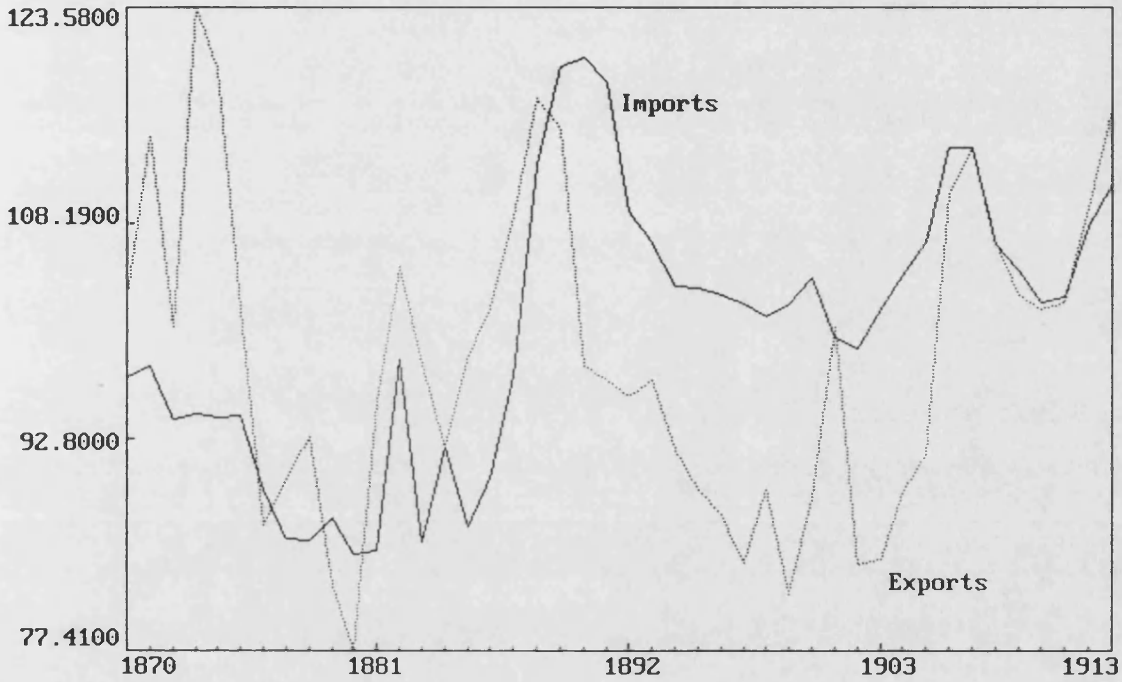
Table D.11

HUNGARIAN TRADE IN AGRICULTURAL MACHINERY[a]
(1000 CURRENT CROWNS)

	Imports	Exports
1913	18,596	4,272
1912	21,685	6,644
1911	17,762	6,418
1910	16,786	6,112
1909	13,596	4,140
1908	12,996	3,390
1907	14,584	3,313
1906	15,655	4,503
1905	13,225	4,184
1904	12,645	3,556
1903	11,236	3,559
1902	9,350	2,488
1901	8,431	1,727
1900	10,295	1,605
1899	11,148	1,462
1898	12,798	2,164
1897	8,936	1,547
1896	7,700	1,369
1895	8,639	1,514
1894	9,976	1,659
1893	8,394	1,606
1892	4,304	749
1891	3,609	853
1890	3,413	869
1889	3,191	707
1888	3,195	829
1887	2,881	796
1886	2,386	672
1885	3,935	706
1884	4,908	668
1883	5,564	1,229

[a] Including internal trade with Austria as given in Table D.10.

Figure D.1: Average Import and Export Unit Prices of Machinery (Crowns/100 KG)



Source: See this Appendix, note 1.

BIBLIOGRAPHY

I.
Archival Sources

Archiv der Creditanstalt-Bankverein, Vienna
Verwaltungsratsprotokolle

Bibliothek der Kammer der gewerblichen Wirtschaft für Wien, Vienna
Sign. IV.6316: Handelspolitische Zentralstelle, *Gutachten zum autonomen Zolltarif: Die Entwicklung der österreichischen Maschinenindustrie seit 1905 bis 1913*, typescript, no place, no year.

Magyar Országos Levéltár, Budapest
Records of
Danubius Hajó- És Gépgyár Rt.
Ganz És Társa Villamossági-, Gép-, Vagon- És Hajógyár Rt.
Ganz-Féle Villamossági Rt.
Hofherr-Schrantz-Clayton-Shuttleworth Magyar Gépgyári Müvek Rt.
Magyar Altálános Hitelbank Rt.
Pesti Magyar Kereskedelmi Bank Rt.
Schlick-Nicholson Gép-, Vagon- És Hajógyár Rt.
"Repertórium", 2 vols., prepared by G. Szilágyi, *Levéltari Leltárak 35* (Budapest, 1965).

Österreichisches Staatsarchiv - Allgemeines Verwaltungsarchiv, Vienna
Akten des Handelsministeriums

Werksarchiv, Voith GmbH, Heidenheim/Germany
Memoranda, protocols, reports

Turbinenlieferlisten nach Ländern
Verzeichnis der von der Firma J.M. Voith für Österreich-Ungarn gelieferten Turbinen-Anlagen

J.M. Voith AG, Turbinenbau, St. Pölten/Austria
Turbinenverzeichnis Voith
Verzeichnis der von der Leobersdorfer Maschinenfabriks-AG gelieferten Turbinen
Leobersdorfer Maschinenfabriks-AG, Wasserturbinen, Lieferungen seit dem Jahre 1900

II.

Official Publications, Proceedings, Reports and Statistical Materials

Compass. Finanzielles Jahrbuch für Österreich-Ungarn (Vienna, 1870-1916).

Handels- und Gewerbekammer Brünn, *Summarischer Bericht der Handels- und Gewerbekammer in Brünn über die geschäftlichen Verhältnisse in ihrem Bezirke während des Jahres 1872/73, 1884, 1889, 1902, 1910* (Brno 1874, 1885, 1890, 1903, 1911).

Handels- und Gewerbekammer Graz, *Bericht der Handels- und Gewerbekammer in Graz über die wirtschaftlichen Verhältnisse des Kammersprengels im Jahre 1895* (Graz, 1896).

Handels- und Gewerbekammer Prag, *Bericht der Handels- und Gewerbekammer in Prag über die volkswirtschaftlichen Verhältnisse ihres Bezirkes im Jahre 1896* (Prague, 1897).

Handels- und Gewerbekammer Prag, *Stenographisches Protokoll über die Verhandlungen der von der Prager Handels- und Gewerbekammer veranstalteten Enquete behufs Feststellung der Ursachen des Niederganges unserer Industrie und der*

Mittel zur Abhilfe (Prague, 1898).

Handels- und Gewerbekammer Wien, *Bericht über die Industrie, den Handel und die Verkehrsverhältnisse in Niederösterreich während des Jahres 1872/74-1913* (Vienna, 1875-1914).

k.k. Handelsministerium, "Materialien zur Kartellenquete 1912, VIII: Eisenindustrie", *Die Kartellfrage in Österreich* (Vienna, 1897-1912).

k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XL: Maschinen, Apparate und Bestandteile derselben* (Vienna, 1913).

k.k. Handelsministerium, *Statistische Materialien über den österreichisch-ungarischen Außenhandel nebst Vergleich der Zollsätze seit 1878, Tarifklasse XXXVIII: Eisen und Eisenwaren* (Vienna, 1912).

k.k. Handelsministerium, Arbeitsstatistisches Amt, *Die Arbeitszeit in den Fabriksbetrieben Österreichs* (Vienna, 1909).

k.k. Handelsministerium, Bureau des Industrierates, *Statistische Materialien über die Besteuerung und Entwicklung der Industrieaktiengesellschaften in Österreich* (Vienna, 1904).

k.k. Handelsministerium, Handelsstatistischer Dienst, *Außenhandel und Zwischenverkehr der im Reichsrathe vertretenen Königreiche und Länder und der Länder der heiligen ungarischen Krone 1909* (Vienna, 1911).

k.k. Handelsministerium, Statistisches Departement, *Nachrichten über Industrie, Handel und Verkehr,* vols.1-90

(Vienna, 1873-1909).

k.k. Handelsministerium, Statistisches Departement, "Statistik der österreichischen Industrie 1870, 1880, 1885, 1890", *Nachrichten über Industrie, Handel und Verkehr,* vols.3 (1874) No.2, 28 (1884), 38 (1888/89), 54 (1894).

k.k. Handelsministerium, Statistisches Departement, *Statistik des auswärtigen Handels des österreichisch-ungarischen Zollgebiets* (Vienna, 1893-1916).

k.k. Handelsministerium, Zwischenverkehrsstatistisches Amt, *Statistik des Zwischenverkehrs zwischen den im Reichsrathe vertretenen Königreichen und Ländern und den Ländern der ungarischen Krone* (Vienna, 1902-1913).

k.k. österreichisches Handelsmuseum, *Gewerbe- und produktionsstatistische Daten* (Vienna, 1915).

k.k. österreichisches Handelsmuseum, *Materialien zur österreichischen Produktions- und Betriebsstatistik* (Vienna, 1916).

Handelspolitische Zentralstelle, "Bericht über die wirtschaftliche Lage Österreichs in den Jahren 1912-13", *Mitteilungen der Handelspolitischen Zentralstelle* 27 (Vienna, 1914).

Jahrbuch der österreichischen Berg- und Hüttenwerke, Maschinen- und Metallwarenfabriken (Vienna, 1905-1912).

Kereskedelemügyi Magyar Kir. Miniszter, "Gép-gyártás és Közlekedési Eszközök Gyártása", *A Magyar Korona Országainak Gyáripara az 1898. Évben,* V. part, ed. J. Szterény (Budapest, 1901).

Kereskedelemügyi Magyar Kir. Miniszter / kgl. ungarischer Handelsminister, *Die Fabriksindustrie des Königreichs Ungarn*, ed. J. Szterény (Budapest, 1901).

Kereskedelemügyi Magyar Kir. Miniszterium, *Emlékirat a hazai kis- és gyáripar fejlesztéséröl* (Budapest, 1909).

Kupelwieser, F., "Die Erzeugung von Flusseisen und Stahl im XIX. Jahrhundert in Oesterreich-Ungarn", *Österreichische Zeitschrift für Berg- und Hüttenwesen* XLIX (1901), pp.655-660.

Magyar Kir. Allami Munkásbiztosítási Hivatal, *A magyar királyi állami munkásbiztosítási hivatalnak az 1907. évi XIX. törvényezikk 177. §-a alapján a kereskedelmügyi magyar királyi minister elé terjesztett jelentése az országos munkásbetegsegélyzö és baleset-biztosító pénztár müködéseröl 1908-1912* (Szeged, 1912, 1914; Arad, 1913; Budapest, 1917).

Magyar Kir. Központi Statisztikai Hivatal, "A Magyar Szent Korona Országainak 1882-1913. Évi Külkereskedelmi Forgalma", *Magyar Statisztikai Közlemények* 63 (Budapest, 1923).

Magyar Kir. Központi Statisztikai Hivatal, *A Magyar Korona Országainak Gyáripara az 1906. Évben*, II. vol., II. part, ed. A. Edvi Ilés (Budapest, 1911).

Magyar Kir. Központi Statisztikai Hivatal, *Magyar Statisztikai Évkönyv* (Budapest, 1872-1915).

k.k. Ministerium des Innern, *Die Gebarung und die Ergebnisse der Unfallstatistik 1889, 1890, 1891, 1892, 1893, 1894, 1895, 1896* (Vienna, 1891-1898).

k.k. Ministerium des Innern, *Ergebnisse der Unfallstatistik der fünfjährigen Beobachtungsperiode 1897-1901, 1902-1907, 1907-1911* (Vienna, 1904, 1909, 1914).

Österreichische Zeitschrift für Berg- und Hüttenwesen LIX-LXII (1911-1913).

Országos M. Kir. Statisztikai Hivatal, "Magyarország Iparstatisztikája 1885-Ben", ed. J. Jekelfalussy, *Hivatalos Statisztikai Közlemények* (Budapest, 1886).

Schuster, F., "Die Stahlproduktion Österreich-Ungarns", *Österreichische Zeitschrift für Berg- und Hüttenwesen* LVIII (1910), pp.377-380.

Stahl und Eisen 32-34 (1912-1914).

k.k. Statistische Central-Commission, "Statistik des auswärtigen Handels der österreichisch-ungarischen Monarchie", *Österreichische Statistik*, vols. 4 (1883/84), 7 (1884), 10 (1885/86), 14 (1886/87), 17 (1887/88), 20 (1888/89), 23 (1889/90), 26 (1890/91), 29 (1891/92).

k.k. Statistische Central-Commission, *Ausweise über den auswärtigen Handel Österreichs* (Vienna, 1870-1882).

k.k. Statistische Central-Commission, *Österreichisches Statistisches Handbuch für die im Reichsrathe vertretenen Königreiche und Länder*, vols. I-XXIII (Vienna, 1883-1915).

k.k. Statistische Central-Commission, *Österreichische Statistik*, vols. 1-93 (Vienna, 1882-1912).

k.k. Statistische Central-Commission, *Statistische Monatsschrift* (Vienna, 1875-1895; N.F. Vienna, 1896- 1914).

k.k. Statistische Central-Commission, *Statistisches Jahrbuch der österreichischen Monarchie* (Vienna, 1870-1882).

Statistische und tarifarische Daten insbesondere über die im Betriebe der k.k. Staatseisenbahnverwaltung stehenden Eisenbahnen (Vienna, 1904).

k.k. Statistische Zentralkommission, "Ergebnisse der gewerblichen Betriebszählung vom 3.Juni 1902 in den im Reichsrate vertretenen Königreichen und Ländern", *Österreichische Statistik*, vol. 75, 1.Heft-11.Heft (Vienna, 1904-1908).

Verein der Montan-, Eisen- und Maschinen-Industriellen in Österreich, *Memorandum über die bei den Handelsverträgen mit den auswärtigen Staaten wahrzunehmenden Export-interessen der Eisen- und Maschinen-Industrie* (Vienna, 1905).

Verein der Montan-, Eisen- und Maschinen-Industriellen in Österreich, *Stenographische Protokoll der Enquete betreffend die Notlage der Eisen- und Maschinen-Industrie* (Vienna, 1902).

Verein Deutscher Maschinenbau-Anstalten, *Denkschrift über die Maschinenindustrie der Welt. Bestimmt für das Kommittee B des vorbereitenden Ausschusses der internationalen Wirtschaftskomferenz des Völkerbundes* (Berlin, 1926).

III.

Articles, Books and Theses

Ashworth, W., "Typologies and Evidence: Has Nineteenth-Century Europe a Guide to Economic Growth?", *EHR* 2nd ser. XXX (1977) No.1, pp.140-158.

Bachinger, K., "Das Verkehrswesen", *Die Habsburgermonarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp. 278-322.

Bairoch, P., "Europe's Gross National Product: 1800- 1975", *JEEH* 5 (1976) No.2, pp.273-340.

Barth, E., *Entwicklungslininen der deutschen Maschinenbauindustrie von 1870 bis 1914* (Berlin, 1973).

Beck, L., *Die Geschichte des Eisens in technischer und kulturgeschichtlicher Beziehung*, 5. Abteilung: *Das XIX. Jahrhundert* (Braunschweig, 1903).

Becker, W., "Die Entwicklung der deutschen Maschinenbauindustrie von 1850 bis 1870", A. Schröter and W. Becker, *Die deutsche Maschinenbauindustrie in der industriellen Revolution* (Berlin, 1962), pp.135-285.

Benedikt, H., *Die wirtschaftliche Entwicklung in der Franz Joseph Zeit* (Vienna, 1958).

Berend, I.T. and Ránki, G., "Das Niveau der Industrie Ungarns zu Beginn des 20.Jahrhunderts im Vergleich zu dem Europas", Separatum *Studia Historica* 51 (Budapest, 1961), pp.267-289.

Berend, I.T. and Ránki, G., "Nationaleinkommen und Kapitalakkumulation in Ungarn, 1867-1914", *Social-Economic Researches on the History of East-Central Europe. Studia Historica* 62, ed. E. Pamlényi (Budapest, 1970), pp.11-34.

Berend, I.T. and Ránki, G., "Ungarns wirtschaftliche Entwicklung 1848-1918", *Die Habsburgermonarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.462-527.

Berend, I.T. and Ránki, G., *Economic Development in Central and South-Eastern Europe in the Nineteenth and Twentieth Centuries (New York, 1974).*

Berend, I.T. and Ránki, G., *Hungary: A Century of Economic Development* (New York, 1974).

Berend, I.T. and Ránki, G., *The Development of the Manufacturing Industry in Hungary, 1900-1944. Studia Historica* 19 (Budapest, 1960).

Berend, I.T. and Ránki, G., *The European Periphery and Industrialization 1780-1914* (Cambridge, 1982).

Berend, I.T. and Ránki, G., *Underdevelopment and Economic Growth - Studies in Hungarian Social and Economic History* (Budapest, 1979).

Berlász, J., "A Ganz-gyar elsö félszáda 1845-1895", *Tanulmányok Budapest múltjából* XII (1957), pp.349-458.

Bokor, G., *Geschichte und Organisation der amtlichen Statistik in Ungarn* (Budapest, 1896).

Brousek, K.M., *Die Großindustrie Böhmens, 1848-1918* (Munich, 1987).

Burn, D.L., *The Economic History of Steelmaking 1867-1939* (Cambridge, 1940).

Buxbaum, B., "Der deutsche Werkzeugmaschinen- und Werkzeugbau im 19. Jahrhundert", *Beiträge zur Geschichte der Technik und Industrie*, vol.9 (Berlin, 1919), pp.97-129.

Buxbaum, B., "Der amerikanische Werkzeugmaschinen- und Werkzeugbau im 18. und 19. Jahrhundert", *Beiträge zur*

Geschichte der Technik und Industrie, vol.10 (Berlin, 1920), pp.121-153.

Buxbaum, B., "Der englische Werkzeugmaschinen- und Werkzeugbau im 18. und 19. Jahrhundert", *Beiträge zur Geschichte der Technik und Industrie*, vol.11 (Berlin, 1921), pp.117-142.

Cairncross, A.K., *Home and Foreign Investment, 1870-1913* (Nr Brighton, reprint, 1975).

Carden, G.L., *Machine-Tool Trade in Austria-Hungary, Denmark, Russia and Netherlands with Supplementary Reports on Italy and France*, U.S. Department of Commerce and Labour, Special Agents Series - No.34 (Washington, D.C., 1910).

Carr, J.C., Taplin, W., *History of the British Steel Industry* (Oxford, 1962).

De Long, J.B., "Productivity Growth and Machinery Investment: A Long-Run Look, 1870-1980", *JEH* 52 (1992) No.2, pp.307-324.

Eckstein, A., "National Income and Capital Formation in Hungary, 1900-50", International Association for Research in Income and Wealth, *Income and Wealth: Series V*, ed. Simon Kuznets (London, 1955), pp.152-223.

Eddie, S., "Agricultural Production and Output per Worker in Hungary, 1870-1913", *JEH* 28 (1968), pp.197-222.

Eddie, S., "Economic Policy and Economic Development in Austria-Hungary, 1867-1913", *Cambridge Economic History of Europe*, vol. 8: *The Industrial Economies*, eds. P. Mathias and S. Pollard (Cambridge, 1988), pp.814-886.

Erlacher, G., "Kartelle in Oesterreich in der Zeit zwischen 1848 und 1938" (unpublished doctoral thesis, Universität Graz, 1970).

Ess, M., *Die Zukunft unserer Maschinen-Industrie* (Vienna, 1903).

Fehringer, F., "Die Lage der österreichischen Lokomotivindustrie", *Die Störungen im deutschen Wirtschaftsleben in ihren Rückwirkungen auf die industriellen, Effekten- und Geldmarktverhältnisse Österreichs. Schriften des Vereins für Socialpolitik* 112, eds. Verein für Socialpolitik (Leipzig, 1903), pp.59-63.

Feinstein, C.H., *National Income, Expenditure and Output of the United Kingdom, 1855-1965* (Cambridge, 1972).

Feldenkirchen, W., "Zur Kapitalbeschaffung und Kapitalverwendung bei Aktiengesellschaften des deutschen Maschinenbaus im 19. und beginnenden 20. Jahrhundert", *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 69 (1982) No. 1, pp.38-74.

Fellner, F. v., "Das Volkseinkommen Österreichs und Ungarns", *Statistische Monatsschrift* XLII (1916), pp.485-625.

Fink, K., *Die österreichisch-ungarische Monarchie als Wirtschaftsgemeinschaft. Südosteuropa-Schriften* IX (Munich, 1968).

Fischer, H., "Die Maschinenindustrie in Österreich", *Die Groß-Industrie Österreichs*, vol.I (Vienna, 1908), pp.95-105.

Fischer, W., "Wirtschaft und Gesellschaft Europas 1850-1914", *Handbuch der europäischen Wirtschafts- und*

Sozialgeschichte, vol. 5: *Europäische Wirtschafts- und Sozialgeschichte von der Mitte des 19. Jahrhunderts bis zum ersten Weltkrieg*, ed. W. Fischer (Stuttgart, 1985), pp.1-207.

Floud, R.C., "The Adolescence of American Engineering Competition, 1860-1900", *EHR* 2nd ser. XXVII (1974) No.1, pp.57-71.

Floud, R.C., *The British Machine-Tool Industry 1850-1914* (Cambridge, 1976).

Freudenberger, H., "An Industrial Momentum Achieved in the Habsburg Monarchy", *JEEH* 12 (1983) No.2, pp.339-350.

Friedmann, G., *Die österreichische Maschinenindustrie und der Export* (Vienna, 1906).

Gavajda, A., "Die Entwicklung der ungarischen Industrie von 1867 bis 1938" (unpublished doctoral thesis, Hochschule für Welthandel, Vienna, 1942).

Gerschenkron, A., *An Economic Spurt that Failed* (Princeton, 1977).

Gerschenkron, A., *Economic Backwardness in Historical Perspective* (Cambridge, Mass., 1962).

Good, D.F., "Austria-Hungary", *Patterns of European Industrialization. The Nineteenth Century*, eds. R. Sylla and G. Toniolo (London 1991), pp.218-247.

Good, D.F., "Economic Union and Uneven Development in the Habsburg Monarchy", *Economic Development in the Habsburg Monarchy in the Nineteenth Century. Essays*, ed. J. Komlos (New York, 1983), pp.65-80.

Good, D.F., "Financial Integration in Late Nineteenth Century Austria", *JEH* 37 (1977) No.4, pp.890-910.

Good, D.F., "Issues in the Study of Habsburg Economic Development", *East Central Europe* 6 (1979) 1, pp.47-62.

Good, D.F., "Modern Economic Growth in the Habsburg Monarchy", *East Central Europe* 7 (1980) 2, pp.248-268.

Good, D.F., "Stagnation and 'Take-Off' in Austria, 1873-1913", *EHR* 2nd ser. XXVII (1974) No.1, pp.72-87.

Good, D.F., "The Cost of Living in Austria, 1874-1913", *JEEH* 5 (1976) No.2, pp.391-400.

Good, D.F., "The Great Depression and Austrian Economic Growth after 1873", *EHR* 2nd ser. XXXI (1978) No.2, pp.290-294.

Good, D.F., *The Economic Rise of the Habsburg Empire, 1750-1914* (Berkeley, Calif., 1984).

Gross, N.T., "Austria-Hungary in the World Economy", *Economic Development in the Habsburg Monarchy in the Nineteenth Century. Essays*, ed. J. Komlos (New York, 1983), pp.1-45.

Gross, N.T., "Austrian Industrial Statistics 1880/85 and 1911/13", *Zeitschrift für die gesamte Staatswissenschaft* 124 (1968), pp.35-69.

Gross, N.T., "Die Stellung der Habsburgermonarchie in der Weltwirtschaft", *Die Habsburger Monarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.1-28.

Gross, N.T., "Economic Growth and the Consumption of Coal in Austria and Hungary, 1831-1913", *JEH* 31 (1971) No.4, pp.898-916.

Gross, N.T., "Industrialization in Austria in the Nineteenth Century" (unpublished doctoral thesis, University of California, Berkeley, 1966).

Gross, N.T., "The Industrial Revolution in the Habsburg Monarchy, 1750-1914", *Fontana Economic History of Europe*, vol.4, part I: *The Emergence of Industrial Societies*, ed. C.M. Cipolla (Hassocks, Sussex, 1976), pp.228-278.

Die Groß-Industrie Österreichs, 6 vols. (Vienna, 1898).

Die Groß-Industrie Österreichs, 4 vols. (Vienna, 1908).

Hammerbacher, *Die Konjunkturen in der deutschen Eisen- und Maschinen-Großindustrie* (Munich/Berlin, 1914).

Hertz, F., *Die Produktionsgrundlagen der österreichischen Industrie vor und nach dem Krieg* (Vienna, 4th ed. 1917).

Hoffmann, W.G., *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts* (Berlin, 1965).

Hoffmann, W.G., *The Growth of Industrial Economies* (Manchester, 1958).

Huertas, T., *Economic Growth and Economic Policy in a Multinational Setting: The Habsburg Monarchy, 1841-1865* (New York, 1977).

Die hundertjährige Geschichte der Ersten Brünner Maschinen-Fabriksgesellschaft in Brünn von 1821 bis 1921 (Leipzig, 1921).

Hundert Jahre Maschinen- und Waggonbau-Fabriks-A.G. in

Simmering, vorm. H.D. Schmid (Vienna, 1931).

Die Industrie 1892-1913. Festnummer zum 20-jährigen Bestand des Zentralverbandes der Industriellen Österreichs (Vienna, 1913).

Kareis, J., "Elektrotechnik", *Entwicklung von Industrie und Gewerbe in Österreich in den Jahren 1848-1888*, eds. Commission der Jubiläums-Gewerbe-Ausstellung Wien 1888 (Vienna, 1888), pp.274-305.

Kartell-Rundschau I-IX (1903-1911).

Katus, L., "Economic Growth in Hungary during the Age of Dualism, 1867-1918", *Social Economic Researches on the History of East-Central Europe. Studia Historica* 62, ed. E. Pamlényi (Budapest, 1970), pp.35-127.

Katus, L., "Transport Revolution and Economic Growth in Hungary", *Economic Development in the Habsburg Monarchy in the Nineteenth Century. Essays*, ed. J. Komlos (New York, 1983), pp.183-204.

Kausel, A., "Österreichs Volkseinkommen 1830-1913", *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829-1979*, eds. Österreichisches Statistisches Zentralamt (Vienna, 1979).

Kestner, F., *Die deutschen Eisenzölle 1879 bis 1900* (Leipzig, 1902).

Klíma, A., "The Beginning of the Machine-Building Industry in the Czech Lands in the First Half of the 19th Century", *JEEH* 4 (1975) No.1, pp.49-78.

Kohn, G., *Österreichs Förderung des fremdländischen Exports* *nach seinen eigenen Absatzgebieten* (Vienna, 1913).

Komlos, J., "Economic Growth and Industrialization in Hungary 1830-1913", *JEEH* 10 (1981) No.1, pp.5-46.

Komlos, J., "Is the Depression in Austria after 1873 a 'Myth'?", *EHR* 2nd ser. XXI (1978) No.2, pp.287-289.

Komlos, J., Review of D.F. Good, The Economic Rise of the Habsburg Empire, 1750-1914. *JEEH* 18 (1989) No.2, pp.452-455.

Komlos, J., *The Habsburg Monarchy as a Customs Union. Economic Development in Austria-Hungary in the Nineteenth Century* (Princeton 1983).

Komlos, J., *Stature, Nutrition, and Economic Development in the Eighteenth Century Habsburg Monarchy: The 'Austrian' Model of the Industrial Revolution* (Princeton, 1989).

Kuznets, S., *Modern Economic Growth. Rate, Structure, and Spread* (New Haven, 1966).

Landes, D.S., *The Unbound Prometheus. Technological Change and Industrial Development in Western Europe from 1750 to the Present* (Cambridge, 1969).

Leuchtenmüller, B., "Die Investitions- und Industriepolitik der österreichischen Großbanken bis zum Jahre 1914" (unpublished doctoral thesis, Universität Wien, Vienna, 1973).

Ludwik, C. and Hotowetz, R., "Die böhmische Maschinen-Industrie", *Die Groß-Industrie Österreichs*, vol.III (Vienna, 1898), pp.23-31.

März, E., "Die wirtschaftliche Entwicklung der Donaumonarchie im 19.Jahrhundert", *Wirtschaft und Gesellschaft* (1985), pp.367-392.

März, E., *Österreichische Bankpolitik in der Zeit der großen Wende 1913-1923* (Vienna, 1981).

März, E., *Österreichische Industrie- und Bankpolitik in der Zeit Franz Joseph I.* (Vienna, 1968).

"Die Maschinenindustrie", *Die Störungen im deutschen Wirtschaftsleben in ihren Rückwirkungen auf die industriellen, Effekten- und Geldmarktverhältnisse Österreichs. Schriften des Vereins für Socialpolitik* 112, eds. Verein für Socialpolitik (Leipzig, 1903), pp.67-72.

Mathis, F., *Big Business in Österreich. Österreichs Großunternehmen in Kurzdarstellungen* (Vienna, 1987).

Matis, H. and Bachinger, K., "Österreichs industrielle Entwicklung", *Die Habsburger Monarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.105-232.

Matis, H., *Österreichs Wirtschaft 1848-1913: Konjunkturelle Dynamik und gesellschaftlicher Wandel im Zeitalter Franz Joseph I.* (Berlin, 1972).

Matlekovitz, A. v., *Das Königreich Ungarn*, 2 vols. (Leipzig, 1900).

Matlekovitz, A. v., *Die Zollpolitik der österreichisch-ungarischen Monarchie und des Deutschen Reiches seit 1868 und deren nächste Zukunft* (Leipzig, 1891).

Matschoss, C., *Ein Jahrhundert deutscher Maschinenbau, 1819-1919* (Berlin, 1919).

Matthews, R.C.O., Feinstein, C.H., and Odling-Smee, J.C., *British Economic Growth 1856-1973* (Oxford, 1982).

Mejzlik, H., *Probleme der alpenländischen Eisenindustrie* (Vienna, 1971).

Milward, A.S. and Saul, S.B., *The Development of the Economies of Continental Europe - 1850-1914* (London, 1977).

Mokyr, J., "And Thou, Happy Austria? A Review Essay", *JEH* 44 (1984) No.4, pp.1094-1099.

Mosser, A., *Die Industrieaktiengesellschaft in Österreich 1880-1913: Versuch einer historischen Bilanz- und Betriebsanalyse* (Vienna, 1980).

Mosser, A., Review of D.F. Good, The Economic Rise of the Habsburg Empire. *Mitteilungen des österreichischen Staatsarchivs* 40 (1987), pp.448-458.

Mühlpeck, V., Sandgruber, R. and Woitek, H., "Index der Verbraucherpreise 1800-1914", *Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich, 1829 - 1979*, eds. Österreichisches Statistisches Zentralamt (Vienna, 1979), pp.649-688.

O'Brien, P.K., "Do We have a Typology for the Study of European industrialization in the XIXth Century?", *JEEH* 15 (1986) No.2, pp.291-333.

Offergeld, W., *Grundlagen und Ursachen der industriellen Entwicklung Ungarns* (Jena, 1914).

Otruba, G., "Quantitative, strukturelle und regionale Dynamik des Industrialisierungsprozesses in Österreich-Ungarn vom Ausgang des 18. Jahrhunderts bis zum Ausbruch des Ersten Weltkrieges", *Vom Kleingewerbe zur*

Großindustrie, ed. H. Winkel (Berlin, 1975), pp.105-163.

Paulinyi, A., "Die sogenannte gemeinsame Wirtschaftspolitik in Österreich-Ungarn", *Die Habsburgermonarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.567-604.

Paulinyi, A., "Die Industriepolitik in Ungarn und in Österreich und das Problem der ökonomischen Integration (1880-1914)", *Zeitschrift für Wirtschafts- und Sozialwissenschaften* (1977) 2, pp.131-166.

Pfaff, C., "Die Maschinen-Industrie", *Entwicklung von Industrie und Gewerbe in Österreich in den Jahren 1848-1888*, eds. Commission der Jubiläums-Gewerbe-Ausstellung Wien 1888 (Vienna, 1888), pp.265-273.

Pigou, A.C., *Industrial Fluctuations* (London, 2nd ed. 1929).

Pindyck, R.S., and Rubinfeld, D.L., *Econometric Models and Economic Forecasts* (Singapore, 2nd ed. 1981).

Pollard, S., *Peaceful Conquest. The Industrialization of Europe 1760-1970* (Oxford, reprint 1986).

Purs, J., "The Industrial Revolution in the Czech Lands", *Historica* 2 (1960), pp.183-272.

Ránki, G., "On the Economic Development of the Austro-Hungarian Monarchy", *Economic Development in the Habsburg Monarchy in the Nineteenth Century. Essays*, ed. John Komlos (New York, 1983), pp.47-63.

Ránki, G., "Problems of the Development of Hungarian Industry, 1900-44", *JEH* 24 (1964) No.2, pp.204-228.

Reitschuler, S., *Die Stellung der Maschinenindustrie im Prozeß der Industrialisierung* (Cologne, 1963).

Rosenberg, N., "Capital Goods, Technology, and Economic Growth", N. Rosenberg, *Perspectives on Technology*, (Cambridge, 1976), pp.141-150.

Rosenberg, N., "Technological Change in the Machine Tool Industry, 1840-1910", *Essays in American Economic History*, eds. A.W. Coats and R.M. Robertson, (London, 1969), pp.165-186.

Rosenberg, N., *Inside the Black Box: Technology and Economics* (Cambridge, reprint 1990).

Rothschild, K., "Wurzeln und Triebkräfte der Entwicklung der österreichischen Wirtschaftsstruktur", *Österreichs Wirtschaftsstruktur*, vol.I, ed. W. Weber (Berlin, 1961), pp.1-157.

Rudolph, R.L., "Quantitative Aspekte der Industrialisierung in Cisleithanien", *Die Habsburgermonarchie 1848-1918*, vol.1: *Die wirtschaftliche Entwicklung*, ed. A. Brusatti (Vienna, 1973), pp.233-249.

Rudolph, R.L., "The Pattern of Austrian Industrial Growth from the Eigteenth to the Twentieth Century", *Austrian History Yearbook* 11 (1975), pp.3-25.

Rudolph, R.L., *Banking and Industrialization in Austria-Hungary: the Role of Banks in the Industrialization of the Czech Crownlands, 1873-1914* (Cambridge, 1976).

Sandgruber, R., *Österreichische Agrarstatistik 1750- 1918* (Munich, 1978).

Sandgruber, R., *Die Anfänge der Konsumgesellschaft: Konsumgüterverbrauch, Lebensstandard und Alltagskultur in Österreich im 18. und 19. Jahrhundert* (Munich, 1982).

Sándor, V., "Die großindustrielle Entwicklung in Ungarn 1867-1900", *Acta Scientiarum Hungaricae* III (1956), part 3, pp.139-247.

Saul, S.B., "The Machine Tool Industry in Britain to 1914", *BH* 10 (1968) No.1, pp.22-43.

Saul, S.B., "The Market and the Development of the Mechanical Engineering Industries in Britain, 1860-1914", *EHR* 2nd ser. XX (1967) No.1, pp.111-130.

Saul, S.B., *The Myth of the Great Depression* (Basingstoke, 2nd ed., reprint 1985).

Schröter, A., "Die Entstehung der deutschen Maschinenbauindustrie in der ersten Hälfte des 19. Jahrhunderts", A. Schröter and W. Becker, *Die deutsche Maschinenbauindustrie in der industriellen Revolution* (Berlin, 1962), pp.11-133.

Schubert, H.R., "The Steel Industry", *A History of Technology*, vol. V: *The Late Nineteenth Century, c. 1850 to c.1900*, eds. C. Singer, E.J. Holymard, A.R. Hall, T.I. Williams (Oxford, 1958), pp.53-71.

Schuster, F., *Materialien zur Eisenkartell-Enquete. Denkschrift des Vereines der Montan-, Eisen- und Maschinen-Industriellen in Österreich* (Witkowitz, 1912).

Slokar, J., *Geschichte der österreichischen Industrie und ihrer Förderung unter Kaiser Franz I.* (Vienna, 1914).

Södersten, B., *International Economics* (London, 2nd ed. 1983).

Solomou, S., *Phases of Economic Growth, 1850-1973* (Cambridge, 1990).

Somary, F., *Die Aktiengesellschaften in Österreich* (Vienna, 1902).

Steller, P., "Die Maschinenindustrie Deutschlands", *Die Störungen im Wirtschaftsleben Deutschlands während der Jahre 1900ff.*, vol.3., *Schriften des Vereins für Socialpolitik* 107, eds. Verein für Socialpolitik (Leipzig, 1903), pp.1-74.

Sugár, O., *Die Industrialisierung Ungarns unter Beihilfe des Staates und der Kommunen* (Leipzig, 1908).

Sylla, R., and Toniolo, G., "Introduction: Patterns of European Industrialization During the Nineteenth Century", *Patterns of European Industrialization. The Nineteenth Century*, eds. R. Sylla and G. Toniolo (London, 1991), pp.1-26.

Teirich, J., "Die Entwicklung der österreichischen Maschinenindustrie", *Die Groß-Industrie Österreichs*, vol.III (Vienna, 1898), pp.5-20.

Tessner, M., *Der Außenhandel Österreich-Ungarns von 1867 bis 1913* (Cologne, 1989).

Tilly, R., "Entwicklung an der Donau: Neuere Beiträge zur Wirtschaftsgeschichte der Habsburger Monarchie", *Geschichte und Gesellschaft* 15 (1989), pp.407-422.

Tinbergen, J., "Business Cycles in the United Kingdom", *Verhandelingen der koninklijke Akademie van Wetenschappen,* n.s. LII (1950), no.4.

Toniolo, G., "Effective Protection and Industrial Growth: The Case of Italian Engineering, 1898-1913", *JEEH* (1977) No.3, pp.659-673.

Trebilcock, C., *The Industrialization of the Continental Powers, 1780-1914* (London, 1981).

Tremel, F., *Wirtschafts- und Sozialgeschichte Österreichs* (Vienna, 1969).

Tremel, F., "Die industrielle Entwicklung in Ungarn 1867-1900", *Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte* 45 (1958) No. 2, pp.242-250.

Voltmann, W., "130 Jahre Leobersdorfer Maschinenfabrik" (unpublished diploma thesis, Wirtschaftsuniversität Wien, Vienna, 1981).

"Waggon- und Maschinenfabrikation", *Die Störungen im deutschen Wirtschaftsleben in ihren Rückwirkungen auf die industriellen, Effekten- und Geldmarktverhältnisse Österreichs. Schriften des Vereins für Socialpolitik* 112, eds. Verein für Socialpolitik (Leipzig, 1903), pp.49-58.

"Werkzeugmachinen- und Werkzeugfabriken", *Die Störungen im deutschen Wirtschaftsleben in ihren Rückwirkungen auf die industriellen, Effekten- und Geldmarktverhältnisse Österreichs. Schriften des Vereins für Socialpolitik* 112, eds. Verein für Socialpolitik (Leipzig, 1903), pp.65-66.

Wöhe, G., *Einführung in die Allgemeine Betriebswirtschaftslehre* (Munich, 13th ed. 1978).

Zickler, C., "Die elektrotechnische Industrie", *Die Groß-Industrie Österreichs*, vol.III (Vienna, 1898), pp.175-190.