

REAL WAGES
IN GERMANY
1871-1913

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1871-1913

ASHOK V. DESAI

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Preface

REAL incomes in most countries, however backward, are rising today: the interesting problems are generally how fast they are rising and under what conditions they would rise faster. They are the problems underlying this study. When one takes up a period a few decades away in history however, one is forced either to rely on qualitative information or to confine oneself to some measurable magnitudes. I wanted to find out how much one could say on the basis of quantitative information with some measure of reliability. Hence I have limited myself to the growth of real industrial wages, for which fairly precise estimates could be made.

This meant that besides factors affecting the growth of real incomes, those influencing the distribution between wage and non-wage incomes must also be analysed. I have dealt with distribution in terms of the neo-Keynesian theory of distribution. It is shown that the rate of rise in real wages declined around the turn of the century; and the decline is explained by an investment boom which, by stimulating demand all round, redistributed income in favour of profits.

Income redistribution within a manufacturing industry with clearly defined groups of wage-earners and others is a fairly transparent process, and has been dealt with quite briefly here. The process is more complex and interesting in agriculture, with its variety of technical and tenurial conditions, and in building, which is closely connected with the capital market. Developments in these two industries are given a closer look.

Changes in technology were prominent in most industries as factors initiating investment upswings and upsetting the prevailing patterns of output and consumption. They could not, however, be given more than passing attention, for they called for a string of micro-studies which could not be fitted into this book.

The emphasis here is on theoretical interpretation of facts, and development of theory has been set aside. One who is interested in verification of theory is apt to be embarrassed by its appetite for facts: the establishment of the smallest theoretical points involves so much spadework. The structure of theory that could be supported by information over half a century old is bound to be puny.

An earlier version of this book was submitted as a doctoral dissertation to the University of Cambridge. In the course of writing it I piled up a considerable debt of gratitude to friends. Foremost among them is Miss Phyllis Deane, who supervised my work in its crucial stages. Her

encouragement was always forthcoming, and her criticism curbed many wayward tendencies.

I am deeply indebted to Professor Walther G. Hoffmann who put a mass of statistical information compiled under his direction at my disposal. Some of it has been used in this book and acknowledged in the appropriate places. Apart from Professor Hoffmann's assistance I benefited greatly from discussions with members of the Institut für industriewirtschaftliche Forschung which he directs. In particular, Dr. Franz Grumbach was an unfailing source of information and ideas.

I also received unreserved help from Professor Erich Schneider in Kiel, and have made extensive use of the resources of the Institut für Weltwirtschaft which he directs. The Institut's library is not only one of the best endowed among those I have worked in, it is one of the few which give the impression of being there for the reader. Its usefulness is partly due to years of intelligent planning and organization; but it owes even more to the readiness to help and the interest in improvements of its librarian, Dr. Erwin Heidemann. I have also received much sympathetic assistance from Frau Treitel, Herr Arp, and other members of the library staff, which made working in the library a pleasure.

I am indebted to the Director of the Mathematical Laboratory of the University of Cambridge for permission to use EDSAC 2 for computations summarized in Chapter 6, and to Dr. Lucy Slater for help in setting up the computer programmes.

ASHOK V. DESAI

Delhi

2 August 1966

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FIG. I.
Political divisions of Germany, 1871-1918.

1

Introduction

ESTIMATES published by Jürgen Kuczynski indicate that real wages in Germany increased little from 1900 to the beginning of the First World War.¹ On the basis of Kuczynski's and other statistics, Phelps Brown and Hopkins have come to the conclusion that the growth of real wages was slowed down 'at some time not later than 1886' in four industrial countries on the Atlantic—Britain, the United States, Germany, and France.² Recently, however, Rees has shown that there was much divergence in the course of prices of various consumption goods in the United States from 1890 to 1913. Earlier American cost-of-living indices gave an unduly large weight to food, and consequently showed a greater increase in the cost of living than actually occurred in this period. Thus, far from real earnings in manufacturing industry having been stationary from 1890 to 1913 as was claimed earlier, they are shown by Rees to have risen substantially.³

The possibility is no less strong that the retardation of the rise in real wages at this time is illusory, for Kuczynski's cost-of-living index also gives undue weight to food items, and his wage data are extremely heterogeneous.

An attempt is made in this book to settle the doubts raised by the inadequacies of his data. We confine ourselves to real earnings in industry, transport, and distributive trades since appropriate information on agriculture is lacking, and present evidence for the view that the rise in real earnings was slower from 1900 to 1913 than in the preceding decade, though more rapid than Kuczynski's figures suggest.⁴ Further, we find it highly probable that the rise in the 1880s was greater than in the following decade. Thus the retardation of the rise in German real wages will be given a surer factual basis than has been available hitherto.

¹ J. Kuczynski, *Die Geschichte der Lage der Arbeiter in Deutschland von 1800 bis in die Gegenwart. Band I. 1800 bis 1932*: third edition, Berlin, 1947, pp. 176 ff.

² E. H. Phelps Brown and S. V. Hopkins, 'The course of wage rates in five countries, 1860-1937', *Oxford Economic Papers*, 1950, pp. 226-96.

³ A. Rees, *Real wages in manufacturing 1890-1914*, NBER General Series No. 70, Princeton, 1961.

⁴ Our object is to obtain estimates of earnings, and we deviate from it only in the case of a few series for the period before 1887 owing to the paucity of information. After 1887 we rely entirely on earnings which are more comprehensive and reliable. Our results are not strictly

1.1. *The explanation*

Once established, the check to real wages invites explanation. Although the evidence begins to get thin here, the temptation to give an explanation cannot be entirely resisted. Phelps Brown and Hopkins are of the view that the retardation of real wages was due to a slackening of the growth of *per capita* output which they attribute to a difference in the nature of innovations in the periods preceding and following the climacteric.¹ They believe that innovations before the 1890s were such as raised output per head, while innovations at the turn of the century created new products and improved the quality of existing ones rather than increased productivity. The alternative possibility in their model, which is in effect a single-commodity, single-industry, closed-economy model, is that the ratio of the growth rate of average wage to the growth rate of productivity was higher before the climacteric than after it. They reject it on the grounds that the ratio of money wage to national money income per occupied person shows no change in trend at the time of the climacteric. The crucial piece of evidence here is their estimates of national income. For most years they are based on the income tax statistics of Prussia, whose population constituted some 60 per cent. of the German population and which admittedly was highly representative of Germany as a whole. But they state that 'income below the income-tax exemption level seems to have been estimated throughout by assigning to the relevant number of occupied persons an average income of 800 marks in the country and 665 marks a year in towns'.² Thus, there is a substantial downward bias to the estimates, and we have no evidence regarding its gravity or changes in it over time. Conclusions based on these estimates are therefore of doubtful validity.

The problem whether there was a change in the way income was distributed between wage-earners and others can be approached in two ways. One can either try to make improved estimates of national income (and of wages, for that matter). This has been attempted by Hoffmann and Müller.³ They make estimates of taxed and untaxed incomes for the principal states of Germany and add them up. Their estimates of incomes below the tax limit are based on figures of wages, and they make adjustments for the increase in the number of people subject to tax with the general increase in incomes. Their statistics can be used to support Phelps Brown and Hopkins's hypothesis. If, however, one brings to mind comparable with Kuczynski's since he uses statistics of wage rates and earnings without distinction.

¹ Their statistics, based as they are on Kuczynski's, refer neither to wage rates nor to earnings specifically. Their analysis is in terms of wage rates but can be easily adapted to earnings.

² *Op. cit.*, p. 261.

³ W. G. Hoffman and J. H. Müller, *Das deutsche Volkseinkommen 1851-1957*, Tübingen, 1959.

the complexity of the income structure¹ and the difficulty of taxing the income of peasants and businessmen, one cannot fail to be impressed by the tenuous character of the assumptions underlying Hoffmann and Müller's estimation of incomes.

A second approach is to look at wages, productivity, and prices in individual industries. While this does not give such unequivocal results as the first approach, it enables us to distinguish between more and less dependable evidence. We shall see in this book how far this approach can take us.

1.2. *The plan*

We begin with a description of the statistics on which our conclusions on real wages are based. We shall review the estimates of money earnings in Chapter 2 and the cost-of-living index in Chapter 3. This will lead us to estimates of real earnings in Chapter 4, where evidence will be presented to show a progressive retardation of real wages. We shall also investigate in that chapter how far the evidence supports the conclusions of Phelps Brown and Hopkins and of Kuczynski, and indicate the lines of inquiry into the causes of the slackening in the rise of real wages which then follows. The behaviour of some of the possible explanatory factors will be explored in Chapter 5, where it will be shown that a rise in the relative prices of consumer goods in terms of the prices of industrial goods contributed to the retardation at a certain stage. The rise in the prices of two major groups of consumer goods—agricultural goods and housing services—will be studied in the two chapters that follow. In Chapter 8 we shall bring together the threads of the argument and set up our own explanation.

¹ For instance, see the analysis of the American income structure in H. P. Miller, *Income of the American people*, New York, 1955, pp. 19–28.

2

Money Earnings

ESTIMATES of average annual earnings in various industries and transport and distributive services are presented in Tables A.1 and A.2. In this chapter we shall describe how we derived them and make an appraisal of their quality. It will be convenient to discuss the series from 1871 to 1886 and from 1887 to 1913 separately since the sources and methods for the two periods differ.

2.1. 1887-1913

The estimates for this period are based on statistics collected in the course of operation of a scheme of compulsory insurance against industrial accidents as instituted by the German Imperial Government. The scheme was administered by a number of industrial associations (*Berufsgenossenschaften*) which reported every year to the state supervisory organization (*Reichsversicherungsamt*) on the number of persons insured and their incomes. This information has been used here to estimate average earnings.

The industrial associations were expected to collect contributions from employers for the finance of the insurance scheme. Most of the associations were organized on the basis of similarity of products of firms that paid them dues. Some were based on the similarity of techniques—for example, those for machines, non-ferrous metals, and chemicals. A few combined heterogeneous trades—for instance, gasworks and waterworks, or saw-mills and furniture-making. These have been excluded from consideration. For some larger industries like iron and steel, textiles and building, there were a number of regional associations. We have combined the figures for these to obtain national averages.¹

2.11. Criteria of insurance

The responsibility of insuring workers and the liability for contributions

¹ F. Grumbach and H. König have used the same sources to derive indices of industrial earnings ('Beschäftigung und Löhne der deutschen Industriewirtschaft', *Weltwirtschaftliches Archiv*, October 1957, pp. 125-55). The main differences between their series and ours are: (a) we have adopted the industrial classification followed by the *Reichsversicherungsamt*, while Grumbach and König have made larger industrial groups, (b) we have calculated average annual earnings, while they claim to have calculated average daily earnings (i.e. to have adjusted the annual figures for the average number of days worked per year per worker), and (c) they have failed to correct distortions in the original data.

lay with employers. Provided one of a number of criteria applied to him, it was compulsory for an employer to get his workers insured.

He was liable if his firm belonged to an industry whose normal techniques were mechanized, that is, where the use of power other than human or animal power was general. If it did not belong to such an industry, he was still liable if the firm used mechanical or electrical power, or if it employed more than ten persons.¹ Firms using animal power came under the scheme in 1900.²

Further, all workers in certain designated industries had to be insured. The insurance law of 1884³ specified mines including salt-mines and salt-works, stone quarries, building sites, shipbuilding works, and metal foundries. Inland and overseas shipping, inland transport, and warehouses were brought into the scheme between 1885 and 1887.⁴ In effect, therefore, all industrial workers outside cottage industry and handicrafts were insured.

In firms covered by the legislation, all workers and officials whose earnings were below a certain income limit were to be insured. This limit was 3,000 marks a year in most industrial associations. The associations for paper and tobacco and four regional associations for iron and steel (south Germany, south-west Germany, Silesia, and Rhine-Westphalia) had a limit of 2,000 marks till 1900, when it was raised to 3,000 marks. The associations listed in Table 2.1 had higher income limits.

In 1913, the upper income limit was raised to 5,000 marks. The limits listed above that were already above 5,000 marks were not affected.⁵

Some industrial associations made provision for the voluntary or compulsory insurance of employers. However, the only industry in Table A.2 where the number of insured employers was appreciable was building. In this industry of small operators, the distinction between wage-earners and employers was vague, and the value of wages as a concept may be open to doubt. The owners of larger businesses were excluded by the income limit which, except for Württemberg, was 3,000 marks. Hence the lumping together of workers and employers is not necessarily to be

¹ *Amtliche Nachrichten des Reichsversicherungsamts*, Berlin, 1884-5, pp. 1-4. 'Bescheide und Beschlüsse.'

² Unfallversicherungsgesetze, II. Gewerbe-Unfallversicherungsgesetz, No. 2697 of 30 June 1900 (referred to hereafter as Uvg. 1900), *Reichsgesetzblatt*, 1900, p. 586, section 2.

³ Unfallversicherungsgesetze, No. 1552 of 6 July 1884 (referred to hereafter as Uvg. 1884), *Reichsgesetzblatt*, 1884, p. 69, section 1.

⁴ Gesetz über die Ausdehnung der Unfall- und Krankenversicherung, No. 1608 of 28 May 1885, *Reichsgesetzblatt*, 1885, p. 159, section 1. Gesetz betr. die Unfallversicherung der Seeleute und anderer bei der Schifffahrt beteiligter Personen, No. 1738 of 13 July 1887, *Reichsgesetzblatt*, 1887, p. 329, section 1.

⁵ Reichsversicherungsverordnung, No. 3921 of 19 July 1911. *Reichsgesetzblatt*, 1911, p. 615, sections 544 and 548.

regretted. Nevertheless, it should be noted that the figures of earnings in this industry represent average incomes rather than wages.

Officials with incomes below the prescribed limits were covered by the scheme, but whether owing to the income limit or for some other reasons, the number of insured officials was nowhere appreciable.¹

TABLE 2.1
Income limits over 3,000 marks²

	<i>Marks per year</i>
Cotton and wool textiles (Saxony)	4,000
Building (Württemberg)	5,000
Mining	5,000
Non-ferrous metals (north Germany)	5,000
Iron and steel (north-east Germany)	6,000
Silk	6,000
Chemicals	6,000
Printing	10,000
Linen textiles	15,000
Iron and steel (Saxony and Thuringia)	No limit
Milling	No limit
Sugar	No limit
Clothing	No limit

2.12. *The available statistics*

The insurance contributions paid by employers were proportional to the annual earnings of their insured workers. Up to 1902, however, the law required a number of adjustments to be made to the earnings before they were used for calculating contributions. After 1902 the industrial associations could use either earnings adjusted in this way or actual earnings as the basis of contributions, and all of them changed over gradually to using actual earnings. Thus, the information that has come down to us is somewhat untidy. We have the number of persons insured by each industrial association from 1886 to 1913; besides, we have their total annual earnings for the years 1903-13, their annual earnings after the adjustments (to be called distorted earnings below) from 1886 to 1902, and for a number of industrial associations we have figures of both actual and distorted earnings from 1903 to 1913. The statistics of actual earnings from 1903 to 1913 are evidently the most suitable for our purposes, and we can derive average earnings by dividing total earnings by the number of insured persons. Problems arise, however, in correcting the level of distorted earnings available up to 1902 so that we can derive from them series

¹ The numbers of insured persons by status classes were given annually in *Amtliche Nachrichten des Reichsversicherungsamts*.

² All income limits are given in 'Ergebnisse des gemäß §16 des Unfallversicherungsgesetzes abgehaltenen Genossenschaftsversammlungen zur Festsetzung der Statuten', *Amtliche Nachrichten des Reichsversicherungsamts*, 1884-5, pp. 162-73, 180-97.

which will be continuous with those obtained from figures of actual earnings in the years that followed, in estimating the seriousness of the errors embodied in the figures of distorted earnings, and in correcting the series if the errors are large. We shall next describe the actual and distorted earnings and go on to outline our solutions of these problems.

2.13. *Actual earnings*

The actual earnings that were recorded in 1903-13 were inaccurate in one respect: for firms with fewer than five workers, a notional sum could be recorded instead of the earnings of their insured workers.¹ The error involved, however, is negligible. Firms with fewer than five workers came under the insurance scheme only if they used mechanical or animal power; and the number of such firms was very small. Further, the sum to be recorded was decided by agreement between the employer and his industrial association, and there is no reason to expect a bias in it. Hence the effect of a number of such agreements on the level and the trend of earnings was likely to be insignificant.

It can be argued that the fixed upper income limit makes the available statistics unsatisfactory for the estimation of average earnings. People whose income crossed the limit thereby became uninsured; hence where incomes were generally rising, the average earnings of people subject to such a limit would understate the rise in incomes. We shall show in section 2.16 however that this downward bias was unimportant. For the present we shall assume this.

2.14. *Distorted earnings*

In the calculation of distorted earnings, the statistics of earnings furnished by employers were subjected to two adjustments. First, the wages of workers (principally apprentices) who earned less than the unskilled wage that was normal in their town were reckoned at this wage.² The normal unskilled wage was determined every year by the ministries of the states in charge of municipal affairs in consultation with the local authorities.³ Second, the excess of individual incomes over 1,200 marks was included only to the extent of a third. This limit was raised to 1,500 marks in the last quarter of 1900 and 1,800 marks in 1913.⁴ We shall call it the *s* limit for brevity.

Thus, distorted earnings have three unwelcome features as far as the calculation of time series of average annual earnings is concerned. First, the level of distorted earnings would differ from that of actual earnings.

¹ Uvg. 1900, p. 596, section 30.

² Uvg. 1884, p. 70, section 3.

³ Gesetz, betr. der Krankenversicherung der Arbeiter, No. 1496 of 15 June 1883. *Reichsgesetzblatt*, 1883, p. 76, section 8. For the wage statistics see *Centralblatt für das Deutsche Reich*.

⁴ Uvg. 1900, p. 596, section 29. *Ämtliche Nachrichten des Reichsversicherungsamts*, 1900, p. 807; 'Bescheide und Beschlüsse 1830', idem, 1915, p. 4.

The two adjustments would tend to cancel each other out in this respect, but the extent of compensation would differ between industries. Second, with a general rise in incomes, the proportion of earnings exceeding 1,200 marks would increase, and so would their underestimation. Hence distorted earnings are likely to rise and fall less rapidly than actual earnings: both their cyclical and secular variations are likely to be damped. Third, it is possible that they rose discontinuously in 1901 and 1913 following the rise in the *s* limit.

For 1903-13 we have simultaneous data of actual and distorted earnings. In the next section, we shall use these to estimate the correction of distorted earnings between 1887 and 1902 necessary to bring their level into line with that of actual earnings after 1902. In section 2.16, we shall use the same information to set outside limits to the other two inaccuracies in distorted earnings—damping of variations and discontinuities in 1901 and 1913.

2.15. Correction of the level of distorted earnings

In Table A.5 we show the ratio of actual to distorted earnings (which we shall call the distortion index) between 1903 and 1913 for industries where both are available. It is evident from the table that there were differences of up to 6 per cent. in the level of distorted and actual earnings; cyclical damping of distorted earnings can also be detected, for instance, in machines and paper products, in the trade cycles of 1903-7 and 1908-12. Abrupt rises in distorted earnings between 1912 and 1913 are less easy to detect. Since 1913 was a less prosperous year than 1912, it is to be expected that the proportion of incomes over 1,500 marks tended to fall and that this would be conducive to a fall in the distortion indices; this cyclical fall cannot be distinguished from the fall due to the raising of the *s* limit from 1,500 to 1,800 marks. Nevertheless, a fall in the distortion index is to be seen in a number of industries, for instance in iron and steel and machines, and it is possible that the rise in the limit contributed to it.

We shall assume that the entire difference between actual and distorted earnings (or the difference between the distortion indices and one) can be ascribed to the three causes of it mentioned above. There are some variations in it that are obviously erratic, for instance in inland shipping in 1904 and 1907; but they are rare enough to justify this assumption.

On this assumption, the difference between the distortion index and unity in 1902 for each industry will be made up of two elements—a constant element which will be present in the indices for 1903-13, and an element which will reflect the cyclical conditions in 1902. If we can estimate the two elements in 1902 and add them together to get the distortion index, actual earnings can be obtained by multiplying the 1902 distorted earnings with it.

In the distortion indices for building, non-ferrous metals, paper and tobacco, there was so little variation in 1903-13 that the cyclical element could be taken to be negligible, and the persistent element could be assumed to be approximately equal to the average of the 1903-13 distortion indices; this average was therefore taken to be an estimate of the 1902 index. A cyclical element entered the indices of other industries, and there was no dependable way of isolating the persistent element from it; nor was it possible to estimate the cyclical element in 1902. Since, however, both 1902 and 1903 were years of early recovery, their cyclical elements, and hence their distortion indices, were likely to be similar. For these industries therefore, the 1903 index was taken to be an estimate of the 1902 index.

There remained six industries for which simultaneous estimates of actual and distorted earnings were not available; their 1902 distortion indices were derived from the indices of other industries. It will be recalled that the distortion resulted from the scaling up of earnings below the local unskilled wages—whose main recipients were young apprentices—and the scaling down of earnings above the s limit. We should therefore expect that the amount of scaled-up earnings would depend on the number of young workers, and since officials would generally be paid more than workers, the number of insured officials in an industry would influence the amount of earnings that were scaled down. Further, the higher the average earnings in an industry, the larger the proportion of incomes exceeding the limit for scaling them down. Hence the distortion index would tend to be lower in industries with a higher proportion of young workers, and higher in industries with high average earnings and with a higher proportion of officials among workers.

We have compared the six industries with others in respect of average earnings, the proportion of young workers and the proportion of officials, and ascribed distortion indices to them for 1902 on the basis of the indices for industries which were similar to them in respect of these characteristics. In Table 2.2 below, we show these data for the six industries and for another five with which they were compared.

Distortion indices for the six industries were estimated by means of the following comparisons:

Mining. The earnings and the proportion of young workers were similar to those in machines and brewing; the proportion of officials was lower. Hence the distortion index was likely to be below that in the other two industries. We have put it at 0.98.

Quarries. Earnings were substantially understated in this industry.¹

¹ See section 2.17 below.

Money Earnings

It had proportions of young workers similar to the paper industry, but its proportion of officials and its probable average earnings were lower. Hence it has been given an index below that for paper—1.00.

TABLE 2.2
Data for the estimation of distortion indices¹

	Per cent. of workers and officials				Average actual earnings 1903	Distortion index 1902
	under 16		16-20	officials		
	1895	1907				
					M. Pf.	
Industries whose distortion indices are to be estimated:						
Mining	1.8	3.3	12.8	5.8	1,151 30	..
Stone quarries	5.5	6.1	16.8	3.7	346 09	..
Bricks	6.4	5.7	16.2	4.3	590 59	..
Silk ²	11.4	9.1	20.0	8.2	781 45	..
Clothing	15.0	8.2	9.5	5.1	743 73	..
Tramways	0.3	0.3	1.6	7.1	1,169 44	..
Industries with which they were compared:						
Brewing	2.9	2.6	9.5	14.7	1,114 15	1.00
Machines	7.2	5.5	12.7	11.7	1,099 89	0.99
Sugar	1.3	3.3	10.2	13.3	507 72	1.505
Tobacco	10.9	10.4	20.9	6.7	531 06	1.015
Paper	5.2	6.6	17.4	9.8	754 54	1.01

Bricks. The earnings were higher and the proportion of officials lower than in sugar and tobacco, while the proportion of young workers was between those in the two industries. Hence its distortion index seemed likely to fall between those of the other two. It has been put at 1.02.

Clothing and laundering. With its abundance of young workers, it represented an extreme case and was given a low distortion index—0.97.

Silk. It probably employed many young workers, but relatively more officials than clothing and laundering; hence it was given a slightly higher index—0.98.

¹ 1895 figures of employment were obtained from *Statistik des Deutschen Reichs* (N.F.), vol. 113, Tables 3 and 4, and 1907 figures from vol. 202, Tables 1 and 3. Average earnings are as given in Table A.2. The distortion indices shown were derived from indices for 1903-13 by one of the methods described earlier.

² The 1907 figures refer to the entire textile industry.

Tramways. With high earnings and a low proportion of young workers, they represented an extreme in the other direction and were given an index of 1.03.

The indices for these six industries are based on very crude guesses. To improve the basis of estimation, we computed a linear regression of distortion indices in 1907 on the proportions of workers under 16, of workers between 16 and 20 and of officials and average earnings in the same year, using data for twelve industries. In the result, the proportion of officials was found to be negatively correlated with distortion indices. Since this could not be explained on any plausible ground, the result was evidently incorrect. It is probable that the relationship was a more complicated one, but attempts to estimate it did not look promising with only twelve observations for each variate, and the guesses given above seemed the best that could be made in the circumstances.

The estimates of 1902 distortion indices obtained are given in Table A.5 with the distortion indices for 1903-13. The distorted earnings for the years 1886-1902 were multiplied by the 1902 indices to improve their alignment with the series of actual earnings for 1903-13. The resulting series for 1886-1902 as well as the actual earnings for 1903-13 were divided by the respective numbers of insured persons to give series of average earnings; these are shown in Table A.2. The figures for 1886 were omitted since they were generally so far above average earnings in 1887 as to be improbable. A few other figures have been omitted from Table A.2 since they did not fit in the series; they are shown in Table A.3. The series for printing was replaced up to 1903 by a series which will be described in section 2.21 below.

2.16. Magnitude of errors of distortion

Table A.5 shows that distortion indices in a number of industries rose during the cycles that reached booms in 1907 and 1912. If we relate these cyclical rises to the concomitant rises in money earnings, we can get an idea of the order of magnitude of the damping in distorted earnings. The noticeable cyclical variations in distortion indices are given in the Table below with the simultaneous increases in earnings.

This Table suggests that the tendency of the distortion index to fall with the increase in wages was substantial only in the iron and steel and machine industries. In the latter, a rise of 1 per cent. in the distortion index is associated with a 2.5 to 3 per cent. rise in earnings. In other words, increases in earnings seem to have been underestimated to the extent of 33 to 40 per cent. by the series of distorted earnings. The proportion is around 12-25 per cent. in iron and steel. In other industries the extent of underestimation suggested is very different for the two

cycles, and the limits that can be set to it are too wide to be of significance. It does appear, however, that the error in their estimates must be much smaller. The order of magnitude of underestimation before 1903 must have been similar, for while the level of earnings was lower then, the *s* limit was also lower—1,200 marks till 1900.

TABLE 2.3
Cyclical increases in distortion indices and earnings¹ (per cent.)

	1903-7 or nearest cycle		1908-12 or nearest cycle	
	Rise in distortion index	Per cent. rise in average earnings	Rise in distortion index	Per cent. rise in average earnings
Iron and steel	0.015	11.7	0.018	7.8
Machines	0.068	19.5	0.039	10.1
Glass	0.025	15.6	-0.004	10.7
Paper products	0.024	9.2	..	6.5
Leather	0.011	10.4	0.012	6.1
Conveyance	0.007	10.4	0.006	11.4

A rough estimate of the effect of the rise in the *s* limit can be made by comparing distortion indices for 1912 and 1913, when it was raised from 1,500 to 1,800 marks. The decline in the indices exceeds 2 per cent. in machines, non-ferrous metals, cotton and wool textiles, warehouses, leather, and inland shipping, and 1 per cent. in sugar. Erratic variations seem to have obscured it in iron and steel, and it is possible that other figures are affected by them. Further, since 1913 was a less prosperous year than 1912, we should expect a cyclical fall in the indices; their decline can be attributed only partly to the rise in the *s* limit. Hence it appears that a fall of 3 per cent. in the distortion index was exceptionally large and that for most industries it was probably under 1 per cent. The magnitude of the declines in the indices in 1900, when the *s* limit rose from 1,200 to 1,500 marks, is likely to be similar.

It will be noticed that since part of the distortion was due to the scaling down of incomes over the *s* limit, the fall in the distortion index following its rise would be greatest in industries where the index was greater than one. Hence the rise of the *s* limit goes some way in reducing the error introduced by the scaling down; if our guesses about the magnitudes are correct, it compensates much of the error. Over 1887-1902 as a whole, the distortions affect the timing of the rises in our earnings series more than their magnitude.

¹ The increases in distortion indices have been obtained from Table A.5, and the increases in earnings from Table A.2.

The rise in the s limit in 1900 meant that the whole amount of earnings between 1,200 and 1,500 marks was included in the distorted earnings instead of a third of it. Hence the associated fall in the distortion index would be the result of the inclusion of two-thirds of these earnings, and their proportion in total earnings must be one and a half times the fall in the index. This proportion is, therefore, very unlikely to have exceeded 5 per cent. in any industry and was probably under 1.5 per cent. in most. Assuming that the frequency distribution of earnings in each industry was like the normal wage distribution—a single-peaked distribution with very high frequencies in the lower income brackets¹—the density around and above 3,000 marks must have been considerably lower. For this reason, the bias we found in actual earnings (section 2.13) can be safely ignored; so can the rise in the limit of upper incomes to 5,000 marks in 1913 (section 2.11).

2.17. *Other characteristics*

There are a number of series which understate the level of earnings owing to a high level of labour turnover. The insurance law asked employers to report the average number of workers employed by them over the year; but it is likely that many simply gave the number listed in their wage records—that is, the number of workers employed at some time or other. The reported total wages were probably also taken from wage records and corresponded to the wages actually paid. In industries with high labour turnover, this led to a gross overestimation of the insured labour force and underestimation of average earnings.

Comparison with employment censuses shows the insured labour force in stone quarries, building, glass, bricks, and shipping to be much above the census numbers.² The difference in shipping is probably due to different definitions of the industry: the insurance statistics classified workers by the business of the employing firms, while the censuses classified them by their individual occupation; so workers employed at ports and landing stations by shipping firms would be excluded from the shipping industry by censuses. The difference in other industries is, however, very likely to be due to labour turnover. No detailed correction of the resulting error is possible in the absence of annual statistics of turnover; the overestimation of the labour force in census years is between 20 and 35 per cent. The error is largely one affecting the level of earnings, and is not likely to have affected their trend.

Finally we might mention two seasonal industries. The sugar industry provided employment in autumn and winter to many farm-workers who

¹ H. P. Miller, *op. cit.*

² F. Grumbach and H. König, *op. cit.*, p. 154, Table 16. Table 23. *Statistik des Deutschen Reichs*, vols. 113 and 202.

worked on beet fields in the growing season; and the brick industry worked in anticipation of building demand, mainly in spring and summer. Hence average earnings in these industries are low, and do not comprise their workers' entire earnings. The trend of earnings in sugar is probably well represented by our series, but even this is not certain of bricks. As labour became less abundant after 1895, the gathering of labour in spring became increasingly difficult for the brick industry. Hence it tended gradually to work all the year round, building up stocks in winter. The series for bricks shows a rapid increase in the years after 1895, associated with the longer working year.

2.18. *The final series*

In Table A.2, all series which have been shown to be subject to faults have been put into the second section; although the errors are not substantial in any series over a number of years, it is necessary to bear in mind the remarks on them in sections 2.16 and 2.17. The series in which there are no detectable faults are grouped in section 1 of Table A.2.

2.2. 1871-1886

A large variety of information about wage rates, agreed, declared, and actual, and about earnings before 1887 is available; its chief sources are firms, trade unions, and official bodies. There are, however, no census-type data comparable to those described in sections 2.1-2.18. In these circumstances, we have compared the available series with the series shown in Table A.2 in respect of their proportional rise in the two periods 1887-1902 and 1903-13, and selected those whose rise came nearest to the rise of our series. The selected series have been multiplied by the ratio of average earnings from 1893 to 1897 as given by Table A.2 to wages as shown by them, to give us series continuous with ours and stretching back to 1871. Since our earnings series for printing up to 1902 was unsatisfactory (section 2.15), the selected series was multiplied by the ratio for 1903-7, and part of it underlies the series for printing in Table A.2 up to 1902. The series of earnings before 1887 that we have derived are shown in Table A.1. Below we shall describe the selection of the pre-1887 series.

2.21. *Printing, building, and mining*

For these industries we have wage data from two proximate sources—J. Kuczynski and G. Bry. The proportional rises of their series are compared with ours below.

Both Kuczynski's and Bry's series are calculated from the same basic data—wage rates for various towns fixed by the printers' trade union and brought together by Robert Kuczynski.¹ J. Kuczynski makes a simple

¹ R. Kuczynski, *Arbeitslohn und Arbeitszeit in Europa und Amerika, 1870-1909*, Berlin, 1913,

average of wage rates in eight principal towns; Bry makes one only for three towns for which uninterrupted series are available—that is, where the union was active from the beginning.

The material for builders' wage rates is similarly available for a number of cities;¹ and here, too, Kuczynski has averaged wage rates for all available cities while Bry has restricted himself to three cities for which continuous series are available.

TABLE 2.4

Comparison of the rise in wages, 1887-1902 and 1903-13, as shown by different series for printing, building, and mining² (per cent.)

	Printing		Building		Mining	
	1887- 1902	1903- 1913	1887- 1902	1903- 1913	1887- 1902	1903- 1913
Our series		23.6	27.0	31.4	49.3	37.8
Kuczynski's series	16	17	28	34	36	33
Bry's series	15.7	23.4	29.1	40.1	54.3	39.0

For mining, Kuczynski compiles an average out of shift earnings in coal-mining in Aachen and the Saar and in iron-ore mining on the banks of the Rhine. His series has a link in 1884 and its two parts are not necessarily continuous. Bry's is a series of shift earnings in the Dortmund coal-mines—one of the most important groups of coal-mines. It might be noted that shift earnings should be expected to rise faster than annual earnings represented by our series, insofar as a part of the increase in earnings over a long period would be taken in the form of a reduced number of shifts per year.

For closeness with our series as regards percentage rises, we have selected Bry's series for printing and mining and Kuczynski's for building. Bry's mining series is to be preferred also because it rises more rapidly than ours as expected, whereas Kuczynski's does not.

2.22. Iron and steel, machines and textiles

For these industries we have statistics of earnings in particular firms. Their rates of rise are compared with ours below.

All the series here except Krupp's are of annual earnings. Nevertheless, it will be obvious that the correspondence between the proportional rises in our and other series is less close here than in the earlier group of

pp. 783-9. Wage rates of compositors and machine-masters up to 1907, then also of correctors, stereotypists and electrotypists.

¹ J. Kuczynski, op. cit., pp. 243-6.

² Calculated from Table A.2; J. Kuczynski, op. cit., pp. 178-9; G. Bry, *Wages in Germany*, Princeton, 1960, p. 333, Table A.3, pp. 339-40, and Table A.5, pp. 346-7.

industries where we had trade union and official data. In particular, our series rise more rapidly than all the other series; this is probably due to the fact that a part of the rise in industrial earnings is due to the increase in the proportion of the labour force employed by firms that are raising wages faster—i.e. that the firms that expand faster also raise their wages faster.

TABLE 2.5

Comparison of the rise in wages, 1887-1902 and 1903-13, as shown by different series for iron and steel, machines and textiles¹ (per cent.)

	Iron and Steel		Machines		Textiles	
	1887- 1902	1903- 1913	1887- 1902	1903- 1913	1887- 1902	1903- 1913
Our series	21.6	32.4	31.7	29.4	23.2	24.1
Bochumer Verein Steelworks	23.0	27.6	..	..	..	..
Krupp's works—daily earnings	..	..	21.6	29.6	..	..
Locomotive works—Munich	..	..	22.3	..	..	..
Hof—spinning section	..	..	..	..	16.4	15.7
weaving section	..	..	..	..	17.7	18.4
Allgäu—spinning section	..	..	..	..	17.3	6.6
weaving section	..	..	..	..	12.8	30.4

In iron and steel we have no alternative to the Bochumer Verein series; and its correspondence with our series is good enough for it to be adopted. In machines there is not much to choose between the two series; the Munich series has been chosen since it is for annual earnings.

Both the Hof and Allgäu firms were cotton users, and their series have been compared with our cotton and wool textile series. The correspondence is not too good in rates of rise, and we have had to take account of the level of earnings. The level in both sections in Hof and the weaving section in Allgäu is fairly close to that of our series, so we have adopted a simple average of the three. Missing values in the three series were put in by linear interpolation.

2.3. The aggregate series

An aggregate series of earnings from 1871 to 1913 is presented in Table A.4 (series D). It has been calculated as follows. First, an average of earnings in the six industries included in Table A.1 from 1871 to 1891 was calculated, the employment in these industries in 1882 being used for weighting. We took the employment in all textiles as the weight for cotton textiles, since it was impossible to separate employment in various

¹ Calculated from Table A.2; J. Kuczynski, op. cit., pp. 248-9 and 251-2; W. Däbritz, *Bochumer Verein für Bergbau und Gusstahlfabrikation in Bochum*, Düsseldorf 1934, Appendix Table 4.

parts of the textile industry; for similar reasons, we took employment in all mining as the weight for coal-mining. The resulting average is the series A in Table A.4.

Next we calculated an average of all complete series in Table A.2 from 1887 to 1913, weighted by the number of insured persons (series B). We linked series A to it with an overlap of five years from 1887 to 1891; in other words, we lowered series A from 1871 to 1886 by the ratio of average earnings in 1887-91 according to series B and the same according to series A. Then we calculated the average of all industries in Table A.2 from 1903 to 1913 (series C). This series was found to lie somewhat above series B; the average difference was 8 M. 57 pf., and fluctuated between fairly narrow limits (6 M. 80 pf. and 9 M. 47 pf.). Hence we added 9 marks to the linked series from 1871 to 1913 obtained from series A and B, and replaced its section from 1903 to 1913 with series C. The resulting series is series D.

This series is most reliable in its last part—from 1903 to 1913. The 1887-1902 section is based on distorted earnings and has somewhat smaller coverage. It might be subject to the ills of distorted earnings described in sections 2.14-2.17, though their effect would be ameliorated to some extent by compensation between errors (e.g. errors in the level of earnings).

The shortcomings are more serious before 1887. They are due to the fixed weighting, restricted coverage, and the fact that the series before 1887 are based on statistics of wage rates and earnings in individual industries. The effect of weighting is appreciable. The 1882-weighted average of the six industries in Table A.1 rises from 635 M. 34 pf. in 1882 to 709 M. 6 pf. in 1895, while the current-weighted average in 1895 is 729 M. 79 pf. Of the actual rise of 14.9 per cent., therefore, the 1882-weighted index would record only 11.6 per cent. Similarly, the 1882-weighted series, and hence our series D, exaggerates the fall in average earnings between 1875 and 1882; while it is impossible to make a reliable estimate of the current-weighted average earnings in 1875, a comparison between the results of the 1875 and 1882 occupational censuses shows a large fall in the employment in building and a small rise in mining, these being the largest changes. As a glance at Table A.1 would show, both these facts would tend to make the 1875 average lower than would be the case with the 1882-weighted series. Our guess is that the fixed weights cause series D to understate the rise in earnings between 1875 and 1887 by about 5 per cent.

The probable effect of restricted coverage is also to exaggerate the fall in earnings from the peak they reached in the 1873 boom, for capital goods industries whom slumps hit harder—building, machines, mining, steel—are heavily represented in the series up to 1886.

The effect of heterogeneity of data is difficult to estimate. Kuczynski's aggregate index of wages,¹ based on a mixture of wage rate and earnings series, rises less rapidly than ours after 1887. Since it is based on changing weights, the difference between it and our series probably arises from his use of wage rates. Hence it is likely that our aggregate series also rises too slowly up to 1887, and that the use of heterogeneous data accentuates the effect of fixed weighting.

¹ J. Kuczynski, *op. cit.*, p. 173.

3

The Cost of Living

A WORKERS' cost-of-living index for Germany from 1871 to 1913 is presented in Table A.8, along with its chief components; and the underlying commodity price series are given in Table A.9. In this chapter we shall relate the chief problems encountered in the construction of the index and our solutions of them.

To begin with, we may recall that this index is to be used in calculating the real wages of workers other than agricultural workers. Such workers are predominantly urban; hence an index based on urban prices will be sufficient for our purposes. Thereby we can also avoid the difficulties associated with the scarcity of rural price data and their irrelevance to the rural workers, who received a large proportion of their income in kind.

The real wage can be looked upon as an index of the quantity of goods consumed by the wage-earner (and his dependents), it being assumed that his entire wage is spent on consumer goods. It is statistically easier to compute the real wage by dividing the money wage by an index of the average cost of consumed goods, instead of obtaining the quantities consumed and averaging them.

3.1. *The problem of weighting in theory*

The relevant index of cost of consumption goods should measure the cost of a composite commodity whose composition reflects the proportions in which various goods enter the wage-earner's consumption. Each pattern of consumption entails a different composite commodity, and given a set of prices, there is a different index for each composite commodity.¹ Hence our first problem is to decide which patterns of consumption to use.

Where a cost-of-living index is being computed for a period of time, the pattern of consumption to be adopted can be taken to be one obtaining at some time during this period, and we should be inclined to choose the one which is the most representative of the patterns current at various times in the period.

¹ If the proportional changes in the prices of two or more goods are identical, a price index is not affected by the weights assigned to them provided their total weight remains unchanged. This case is trivial in itself, but its often useful corollary is that the more uniform the movements of price series the less is their average affected by a change in their weighting pattern.

If commodities were unequivocally defined, it would be a matter of accident if a representative pattern of consumption were available for a period; for the representativeness of a pattern will depend on its similarity to the various patterns in the period, and hence on the degree of stability in the patterns. If the composition of consumption changes frequently over a period, there will obviously be no representative pattern for the entire period.

In fact, however, commodities are not so clearly distinguished. If they are distinguished by their physical characteristics, there can still be ambiguity about how large physical differences must be for two objects to constitute separate commodities. If commodities are defined with respect to the wants they satisfy, the ambiguity is transferred to the definition of wants. This ambiguity is not so serious as to permit us to abandon the distinction between commodities; but it gives us a certain freedom in their demarcation.

Insofar as this freedom of demarcation is available in defining the weights of commodities in a cost-of-living index, it should be used to increase the stability of the pattern of weights. Commodity groups should be so defined that as large a proportion of changes in the consumption pattern as possible consists of changes within commodity groups rather than between them; and within the groups, ways of translating quantities of one commodity into another should be established. If these two conditions were fulfilled, we would be enabled to define a stable and therefore representative weighting pattern in terms of commodity groups, and to calculate price indices for each commodity group on the basis of weights which reflect changes in the importance of commodities in consumption.

3.11. Classification of changes in the pattern of consumption

A large number of changes in the pattern of consumption arise out of substitution between commodities. They can be accommodated in a cost-of-living index if we can establish equivalent quantities of substitutes. Ideally, equivalence between their quantities should be based on their capacity to satisfy a want. This capacity is, however, essentially non-quantifiable, and some physical characteristic has generally to be taken as a yardstick; e.g. the fat content of milk, or thermal capacity of fuels. Once such a measure is established, the consumption of substitutes can be expressed in a common unit, and can be used to derive a price index for them weighted by their share of the consumption of their group in each period. We shall call the equivalent of a substitute in terms of the common unit its substitution index.

A change in quality must be distinguished from the introduction of a substitute, for it is not only a change in the capacity of a commodity to

satisfy a single want: it signifies a qualitative rather than a quantitative change. In particular circumstances such a change might be capable of interpretation as a change in the capacity to satisfy several wants. In such a case, commodities differing in quality can be dealt with in a way similar to substitutes: a quality index can be calculated for one commodity in terms of another by finding a quantitative analogue for its relative capacity to satisfy each want and weighting these ratios by some indicators of the relative importance of the wants. The degree of arbitrariness involved in the calculation of such an index is somewhat larger than in finding ratios of equivalence between substitutes, but it does provide a way of accommodating some quality changes in the cost-of-living index. It will be evident that the substitution index is a special case of the quality index where there is only one want.¹

Where the new quality partly satisfies wants that cannot be specified, or where it satisfies a want previously not satisfied, it is akin to a new commodity serving a new want. Where such a commodity has entered consumption, the real wage in the sense of the quantity of a composite commodity consumed has no relevance; the composition of this commodity has changed, and there is no unequivocal measure of its quantity. Nor is there a continuous cost-of-living index in the circumstances; it would be appropriate to start a new index, and if necessary to link it with the old one.

3.2. *Applications*

We shall now turn to the application of these ideas to the construction of our cost-of-living index. We shall first describe our pattern of weights, and then our treatment of substitutes.

3.21. *The weight pattern*

We have taken as weights the average expenditure proportions of thirteen families with incomes under 1,200 marks a year, obtained from a national budget inquiry held in 1907-8. The average income of the heads of these families was 929 marks, while the average earnings of workers insured against industrial accidents, described in section 2.1, were 925 marks in 1907 and 939 marks in 1908.² The average income of the families was 1,074 marks; it exceeded that of the heads of the families to the extent of the earnings of other members of the family and rents from sub-tenants.

¹ The concept of a quality index is due to Frisch (*En byggekostnadsindeks grunnlagt på de faktiske byggeforhold til enhver tid*, Oslo, 1943, pp. 26 ff.); Hofsten has also used it (E. v. Hofsten, *Price indexes and quality changes*, Stockholm and London, 1952, p. 48). Both use it in the sense of our substitution index; they probably did not think of the quality index in our sense because they made the traditional assumption of unity of wants which underlies utility and indifference curve analyses.

² See Table A.4, series C.

The budget inquiry¹ covered twenty-seven cities and three suburbs of Berlin; and the information that is used here was based on account books kept by families for a whole year. The year started in different months of 1907 in different cities, depending on the local statistical office that conducted the inquiry. Some local offices declared rewards (either 5 or 10 marks or books) for keeping accounts, generally a few months after the beginning of the inquiry. Only in Düsseldorf, which furnished 10 from a total of 826 accounts, did this lead people who had stopped keeping accounts to begin to keep them again.

The names and addresses of families were collected from trade unions, guilds, friendly societies, and other institutions (including a vegetarian society). Their only initial specification was that they were to be representative low-income families with incomes below 3,000 marks and with three to five children. The rate of attrition during the period of inquiry was high. Of the 3,655 families that began keeping accounts, only 960 kept them for a whole year, and accounts for six months could be extracted from the books of another 699. Estimates of incomes and expenditure were compiled from 852 of the year-long accounts.

TABLE 3.1

Distribution of expenditure of classes with incomes from 600 to 1,200 marks and from 1,200 to 1,600 marks² (per cent.)

	Group with incomes of	
	600-1,200 marks	1,200-1,600 marks
Meat	11.4	13.7
Other foodstuffs	42.8	45.7
Rent, cleaning, and decoration	20.0	17.2
Heating and fuel	4.5	3.3
Lighting	1.7	1.0
Clothing	7.1	8.6
	87.5	89.5

There is no certainty about the randomness of the sample. It is nevertheless much superior to the samples of other inquiries we could have used, for a number of reasons.³ The average earnings of heads of families are, as we have seen, very representative, the sample covers a larger number of families in a larger number of places, and it is based on actual accounts and not on questionnaires to which all other inquiries had recourse in the absence of adequate information from accounts.

¹ 'Erhebung von Wirtschaftsrechnungen minderbemittelter Familien im Deutschen Reiche', *Reichsarbeitsblatt*, supplementary issue No. 2, Berlin, 1909, pp. 8* ff.

² *Ibid.*, pp. 156-8.

³ A list of all budget inquiries in Germany up to 1907 is given in 'Erhebung . . .', *ibid.*, pp. 14*-15*.

The number of families is not so large as we would like. However, this has introduced no detectable error in the expenditure pattern, which shows the sort of relation to the pattern for the next income group that we would expect. This group consists of 171 families with incomes between 1,200 and 1,600 marks and average income of family heads of 1,281 marks. As is to be expected, their expenditure pattern shows a higher proportion spent on meat and clothing and a smaller proportion on rent, heating, and lighting than the pattern of the 600-1,200-mark group.

3.22. *Treatment of substitutes*

Within the commodity groups defined in the weighting pattern described above, there are several groups of substitutes. The general method of deriving price indices for them was to express their consumption in each year in a common unit, to calculate with its help the share of each substitute in total consumption in each year and use the shares as weights in the calculation of a price index for the entire commodity group. Flour and bread form an exception to this procedure. We describe below the methods followed for each group.

3.221. *Bread and flour*

Wheat and rye being the only important cereals used, the weights for bread and flour were distributed between the two. The common unit was taken to be weight. While no information is available about the proportions in which wheat and rye were consumed by wage-earners, figures of national consumption can be calculated by means of harvest and foreign trade statistics from 1878 onwards. It was found, however, that neither the changes in the proportions of consumption nor the changes in relative prices were large enough to cause an appreciable difference between an index with weights based on national consumption in the current year and a fixed-weighted index. Hence we have weighted wheat and rye in proportion to their *per capita* consumption in 1893-1912—62 per cent. to rye and 38 per cent. to wheat.¹ The index for flour understates the fall in prices from the 1870s to the 1890s when the share of wheat in consumption was rising; and the index for bread understates the rise in prices from the 1890s onwards; both the biases are, however, negligible.

3.222. *Meat*

Weight was taken as the common measure in the case of meat. The shares of various meats in total production are given below.

As a result of import restrictions and health regulations, the imports of meat were negligible and the figures above can be treated as figures of

¹ *Statistisches Jahrbuch für das Deutsche Reich*, 1913, p. 289, Table X.1.

meat consumption. We estimated shares in the intervening years by linear interpolation, and assumed the shares before 1883 to have been the same as in 1883.

Price indices of various kinds of meat were weighted by these shares and a complete index for meat was derived. Since the series for veal and mutton began in 1873, an index for beef and pork for 1871-3 weighted by their 1883 shares was calculated and linked to the index for the following years.

TABLE 3.2
Meat production, 1883-1913¹

	Beef	Veal	Mutton & goats' meat ²	Pork	Total	Beef	Veal	Mutton & goats' meat	Pork
	Thousand tons					Per cent.			
1883	484.4	95.8	126.7	659.9	1363.8	35.5	7.0	9.3	48.2
1900	812.4	158.4	103.1	1428.6	2502.5	32.5	6.3	4.1	57.1
1913	931.8	200.4	82.0	2283.7	3498.3	26.6	5.7	2.3	65.2

It is likely that the proportion of pork in consumption rose at the expense of beef before 1883 as it did after. This could not be taken into consideration in the calculation of the weights, but it would probably have little effect on the composite index since the prices of beef and pork behaved very similarly in 1871-83.

3.223. *Dwellings*

It is difficult to obtain a common measure for dwellings. The choice for us was restricted by the information available, which classified dwellings by the floor and by the number of heatable rooms. The number of heatable rooms was, therefore, the only measure of the size of dwellings available. Heatable rooms were, obviously, not uniform; nor was their number a comprehensive measure of the size of the dwelling. Kitchens and rooms without fires were not included among them. Nevertheless, the division between heatable and non-heatable rooms was stable, since movable fires were rare in Germany (except in Frankfurt-am-Main); and the number of heatable rooms did indicate the size of the dwelling, since the number of unheated rooms tended to be larger in houses with more heatable rooms.³

¹ Calculated from E. Bittermann, *Die landwirtschaftliche Produktion in Deutschland, 1800-1950*, Halle a. d. S., 1956, p. 55, Table 17. Figures for 1883 and 1900 are estimated from census figures of livestock population and sample estimates of the ratios of animals annually slaughtered and of their average deadweight.

² The share of goats' meat was negligible.

³ Cf. *Protokoll der 2-en Konferenz der deutschen Gemeinde-Statistiker*, Dresden, 14 and 15 June 1885, p. 7.

The large majority of workers lived in dwellings with one or two heatable rooms. This is shown by the following figures of the proportion of workers in dwellings of these sizes in Munich and Berlin.

TABLE 3.3

Proportion of workers living in small dwellings¹

	<i>Dwellings with</i>	
	<i>1 heatable room</i>	<i>2 heatable rooms</i>
	<i>Per cent.</i>	
<i>Munich 1895</i>		
Skilled industrial workers	34.5	36.8
Skilled workers in transport and commerce	20.8	31.9
Unskilled workers	39.6	25.6
<i>Berlin 1890</i>		
Journeyman and skilled workers	71.8	25.2
Workers in personal services	66.2	27.1
Unskilled workers	81.1	16.1

That the situation was similar in other cities is suggested by the large percentage of population living in small dwellings.² It seemed therefore that the proportion of workers living in dwellings with three or more heatable rooms was so small that the rents of such large houses were, by and large, irrelevant to their cost of living. This led us to decide that the index of rent should be based on the rents of dwellings with one or two heatable rooms. Since the proportions of workers in dwellings of each size were not available in detail, we decided to base the weights for the dwellings on the proportion of total population living in them.

Between the two sizes, the proportion of the population living in two-roomed dwellings was rising at the expense of one-roomed dwellings. Hence the question arose whether this represented an increase in the quantity of dwelling space *per capita* or whether it was an improvement in the quality of housing insofar as it made it possible to divide dwellings functionally into separate bedrooms, living-rooms, work-rooms, etc.

To settle this question we needed to find out how far an increase in the size of the dwellings was associated with increased living space. We present below some figures of the density of residence in dwellings of the two sizes. It will be seen that the density generally exceeds two persons per heatable room in two-roomed dwellings; the scope for a functional division between rooms does not appear to be large at such a high density. It is

¹ H. Lindemann, 'Wohnungsstatistik', *Schriften des Vereins für Sozialpolitik*, vol. 94.1, pp. 277 and 383.

² See Table A.8.

clear on the other hand that the density was much higher in one-roomed dwellings, and it is fair to conclude that moving from one-roomed to two-roomed dwellings greatly increased the *per capita* dwelling place for the worker's family: that it represented a substantial increase in the consumption of dwelling space. On the basis of this fact, we have treated dwellings of the two sizes as substitutes, with the heatable room as their unit of measurement. The ratios of the population of various cities

TABLE 3.4
Average number of residents per heatable room¹

	1885		1905	
	Dwellings with			
	1 heatable room	2 heatable rooms	1 heatable room	2 heatable rooms
Berlin	3·8	2·2	3·2	2·1
Hamburg	3·9	2·3	3·6	2·1
Breslau	4·1	2·2	3·4	2·0
Leipzig	3·9	2·6	3·5	2·2
Magdeburg	3·8	2·2	3·6	2·0
Altona	3·5	2·2	3·4	2·1
Gorlitz	3·5	2·1	3·0	1·9

living in dwellings of either size to the total population of the dwellings of both sizes are shown in Table A.11. These ratios are used as weights in the calculation of rent indices for each city from the figures of rent given in Table A.12; thus we have in effect assumed that all workers and none but the workers lived in these dwellings. Unweighted averages of rent indexes for the cities are used to derive the national rent index. Further information on sources of rent statistics is given in section 3.34.

3.224. *Fuel and lighting*

There is much qualitative evidence that the means of heating and lighting changed radically after 1890 with the upsurge in the production of gas and electricity; but little is known about the magnitude of the changes. We could find data regarding the domestic importance of gas and electricity only for the city of Breslau.

There is no close relation between the number of heatable rooms and living rooms; but normally, small dwellings used to have one unheated living room, so that dwellings with one or two heatable rooms corresponded roughly with dwellings with two or three living rooms.

It is evident that as late as 1910, electric lighting was insignificant in the

¹ Calculated from *Statistisches Jahrbuch deutscher Städte*, vol. 1, 1890, p. 75, Table IV. 6; vol. 16, 1909, pp. 442-4, Tables XXVII. 4 and 5.

small dwellings of Breslau. The highest *per capita* private consumption of electricity in any German city was about five times the level in Breslau in 1910.¹ Hence electric lighting (and heating) can have played only a small role before the First World War.

TABLE 3.5

Use of gas and electricity in Breslau dwellings, 1910² (per 1,000 dwellings)

	Dwellings with				All dwellings
	0-1 living room	2 living rooms	3 living rooms	4 living rooms	
Gas in living rooms only	8	8	8	10	10
Gas in living rooms and kitchen	..	10	57	164	189
Electric light	..	2	3	4	18

The use of gas was more widespread; 10 to 15 per cent. of the small dwellings in Breslau might have been fitted with gas for cooking and lighting. Average *per capita* consumption of gas in German cities was probably slightly higher than in Breslau.³ Hence we have very roughly put the proportion of the urban workers' dwellings using gas, both for lighting and as a fuel, at 15 per cent.

The index of production of gas rose from 25.1 in 1895 to 75.4 in 1910.⁴ The proportion of gas used for domestic purposes remained between 70 and 90 per cent. in most cities.⁵ It is likely, therefore, that the domestic consumption of gas rose at about the same rate as production, i.e. three-fold. Of the privately consumed gas, 19.3 per cent. in 1896 and 50 per cent. in 1907-8 was used for cooking and heating.⁶ The proportions were probably near to 18 per cent. in 1895 and 60 per cent. in 1910. On the assumption that they were, the consumption of gas as a fuel must have risen tenfold, and of gas for lighting one and a half times.

It is not known how the stock of workers' dwellings changed. But the number of industrial workers rose from 5.96 million in 1895 to 8.59 million in 1907—an increase of 44 per cent.⁷ Between 1895 and 1910 the rise might have been of the order of 50 per cent. As Table A.11 shows, there was a shift of population from dwellings with one heatable room to dwellings with two; and Table 3.4 shows that this shift was

¹ *Statistisches Jahrbuch deutscher Städte*, vol. 19, 1913, pp. 810-11 and 846-7. The figures for 1910 are: Breslau 6.57 kWh. and Strassburg 30 kWh. per year. Much of the electricity was used in public lighting and transport.

² From *Breslauer Statistik*, vol. 33, 1914, p. 45.

³ *Ibid.*, pp. 786-7.

⁴ See Table A.19.

⁵ Information in *Statistisches Jahrbuch deutscher Städte*, vols. 1-19, 1890-1916.

⁶ *Idem*, vol. 8, 1900, pp. 382-3; vol. 17, 1910, p. 515.

⁷ *Statistik des Deutschen Reichs*, vol. 102, p. 2; vol. 202, p. 4.

accompanied by a fall in residential density. Further, there was a decline in urban fertility, so that the number of families rose faster than urban population.¹ Hence it is probable that the number of urban dwellings also rose more rapidly than population. We have therefore assumed an increase of 60 per cent. in the number of urban working-class dwellings. On the further assumption that gas consumption per dwelling remained constant, the proportion of dwellings using gas for either purpose in 1895 can be worked out as follows.

TABLE 3.6

Estimated increase in the proportion of workers' dwellings fitted with gas, 1895-1910

	1895	1910
Domestic gas consumption	100	300
Domestic consumption of gas as fuel	18	180
Domestic consumption of gas for lighting	78	120
Number of workers' dwellings	100	160
Proportion of workers' dwellings using gas as fuel	2.4	15
Proportion of workers' dwellings using gas for lighting	15.8	15

These rough calculations suggest that the use of gas for lighting did not spread greatly, while its use as a fuel increased greatly. On their basis we gave for lighting a fixed weight of 16.67 per cent. (one-sixth) in the price index for lighting to gas and a weight of 83.33 per cent. to mineral oil.

Gas was given a 15 per cent. weight in the fuel price index in 1910. Since the consumption of gas per dwelling in 1895 was probably lower and the number of dwellings using gas as fuel higher than we have estimated, we have given it a weight of 3 per cent. in 1895. Weights for other years were calculated by linear interpolation and extrapolation. Gas enters the heating materials index with a weight of 0.6 per cent. in 1892, and its weight increases by 0.8 per cent. a year to 17.4 per cent. in 1913.

3.3. Sources

The primary sources of all the component price series are official. We have used statistics collected by the Imperial Government, the state governments and local authorities of various towns.

Ideally, we should like to have for each commodity an average of prices in all towns, weighted by the number of non-agricultural workers and their dependents. Such averages are not available; nor is their computation

¹ C. Ballod, 'Die Bevölkerungsbewegung der letzten Jahrzehnte in Preußen und einigen anderen wichtigen Staaten Europas', *Zeitschrift des Königlichen Preussischen Statistischen Landesamts*, 1914, pp. 275-9.

a practical matter owing to the collection of data and arithmetical work it would involve. Hence we have generally relied on unweighted averages of local prices.

The priorities followed in the choice of prices are as follows. Where possible we have used retail price series for states, and especially for Prussia which contained over 60 per cent. of the population and territory of Germany. The next in priority were retail price series for individual towns; wholesale prices came last.

Retail prices are to be preferred in the estimation of the cost of living being the prices paid by consumers. Wholesale prices are not a good indicator of retail prices; they fluctuate more frequently and in wider limits, and tend therefore to exaggerate movements in the cost of living. Again, turnover is more sensitive to movements in wholesale prices than in retail prices owing to the larger role played by expectations; and normally the volume of trade is smaller at extreme prices since greater uncertainty regarding future prices is associated with them. Hence a simple average of periodic notations of wholesale prices, which most wholesale price series represent, is less stable than an average weighted by turnover would be. The wholesale prices at our disposal also have the disadvantage that their regional coverage is limited.

In a few cases, however, retail prices were not available between 1871 and 1890, and the price behaviour of the commodities had important features that had to be incorporated into the cost-of-living index. There we have used wholesale prices rather than omit the commodities from the index altogether, and we believe that the index has been more representative as a result. The total weight of wholesale prices in the index is 42.5 per cent. in 1871-3, 27.5 per cent. in 1873-81 and 9.3 per cent. in 1881-90.

3.31. *Food, coal, and oil*

Price indices of mutton, wheat flour, and rye flour are based on series of average prices in Prussian towns, and those of beef, veal, pork, lard, eggs, and butter on a weighted average of prices in Prussian and Bavarian towns.

The Prussian series are unweighted averages of annual prices in Prussian towns whose number varied between 154 and 165.¹ The annual price for each town was calculated by averaging shop prices on 'one of the last days' of each month of the year; presumably this means the last working day of the month. Prices were collected by means of questionnaires sent to a number of shops. Each shop was asked to give the highest and the lowest price charged for the commodity on the day of reporting. The unweighted

¹ 'Kleinhandelspreisstatistik', special supplement to *Zeitschrift des Königlich Preussischen Statistischen Landesamts*, 1907, pp. 1 ff.

average of both prices for all reporting shops was taken to be the town average. The prices were collected for the quality most commonly consumed by middle-class households, and the best and the worst qualities were excluded. So they are not quite what we require for a working-class cost-of-living index, but the best approximation available.

The methods changed slightly from 1909. Price reports for meat were collected on six days in the month, and for butter and eggs on five days. Prices of lard and flour continued to be collected at the end of the month. The most frequently charged price was asked for instead of the highest and lowest prices. No noticeable discontinuities resulted from these changes.

The methods of estimation in Bavaria were the same as in Prussia till 1907. The number of reporting towns rose from 62 in 1881 (the year from which we have used Bavarian series) to 69 in 1885 and remained unchanged till 1907. In 1908 the number of towns reporting meat prices was raised to 98, most frequently charged prices were collected instead of highest and lowest prices, and the average for the state was derived by weighting the town prices by the annual number of animals slaughtered. There were no changes in the collection of other prices.

Where used together, Prussian and Bavarian series were weighted eight to one, i.e. roughly in proportion to the number of industrial workers. Since Bavarian series were included from 1881, the series for Prussia alone from 1871 or 1873 (depending on the commodity) to 1881 was linked to the Prussian-Bavarian average with a one-year overlap.

Price series for salt, oil, beer, wheat bread, sugar, coffee, coal, and potatoes are based from 1890 to 1912 on unweighted averages of local price series obtained from the publications of the Verein für Sozialpolitik. Since the series in these publications end in 1912, we have found the 1913 prices for as many of the included towns as possible from local publications, constructed a simple average of them for 1912 and 1913 and linked it to the 1890-1912 index.

The series for salt and oil (used for lighting) begin in 1890. The series for beer, wheat bread, sugar, coffee, coal, and potatoes consist of two bits—a series for 1890-1913 calculated as was described above and a simple average of retail prices in a smaller number of towns from 1881 to 1890—linked with a one-year overlap. The series for sugar, coffee, coal, and potatoes have been extended further back to 1871 by being linked with series of wholesale prices from 1871 to 1881. The index for milk is based on its price in Stuttgart.

The index for rye bread is made up of a simple average of prices in Berlin, Bavaria, and Württemberg from 1881 to 1885 and another of prices in nine cities from 1886 to 1912. An average of prices in Berlin, Dresden and Hanover has been used to link the two bits. The extension to 1913

has been made by using an average for five cities whose 1913 prices were available.

3.32. Gas

Two price series have been used—one for gas used for lighting and another for gas used in cooking and heating. Both are simple averages of prices in all towns listed in the *Statistisches Jahrbuch deutscher Städte*; they are thus based on prices in almost all the towns where gas had been available for over a year. The number of such towns increased rapidly; the averages therefore refer to an expanding sample. However, neither this nor the use of an unweighted average is likely to affect our indices much since the variations between towns were small. No account has been taken of block tariffs, special rates for large quantities, etc.

3.33. Clothing

The only retail prices of clothing that could be found were for Chemnitz from 1890 to 1913 for eleven intermittent years. We have taken them as the basis for our clothing index, obtaining figures for missing years by linear interpolation. The index is based on the annual needs of a family with three children, consisting of the following:

1 man's suit	6 men's shirts	1 child's suit
6 women's blouses	1 skirt	16.25 metres cotton cloth
1 girl's garment	6 socks	1 flannel blouse
6 stockings	1 cotton blouse	3 pairs of children's shoes

Between 1871 and 1890 the index is based on the ex-mill price of Kattun, a widely used type of coarse cotton cloth, in Mühlhausen.

3.34. Housing

Rent statistics were collected by local statistical offices in censuses of houses at five-year intervals. Since various statistical offices began functioning at different dates the available series of rents also have different lengths. Besides, there were some discontinuities resulting from the extension of city limits. Hence it was impossible to have a constant sample of cities for the entire period, and various bits had to be patched together to get the overall index. The cities included in the bits are as follows:

- 1875-80: Leipzig (old).
- 1880-5: Leipzig (old), Berlin and Dresden.
- 1885-90: The three above, Breslau and Hamburg.
- 1890-5: The five above, Lübeck, Leipzig (new) and Magdeburg.
- 1895-1905: All above except Leipzig (old), which was merged into Leipzig (new).

In calculating the bits, we first estimated the rents per heatable room of houses with one and two heatable rooms in each city (given in Table A.12) and averages of them weighted by the number of people living in houses with one and two heatable rooms respectively (given in Table A.10). The series of average rent in each city that was thus obtained was then normalized with $1895 = 100$, and simple averages of the normalized series were calculated to get the various bits of the national index. The latter was then constructed by linking the bits in overlapping years.

Up to 1905, houses were classified by their number of heatable rooms, i.e. rooms with a fire, excluding kitchens (some towns did include kitchens, but none of them is included in the index). The 1905 census introduced a new classification by the number of living rooms, i.e. rooms with or without a fire but excluding kitchens, bathrooms, sculleries, wardrobes, etc. Rent statistics on the heatable-room classification continue to be available up to 1910 for all towns in the index except Berlin, but the number of inhabitants in dwellings with one and two heatable rooms is not available for many towns in 1910. Since the proportions of population in the two types of dwellings cannot have changed much in five years, we calculated (for towns other than Berlin) indices of average rents of dwellings with one and two heatable rooms in 1910 with 1905 as base and obtained an average of the indices weighted by the 1905 population proportions. The resulting index was used to extend the national index to 1910.

All that was available after 1910 was average rents of vacant houses from 1910 to 1912 in Stuttgart and Breslau and to 1913 in Dresden. We calculated 1910-based indices of rent of dwellings with one and two living rooms in the three towns from 1910 to 1912 and obtained an unweighted average of them. The rents of the two types of dwellings changed little in Dresden between 1912 and 1913; so we assumed that the average for the three cities also remained unchanged. By means of it we extended the national rent index to 1913.

3.4. *Size of the sample*

The number of price series to be averaged becomes important if we use unweighted averages. Where there are unrelated local variations in prices it is desirable to minimize their effect on the national average; this can be done by taking as large a sample of local prices as possible. For this reason we have, where possible, used indices of retail prices in Prussia and combined them with indices for Bavaria. These were the largest states of Germany and contained nearly three-quarters of the German population; and their price indices were based on large samples—of over 150 places for Prussia and over 50 for Bavaria.

It is evident however that the advantages of a large sample are associated

with the presence of unrelated local price variations. Where such variations are unimportant, a large sample size has no special virtue.

Thus, we found that local variations in the price of salt were rare and the prices very stable; in the circumstances, a larger sample would have been of little advantage. The prices of milk were also stable, but their level differed between places. Local prices changed roughly together and by discrete amounts—one or two pfennigs a litre each time. Hence while the years of price change coincided, the relative magnitude of price changes was larger in places where prices were lower. It was doubtful here whether in samples below a certain size—say, twenty-five or thirty—a larger sample gave a better approximation to the national average than a smaller; the composition of the sample mattered more than its size. We could collect prices in only eleven places; hence rather than a mean of local prices we have used the price series for only one city—Stuttgart—whose prices were roughly median in the sample.

3.5. *Interpolation of annual figures*

Statistics of rent were available at five-yearly intervals; hence annual figures of the cost-of-living index were derived by interpolation. For this purpose, an annual index for all items other than rent (I_a) was calculated besides the quinquennial index including rent (I_q). From the values of I_q for years t and $t+5$ and those of I_a for years $t, \dots, t+x, \dots, t+5$, the total index for the year $t+x$ could be calculated by using the following formula.

$$I_q(t+x) = I_q(t) + \frac{[I_a(t+x) - I_a(t)][I_q(t+5) - I_q(t)]}{I_a(t+5) - I_a(t)}$$

3.6. *The cost-of-living index*

The cost-of-living index can be divided into three sections differing in quality. The last section from 1890 to 1913 is the most reliable; it is based entirely on retail prices except for potatoes, and the embodied material is sufficiently abundant to ensure that the effect of erratic local variations is small. The section from 1881 to 1890 differs little from the last section in the quality of the underlying price series or commodity coverage, but its regional coverage is inferior. Between 1871 and 1881 the index loses many of its food components, and might exaggerate price movements owing to the inclusion of wholesale prices. In other words, the fall in the cost of living might have been somewhat less than the 12.5 per cent. shown by the index between 1875 and 1885.

4

Real Wages

THE statistics of money earnings and workers' cost of living, presented in Tables A.1, A.2, and A.9 and described in the preceding two chapters, can be used to make estimates of real wages. We have made such estimates at five-year intervals; they are shown in Table A.13. To present a clearer picture of the movements in real wages, their geometric average rates of growth in these intervals have been calculated; these are presented in Table A.14.

Table A.14 brings out the impact of the 1871-3 boom only partially, for real wages rose much more rapidly in the boom than in the following years in all industries except textiles. In mining they rose nearly 50 per cent. between 1871 and 1873; in machines, over 30 per cent.; in building, printing, and iron and steel, around 20 per cent.; and in textiles, nearly 10 per cent. As in many other respects, the boom of 1873 was a unique event in the history of real wages.

The basis of the 1873 boom was railway construction on an unprecedented scale, and its outstanding beneficiaries were the industries which supplied railways with construction material, equipment, and fuel.¹ Consequently, the collapse which followed affected these industries most heavily. Between 1875 and 1880, real wages fell in all investment goods industries except machines. While textiles and printing were less affected, they too saw a very slow rise in real wages.

The difficulties of investment goods industries were largely over by the beginning of the 1880s, and their real wages rose more than 25 per cent. in that decade. In textiles and printing, however, the rise in real wages was much slower. The increase in the 1890s was smaller than in the preceding decade in all the investment goods industries as well as in printing; in textiles, however, it was more rapid. On the basis of this evidence, we are inclined to say that real wages rose more rapidly in the 1880s than in the 1890s; but it must be noted that investment goods industries are much better represented in the evidence than consumer goods industries. Further, there is an implicit assumption in this comparison that the change from local to national series as data underlying our money wage statistics

¹ For descriptions of the 1873 boom, see M. Müller-Jabusch, *So waren die Gründerjahre*, Düsseldorf, 1957; and A. Soetbeer, *Die fünf Milliarden. Betrachtungen über die Folgen der großen Kriegsentschädigung für die Wirtschaftsverhältnisse Frankreichs und Deutschlands*, Berlin, 1874.

in 1887¹ does not affect their continuity. Our grounds for making this assumption are not as strong in the case of textiles and printing as for other industries.²

The evidence for a comparison between 1890-1900 and 1900-13 is more abundant and reliable than for the comparison made above. Real wages rose more rapidly in the first period than in the second in fifteen industries for which we have information, and less rapidly in seven industries.

What we have found about real wages in particular industries is reflected in the aggregate series. The aggregate real wages rose rapidly between 1871 and 1875, and fell in the following five years. Their rate of increase also shows a fall from 2 per cent. per annum in 1880-90 to 1.5 per cent. in 1890-1900 and 1.0 per cent. in 1900-13. In the preceding chapters we have given reasons for believing that the series of aggregate money wages underestimates the rise in wages up to 1887 by 5 to 10 per cent., and that the cost-of-living index exaggerates the fall from the peak of 1874, perhaps by 2 or 3 per cent.³ If we put these guesses together, it appears likely that the fall in real wages in 1875-80 was somewhat smaller and the rise in 1880-90 somewhat greater than our series indicates.

4.1. *Comparison with other estimates*

Our estimates of money wages, the cost of living, and real wages are compared with those of Kuczynski and Phelps Brown and Hopkins in Table 4.1 below.

Taking Kuczynski's estimates first, our index of money wages agrees closely with his up to 1885. There are two main differences in the construction of the indexes: our component wage series are a selection from those Kuczynski has used, and owing to deficiencies of the data, we have left out two industries—woodwork and chemicals—which Kuczynski has taken into his index. These differences appear to have had little influence, except in 1871, when there is a difference of eight points between the two indices. After 1885, however, our index rises appreciably faster than Kuczynski's. Our index of cost of living falls more in the 1870s and rises less after 1900. Consequently, our index of real wages shows a much larger increase between 1871 and 1875, falls less in the next five years, and rises more rapidly after 1900.

The index of money wages given by Phelps Brown and Hopkins is made up out of the same series for individual industries as Kuczynski's;⁴ it differs from Kuczynski's money wage index in three respects. First,

¹ See section 2.2.

² See sections 2.21 and 2.211.

³ See sections 2.3 and 3.6.

⁴ *Oxford Economic Papers*, 1950, p. 258. The series for industries have been taken from J. Kuczynski, *Löhne und Ernährungskosten in Deutschland 1820-1937*, Libau, 1937, pp. 38-41; Kuczynski gives the same material in *Die Lage der Arbeiter in Deutschland*.

Phelps Brown and Hopkins use data for five industries up to 1885 and eight industries from that year; i.e. they have not used series of wages in three industries (presumably woodwork, chemicals, and transport) before 1885, while Kuczynski has. Second, Kuczynski has used series of absolute

TABLE 4.1
Comparison of estimates of real wages¹

	<i>Our estimates</i>			<i>Kuczynski's estimates</i>			<i>Phelps Brown and Hopkins's estimates</i>		
	<i>Money wages</i>	<i>Cost of living</i>	<i>Real wages</i>	<i>Money wages</i>	<i>Cost of living</i>	<i>Real wages</i>	<i>Money wages</i>	<i>Cost of living</i>	<i>Real wages</i>
1871	70	106	66	78	95	82	75	103	72
1875	98	113	87	97	104	93	96	107	90
1880	82	104	79	82	104	79	84	109	77
1885	87	99	88	88	96	92	90	97	93
1890	98	102	96	100	103	97	100	105	95
1895	100	100	100	100	100	100	100	100	100
1900	118	106	111	115	105	110	113	105	108
1905	128	112	114	122	113	108	120	115	104
1910	147	124	119	139	126	110	136	128	106
1913	163	130	125	153	137	112	148	136	109

wages in the calculation of the total index, while Phelps Brown and Hopkins have probably used indices of money wages. Third, they use fixed weights to combine the series for individual industries—weights based on employment in June 1895 as given by the occupation census in that year. Kuczynski also weights his individual series by employment, and it is probable that he has made use of the occupation censuses of 1875, 1882, 1895, and 1907 for this purpose. He seems to have changed his weights according to the changes in the pattern of employment. He does not say how he estimated the weights for years other than census years; it can be presumed that he estimated them by linear interpolation and extrapolation.²

It is evident from Table 4.1 that Phelps Brown and Hopkins's use of data for five industries out of eight up to 1885 causes no appreciable difference between their index and Kuczynski's. Further, Kuczynski has found that the use of wage indices instead of absolute wages made little difference.³ Hence the difference between the two indices must be due to the differences in weighting. As is to be expected from its use of fixed weights, the Phelps Brown-Hopkins rises less than Kuczynski's after 1895.

¹ Our estimates have been calculated from Tables A.4, A.8, and A.13; Kuczynski's have been obtained from *Die Lage der Arbeiter in Deutschland*, vol. 1, 3rd edition, Berlin, 1947, pp. 173 and 175. The series refer to wages in all industry (excluding wages in agriculture). The Phelps Brown-Hopkins estimates are taken from their paper, 'The course of wage rates in five countries, 1860-1939', *Oxford Economic Papers*, 1950, p. 274.

² J. Kuczynski, op. cit., p. 242.

³ Ibid., p. 242.

Phelps Brown and Hopkins construct a cost-of-living index out of earlier versions of Kuczynski's index.¹ Up to 1891 it is based on an index for food only. Food prices fell more than other consumer goods prices in the period 1873-96; hence their cost-of-living index falls more and their real wage index rises more rapidly than Kuczynski's in this period. From 1895 there is little difference between the two cost-of-living indices, and the difference between the real wage indices is largely due to the difference between money wage indices. The real wage index of Phelps Brown and Hopkins rises more slowly than Kuczynski's and yet more slowly than ours after 1895.

While our index of real wages confirms the progressive slackening of their growth from the 1880s onwards shown by the other two indices, its trend is more strongly upward than theirs. This is particularly striking between 1900 and 1913; while the other indices show real wages to be almost stationary between these years, ours shows an increase of nearly 13 per cent.

4.2. *Analysis of real wages*

We shall now look for an answer to the question: what might we look at as possible determinants of the course of real wages? In answering this question, it would be useful to look upon real wages in the way they are treated statistically—i.e. as a quantity of a composite commodity, or as money wages divided by the price of such a commodity. To illustrate, let us make the following assumptions: that the economy is made up of one industry producing one consumer good, that there is no foreign trade and that wage-earners get a certain share in the output. If we put r for the average real wage, W for the total wage bill, L for the labour force, Q for the output of the consumer good, s for the wage-earners' share in it and q for output per head,

$$r = \frac{W}{L} = \frac{sQ}{L} = sq \quad 1$$

If there are two industries, one producing a consumer good and the other an investment good, the real wage in the consumer goods industry can still be represented by formula 1; but the real wage in the investment goods industry becomes related to the ratio of the price of the investment good to that of the consumer good. If we represent the value of total output by V , the price by p and the industries producing the consumer good and the investment good by subscripts c and i ,

$$r_c = \frac{W_c}{L_c p_c} = \frac{W_c}{V_c} \cdot \frac{V_c}{L_c p_c} = s_c q_c \quad 2$$

$$r_i = \frac{W_i}{L_i p_c} = \frac{W_i}{V_i} \cdot \frac{V_i}{L_i p_i} \cdot \frac{p_i}{p_c} = s_i q_i \frac{p_i}{p_c} \quad 3$$

¹ Cf. E. H. Phelps Brown and S. Hopkins, *op. cit.*, pp. 259-60.

If there are a number of investment goods industries, each producing its own raw materials, formula 3 will apply to each of them. If there are a number of consumer goods industries, p_c , which must then be interpreted as a cost-of-living index, will be different from their own price; so it will be appropriate to apply formula 3 to consumer goods industries also. But the more important a consumer good in the workers' budget, the less sensitive will p_i/p_c be to a change in its price.

If an industry does not produce its own raw materials, a difference arises between the value of gross output and the value added. It is evident that in such circumstances, V in the above formulae should be replaced by value added, i.e. by the difference between the value of output and the value of materials purchased and used. Further, if the industry produces a number of commodities, the value of gross output should be obtained by summing over all the goods produced. Formula 3 will then be replaced by

$$r_i = \frac{s_i \left(\sum_{j=1}^x p_j Q_{ij} - \sum_{k=1}^y p_k M_{ik} \right)}{L_i p_c} = s_i \left(\sum_1^x \frac{p_j}{p_c} q_{ij} - \sum_1^y \frac{p_k}{p_c} m_{ik} \right) \quad 4$$

where Q_{ij} ($j = 1, 2, \dots, x$) are the quantities of x goods produced by the industry i , M_{ik} ($k = 1, 2, \dots, y$) are the quantities of y materials used in their production, p_j and p_k are the prices of outputs and inputs respectively, and q_{ij} and m_{ik} are the outputs and inputs per worker.

Foreign trade does not affect formula 4. It might, however, influence the prices of imported and exported goods—prices which might enter the formula as prices of products, materials, or consumer goods.

Thus, formula 4 holds under fairly general conditions; and where an industry is largely self-sufficient in raw materials, formulae 2 or 3 will give a good approximation to it. All the formulae are identities and have no explanatory value in themselves; but they show us the factors we might investigate to find an explanation of the course of real wages—relative prices, share of wages, value added per worker, and the cost of living.

4.3. Real wages and productivity

Among the above factors, the behaviour of labour productivity has been singled out by Phelps Brown and Hopkins as the cause of the slow-down in the rise of real wages. Let us compare movements of real wages and productivity and see how similar they are.

Comparisons have to be restricted to the years of occupation censuses, which give the most reliable estimates of employment. Further, we must exclude the 1875 census from consideration. It was held in December while the subsequent censuses were held in June and there is no way of making their figures comparable. Employment in 1913 was estimated

by extrapolating figures for the census year 1907 with the help of the number of workers in different industries insured against industrial accidents (Table A.6) and figures of industrial employment furnished by factory inspectors (Table A.7).

Annual average rates of growth of productivity in various industries in 1882-95 and 1895-1913 are given in Table A.14, and can be compared with the rates of growth of real wages in 1880-95 and 1895-1913. Estimates of growth-rates of real wages have been divided into two sections as in Table A.2; section 1 contains the more reliable series. Similarly, figures of growth rates of productivity have been given grades A, B, and C in a descending order of reliability on the basis of information given in Appendix B.

Direct comparisons of the growth-rates of real wages and productivity before and after 1895 are possible for only four industries—iron and steel, building, mining, and textiles. Three of these industries show a slower rise in real wages after 1895, and three show a more rapid growth in productivity after 1895. Data for 1895-1913 are available for ten industries; among them, rank correlation coefficients between growth rates of real wages and output per head work out as follows:¹

5 industries with A-grade output series	—1.00
7 industries with A and B-grade output series	—0.36
10 industries with A, B and C-grade output series	0.24

This is not sufficiently comprehensive evidence to clinch the issue; but such as it is, it gives no support to the hypothesis of a direct association between the course of real wages and of productivity. In other words, the information we have suggests that there was no slackening of the growth of productivity concomitant with that of the rise in real wages. The explanation of the latter cannot therefore run in terms of productivity alone.

From this point we can proceed further in two directions. First, we can collect further information on real wages and output per head and see if it affects the above conclusion. In the present case, however, collection of additional information entails rapidly diminishing returns in quality—especially the quality of information on output. Hence it would not enable us to increase the reliability of the conclusion.

The other possibility is to look for an alternative explanation and to see how strongly it is supported by evidence. Our freedom of manœuvre in this direction is much greater; for, as we shall see, we can reach a fairly unequivocal explanation of the slow-down in the rise of real wages. By turning to other explanations, we can also extend the limits set by the

¹ Since some industries show the same rate of growth of productivity or real wages, the ranking is not unique. The correlation coefficients given here are the highest in the positive direction that can be obtained.

available information, for different pieces of information are relevant to different explanations; given the haphazard nature of the information that got collected in the period of our study and survived the intervening years, more of it can be utilized by extending the number of possible explanations. In the following chapters we shall look for an explanation in terms of the factors which are connected with real wages as shown in section 4.1.

5

A Survey of Influences

IN section 4.2 we suggested some factors that might exercise influence on the movements of real wages. In this chapter we shall see what similarities there were between their behaviour and that of real wages.

5.1. *Changes in money wages*

Wage changes show widespread uniformity between industries. There is much empirical evidence of long-term stability of the wage structure as well as stability (in the absence of deliberate policy measures) in the spread of wages, which together imply long-period uniformity of rates of wage increase.

Hoffman¹ has estimated average wages in various industries to represent the average wage structure, and calculated the rank correlation coefficients of the average wages to wages in the individual years of the period. He has investigated the wage structure in ten countries (including Germany) in this way, and found that the correlation coefficients were over 0.9 in almost all countries and years. They fell below 0.9 in some years of severe depression, inflation and war, but soon rose above it again. Except in Sweden where deliberate policies were followed to change the wage structure after the Second World War, they were never below 0.9 for more than three consecutive years.

The standard deviation of wages in different industries fluctuated a great deal, but showed no trend in any country except Sweden. It fell heavily in most countries during and after the Second World War, but tended to return to pre-war levels in the fifties. Hoffmann's data are very heterogeneous and the number of industries included differs greatly between countries. This variety of circumstances, however, only reinforces the generality of his conclusions.

In the absence of deliberate policy measures, therefore, the rates of increase of wages in different industries tend towards uniformity. This suggests that some force or forces that are not specific to particular industries lie behind wage movements.

One such force could be changes in the cost of living which might affect workers in different industries similarly. This cannot have been the only

W. G. Hoffmann, *Die branchenmäßige Lohnstruktur der Industrie*, Tübingen, 1961, pp. 21-47.

force, however, since there was no tendency for money wages to keep just in step with the cost of living and for real wages to be stationary.

A second possibility is that wage movements in different industries were governed by conditions of general shortage or abundance of labour. Several variants of this hypothesis must be considered here.

The simplest formulation is in terms of a market for labour; it is also one in which it is easy to pick holes. Labour is homogeneous neither in the tasks that it can perform nor in those that it does perform; it is divided into a large number of groups between which there is no appreciable competition. Further, workers and employers take decisions to buy and sell labour only occasionally. Decisions to change employment or replace workers are much less frequent than if they were made whenever the end of the employment contract allowed; and when they are taken, human and other non-economic considerations exercise considerable influence on them. Finally, the hypothesis of a labour market does not work where there is a labour surplus; wages do not show a tendency to fall progressively where there is a labour surplus, even when they are above the subsistence level.

The rigidity of wages in the presence of unemployment can be accommodated in a theory which postulates a non-linear relation between excess demand or excess supply of labour and the rate of increase of money wages. Such a theory has been the subject of much discussion in recent years. The discussion has mainly related to two problems: whether unemployment is a better predictor (as shown by partial correlation coefficients) of the rate of change of wages than other variables like the cost of living, the level of profits or their rate of change; and which hypotheses are consistent with a relation between unemployment and the rate of change of money wages.¹ The proportion of unemployed labour force has generally shown itself to be a good predictor in least-squares regressions, though not necessarily a better one than profit variables, which were found to be better predictors on U.S. data between 1900 and 1959 and on British inter-war data.²

The information available on the efficiency of predictors is inadequate,

¹ The discussion was started by an article of A. W. Phillips, 'The relation between unemployment and the rate of change of money wage rates in the United Kingdom, 1861-1957', *Economica*, 1958, pp. 283-99. Among other contributions are N. Kaldor, 'Economic growth and the problem of inflation', *Economica*, 1959, pp. 212-26 and 287-98; G. Routh, 'The relation between unemployment and the rate of change of money wage rates: a comment', *Economica*, 1959, pp. 299-315; K. G. J. C. Knowles and C. B. Winsten, 'Can the level of unemployment explain changes in wages?', *Bulletin of the Oxford Institute of Statistics*, 1959, pp. 113-20; R. G. Lipsey, 'The relation between unemployment and the rate of change of money wage rates in the United Kingdom 1862-1957: a further analysis', *Economica*, 1960, pp. 1-21; R. G. Lipsey and M. D. Steuer, 'The relation between profits and wage rates', *Economica*, 1961, pp. 137-55; R. J. Bhatia, 'Unemployment and the rate of change of money earnings in the United States 1900-1958', *Economica*, 1961, pp. 286-96, and 'Profits and the rate of change of money earnings in the United States, 1935-1959', *Economica*, 1962, pp. 255-62.

² R. J. Bhatia, R. G. Lipsey, and M. D. Steuer, cited above.

and there are reasons to suspect that it was low.¹ Few of the results are found to be significant at the 5 per cent. level. Further, the number of observations in the studies was small, and no attention was paid to the possibility of serial correlation which is often present in economic time series and which would reduce the efficiency of the predictions. Thus, no conclusions of immediate use to us have emerged from the discussion. Besides, there are more direct reasons to think that a relation between unemployment and the rate of change of wages would not be appropriate for our data. In the empirical studies on the question it has been found that the sensitivity of the rate of change of wages to changes in unemployment was low at high levels of unemployment, and that the relation between the two was not close. We have evidence that throughout the period we are considering, labour for industry was abundant in Germany. The increase in the industrial working population between 1882 and 1895 was about 3.2 million;² in the same period there was a net emigration of nearly 1.5 million of whom perhaps 80 per cent. would have been working if they had stayed.³ Thus, more than a quarter of the increase in the labour force emigrated in this period. Emigration in the 1870s, though less heavy, was nevertheless substantial. After 1892 or so there was a decline in emigration, and there was even a little net immigration after 1895; but the statistics of urban labour exchanges, which start in 1896, show a large excess of registered male seekers of work over vacancies.⁴ Labour exchange statistics are subject to serious pitfalls and the conclusions they suggest are not final. But their evidence is generally borne out by literary sources: while particular industries (for instance, sugar and brick-making) suffered shortages of labour and particular skills were often scarce, this was due to local circumstances and not to a general labour shortage.

We would give a different formulation to the labour market theory. The tendency of wages to increase depends on the difference between the rate at which employers wish to expand their labour force and the rate at

¹ Cf. R. G. Lipsey and M. D. Steuer, *ibid.*, p. 150, footnote: 'Although on a comparative test the unemployment theory emerges as definitely superior to the profits theory, the absolute explanatory power of the former is not very great.'

² *Statistisches Jahrbuch für das Deutsche Reich*, 1913, pp. 80-85.

³ Statistics of emigration are to be found in W. F. Willcox (ed.), *International migrations*, vol. ii, New York, 1931, p. 351, Table 133; A. Dix, 'Materialien zur internationalen Wanderungsbewegung', *Weltwirtschaftliches Archiv*, vol. 2, 1933, p. 293; and contemporary issues of *Statistisches Jahrbuch für das Deutsche Reich*. W. Mönckmeyer gives the proportions of children, males, and females among emigrants during 1871-1910 at about 3.5, 55, and 45 per cent. ('Wandlungen und Entstehungstendenzen in der deutschen Auswanderung', *Jahrbücher für Nationalökonomie und Statistik*, 1913, p. 340). If we assume that the proportion of emigrating women who would not have taken up an occupation was the same as in the 1882 German population, viz. 40 per cent., the proportion of adult workers works out at about 80 per cent.

⁴ Labour exchange statistics are given in *Der Arbeitsmarkt*, Berlin, from 1896, and in *Reichsarbeitsblatt* from 1903. For their appraisal see J. Jastrow, 'Die Arbeitsnachweise als Umschlagstellen des Arbeitsmarkts', *Schriften des Vereins für Sozialpolitik*, vol. 109.V, pp. 1 ff.

which they can do so. The latter depends on three factors. First, the demographic structure of the region determines the rates at which young workers become available for employment and old people pass out of the labour force. Second, the proportion of young people who choose a particular occupation depends partly on the circumstances of upbringing and milieu which introduce a certain inertia into the occupational distribution, and partly on the current prestige ranking of jobs. Third, the number of people who become available for employment in a particular occupation depends partly on the extent of training facilities (insofar as training for the job is required) and partly on the number of unemployed workers. Employers' labour requirements depend on the output they wish to produce. The greater the excess of their requirements over the available labour, the greater the inducements, including higher wages, that they will offer to attract workers.¹ If this supposition is correct, we would find some correlation between the rates of change of wages and of employment.²

To compare the rates of change we need to choose periods. The longer the periods we choose, the freer the figures will be from erratic year-to-year fluctuations; on the other hand, the long-run tendency of wages in different industries to increase uniformly might obscure the correlation. Further problems that arise in the parallel comparisons of relative prices that we make in section 5.3 below also have a bearing here: the underlying series there are averages of prices in a small number of places and therefore sensitive to local variations, and all series show pronounced cyclical variations whose magnitude differs between commodities.

To meet all these problems we have taken unweighted averages of wages and prices over entire trade cycles and then calculated their proportional changes between successive cycles. According to Spiethoff's chronology,³ which we have adopted, there are five complete cycles between 1871 and 1913. We have taken them to run from trough to peak (from the first year of depression to the year of capital shortage in Spiethoff's terms) and numbered them as follows: I from 1874 to 1882, II from 1883 to 1890, III from 1891 to 1900, IV from 1901 to 1907, and V from 1908 to 1913.

The actual changes between cycles are given in Table 5.3 below; here we shall just give the rank correlation coefficients between wage changes and changes in employment, output and output per head. For lack of earlier information Table 5.1 covers only cycles III to V.

¹ A similar hypothesis has recently been put forward by Sara Behman and supported with an interesting analysis of labour turnover in manufacturing industries in the U.S.A. ('Labor mobility, increasing labor demand, and money wage-rates in United States manufacturing', *Review of Economic Studies*, vol. 31, 1964, pp. 253-66).

² W. B. Reddaway established association between changes in hourly earnings and in employment between 1951 and 1956 in British industries included in the censuses of production ('Wage flexibility and the distribution of labour', *Lloyds Bank Review*, October 1959, pp. 32-48).

³ A. Spiethoff, *Die wirtschaftlichen Wechsellenen*, Tübingen, 1955.

Table 5.1 shows a much higher correlation between rates of change of wages and employment between cycles III and IV than between IV and V; between IV and V wage changes are better correlated with changes in output and productivity. This seems to be connected with the fact that real wages rose considerably between III and IV and were almost stationary between IV and V; both sets of facts could be explained in the following

TABLE 5.1

Inter-industry rank correlation coefficients between changes in money wages, productivity, output, and employment¹

Changes in	Changes in					
	Productivity		Output		Employment	
	III-IV	IV-V	III-IV	IV-V	III-IV	IV-V
Wages	0.25	0.54	0.24	0.62	0.53	0.33
Productivity	..	..	0.80	0.77	-0.08	0.16
Output	..	..	..	..	0.35	0.45

way. Increases in the cost of living generated pressure for higher wages, and the resistance to this pressure was weakest where the growth of productivity was increasing profits. Hence the association between the growth of productivity and wages between IV and V. Between III and IV, however, the increase in profits in most industries was more than sufficient to raise money wages with the cost of living; and wage increases above this rate were given when an industry was expanding faster than the growth of its normal labour supply permitted and further incentives were necessary to attract sufficient labour.

This is how inter-industry differences in the rates of wage increase between cycles might be explained. Over longer periods however these differences tended to disappear. We mentioned Hoffmann's results on this subject earlier; Table 5.2 below shows that even between cycles the variation among wage changes was much less than among changes in productivity, output, and employment. Where this uniformity of wage changes is not explained by the influence of changes in the cost of living, it seems appropriate to postulate an element of emulation in wage increases. Whether as a result of customs maintaining wage differentials or of

¹ Rank correlation coefficients have been used here for ease of computation. They are known to be subject to two disadvantages—they waste quantitative information on variables and they are not associated with any measures of reliability. Both disadvantages are unimportant here: the regression coefficients that could be obtained by means of least squares would be of little interpretative value, and with a small number of observations there is a strong presumption that the levels of significance will be low. Rank correlation coefficients are slightly under least-squares coefficients for normally distributed variables—generally within 2 per cent. of them (F. E. Croxton and D. J. Cowden, *Applied general statistics*, London and New York, 1946, 13th edition, p. 686).

leap-frog activities, wage increases in one industry led eventually to similar proportional increases in other industries.

TABLE 5.2
Mean deviations and means of changes in wages, productivity, output, and employment

	<i>Changes in</i>							
	<i>Real wages</i>		<i>Productivity</i>		<i>Output</i>		<i>Employment</i>	
	<i>III-IV</i>	<i>IV-V</i>	<i>III-IV</i>	<i>IV-V</i>	<i>III-IV</i>	<i>IV-V</i>	<i>III-IV</i>	<i>IV-V</i>
Mean deviations	7.7	2.4	12.3	9.7	16.1	11.2	13.3	9.1
Means	111.8	102.9	113.8	109.9	138.8	119.6	123.4	109.5

5.2. *The share of wages*

The movements of the share of wages in value added cannot be studied in the absence of data about the latter; but unless there are appreciable fluctuations in the ratio of value added to the value of output, an indication of the share of wages in value added can be got from their share in the value of output. The movements of the latter are shown in Table 5.3 below. The sample of industries is small and the underlying data are not very satisfactory. Nonetheless, some of the largest industries—iron and steel, textiles, and mining—are included, and the results are so unequivocal that the roughness of the data is probably not very consequential.

The share of wages fell in almost all the industries in the Table between cycles III and IV and rose in almost all of them between IV and V. If we recall that these cycles saw a progressive retardation in the rate of increase of real wages, changes in the share of wages are seen to have been associated with the movement of real wages between cycles III and IV but not between IV and V. Increases in productivity between III and IV are underestimated in Table 5.3 since the employment series tend to rise too fast. This further strengthens our belief that the movements of real wages and the share of wages were associated between those cycles.

5.3. *Relative prices*

Formula 4 in section 4.2 shows the real wage as the product of the share of wages and the value added per worker deflated by the cost of living of workers. We cannot derive value added per worker since the detailed outputs and inputs per worker in different industries are not available; however, we give some ratios of prices of industrial products to workers' cost of living in Table 5.4 below, as interesting indications of movements in the real value added per worker.

As in earlier sections of this chapter we have averaged prices over trade cycles. We have then divided each cyclical average by the average for the

preceding cycle, and divided the resulting relative by the corresponding relative for the workers' cost-of-living index. The figures therefore express the ratio of the price of an industrial product to the cost of living in one cycle as an index with the corresponding ratio in the previous cycle as base.

TABLE 5.3

Data relating to changes in the ratio of wages to the value of output¹

	Changes in					
	<i>Wages</i>	<i>Output</i>	<i>Employment</i>	<i>Productivity</i>	<i>Product price</i> <i>Cost of living</i>	<i>Wages</i> <i>Value of output</i>
<i>(a) Between cycles III and IV</i>						
Iron and steel	109.5	182.3	137.7	132.4	90.6	91.3
Mines	118.5	164.5	143.3	114.8	105.6	97.8
Textiles	107.3	115.4	121.1	95.3	117.1	96.2
Bricks	125.5	126.3	107.7	117.3	111.5	95.6
Brewing	107.8	126.7	112.9	112.2	93.9	102.3
Sugar	105.0	142.2	97.4	146.0	83.5	86.1
Tobacco	97.0	137.1	120.6	113.7	..	..
Leather	109.5	120.1	149.1	81.0	..	..
Building	126.0	134.7	121.2	111.1	..	..
<i>(b) Between cycles IV and V</i>						
Iron and steel	104.6	147.6	122.3	120.7	83.8	103.4
Mines	105.1	135.6	127.6	106.5	99.2	99.5
Textiles	101.3	113.6	114.1	99.6	94.5	107.6
Bricks	108.8	117.8	92.5	127.4	72.6	117.6
Brewing	102.0	101.0	104.0	96.7	96.5	109.3
Sugar	99.6	114.8	97.4	117.9	83.4	101.3
Tobacco	101.3	108.3	115.0	94.2	..	..
Leather	102.3	120.9	103.9	116.4	..	..
Building	99.4	116.9	108.3	107.9	..	..

As Table 5.4 shows, industrial prices tended to fall in relation to the cost of living, and this tendency was strongest between cycles IV and V. Between cycles III and IV however, most industrial prices rose more rapidly than the cost of living. The ratio to the cost of living of the prices of 9 goods out of 14 fell between cycles I and II, as did those of 10 goods out of

¹ The sources are as follows: *Wages*: Table A.2. *Cost of living*: Table A.8. *Output*: Table A.22. *Employment*: Table A.6. *Price of Beer*: Table A.9. *Other prices*: as for Table 5.4; see the next footnote. Prices received by iron and steel and textile industries are represented by unweighted averages of prices of iron and steel and of cotton yarn, cotton cloth, and linen yarn respectively. The price of mining products is an average of prices of coal and brown minette and roasted spar iron ores weighted 90:5:5; the actual share of coal in the value of mines' output in 1907 was 75.6 per cent. and of iron ore 6.5 per cent. (E. Jungst, 'Die Industrien', *Die Weltwirtschaft*, 1908, part II, p. 60). Regarding the accuracy of estimates of productivity increase see the description of output and employment series in Appendix B.

14 between cycles II and III and of 17 goods out of 19 between IV and V; between cycles III and IV however, the ratios rose for 15 out of 19 goods.

These figures have some implications for the movements of value added per worker deflated by the cost of living. Value added per worker would normally increase over time in most industries; hence indices of change in

TABLE 5.4

Changes in the ratio of prices of industrial products to the cost of living¹
(Ratio in the preceding cycle = 100)

	Cycles			
	I-II	II-III	III-IV	IV-V
Cement	84.7	76.6	132.8	65.0
Zinc	93.3	112.5	104.7	94.0
Tin	123.2	82.3	151.4	129.7
Copper	82.1	93.3	114.7	83.4
Lead	102.8	94.1	102.1	95.0
Iron	90.3	109.1	96.1	85.7
Steel	..	..	86.9	82.0
Iron ores				
Brown minette	..	..	100.7	85.0
Roasted spar	..	..	110.1	94.6
Coal	85.8	138.3	107.0	100.2
Coke				
Blast furnace			114.2	90.3
Foundry			115.1	90.6
Cotton yarn	105.8	101.2	131.9	96.4
Cotton cloth	82.5	84.8	106.1	92.1
Linen yarn	99.0	91.7	114.1	94.9
Bricks	114.1	79.5	111.5	72.6
Tiles	93.1	94.5	103.8	82.1
Lime	107.4	97.5	91.5	88.1
Sugar	77.7	82.8	83.5	83.4

the average value added divided by the cost of living would generally be above the price ratios given in Table 5.4. So there can be little doubt that value added per worker rose faster than the cost of living between cycles III and IV. On the other hand, there are such large widespread falls in the price ratios between cycles IV and V that the cost of living probably rose faster than the value added per worker in most industries.

Let us now see the bearings of these movements on those of real wages. The rise in real wages quickened between cycles I and II and slackened progressively thereafter. It is probable therefore that their movement was

¹ Prices of iron ore, steel, and coke are from H. J. Schneider, *Zur Analyse des Eisenmarkts*, Berlin, 1927, p. 99. Price of cotton cloth (*Kattun*, Mühlhausen, 90 cm. broad) is taken from the following sources: 1874-1902—*Vierteljahrshefte zur Statistik des Deutschen Reichs*, 1903, p. I.14; 1903-12—*Statistisches Jahrbuch des Deutschen Reichs*, 1913, p. 287, Table IX. Other prices are from A. Jacobs and H. Richter, *Die Großhandelspreise in Deutschland von 1792 bis 1934*, Berlin, 1935, pp. 74-81.

associated with a fall in the ratios of value added per worker to the cost of living between cycles IV and V. It is possible but not certain that the acceleration of the rise in real wages between the first two cycles was associated with a faster fall in the cost of living than in the value of net output per worker in many industries. Between cycles III and IV, however, value added per worker was increasing faster than the cost of living at a time when the rise in real wages was slackening; this slackening was thus due to a fall in the share of wages and a widening of profit margins.

Bringing together the results in this chapter, we may say that the acceleration of real wage increases between the 1870s and 1880s might have been due to the fall in the prices of consumer goods. In or after the 1880s, however, something led to a widening of profit margins and pressed down the rise in real wages. The pressure on the share of wages eased some time in the first decade of this century; but by that time the cost of living had begun to increase and to retard the rise in real wages still further.

Thus, the movements in real wages can be explained by reference to the behaviour of the cost of living and of the distribution of income. In the next two chapters we shall investigate the price movements of two major components of consumption—agricultural consumer goods and housing services. In the last chapter we shall discuss the influences on income distribution and build up a comprehensive explanation of the real wage movements.

6

Agricultural Prices and Production

IN this chapter we shall investigate the price formation of two groups of agricultural commodities of prime importance in working-class budgets—cereals and meat. Together with their products they accounted for 11·4 and 12·3 per cent. of working-class expenditure respectively.¹

6.1. *Retail and wholesale prices of cereals*

Comparable wholesale prices of wheat and rye and retail prices of bread are available only for Berlin. Even for Berlin we have data for only one quality each of wheat, rye, and bread; hence an analysis of the margins charged by millers, traders, bakers, etc. is impossible. Whatever the behaviour of these margins however, some useful conclusions can be derived about their total. For this purpose, the retail price of rye bread in Berlin is plotted together with the wholesale price of rye in Figure 2, and the retail price of wheat bread with the wholesale price of wheat in Figure 3.²

The margin between the two prices shows a slight increase over the years in the case of rye, both absolutely and relatively; in the case of wheat it is fairly constant. The absolute margins rise in booms for both cereals; but as a proportion of wholesale prices they tend to fall. In other words, bread prices were stabler than wholesale grain prices when the difference in levels was allowed for. In the general direction of movement the two agree closely. Thus it is safe to conclude that the movement of wholesale cereal prices in Berlin was largely reflected in that of bread prices apart from a small part of the rise in the price of rye bread after 1894. We shall assume for simplicity that the movements of prices of bread and flour were determined in all German cities by those of wholesale prices of wheat and rye, and proceed to analyse the course of the latter.

6.11. *The influence of import prices*

The import prices of rye and wheat have also been plotted in Figures 2 and 3.³ The close correspondence between them and the wholesale prices is evident. As Tables A.15 and A.16 show, this was equally true of other cities. Further, wholesale prices were generally above import prices;

¹ See Table A.10.

² The underlying series are given in Tables A.15 and A.16.

³ Average annual unit values; the series are given in Tables A.15 and A.16.

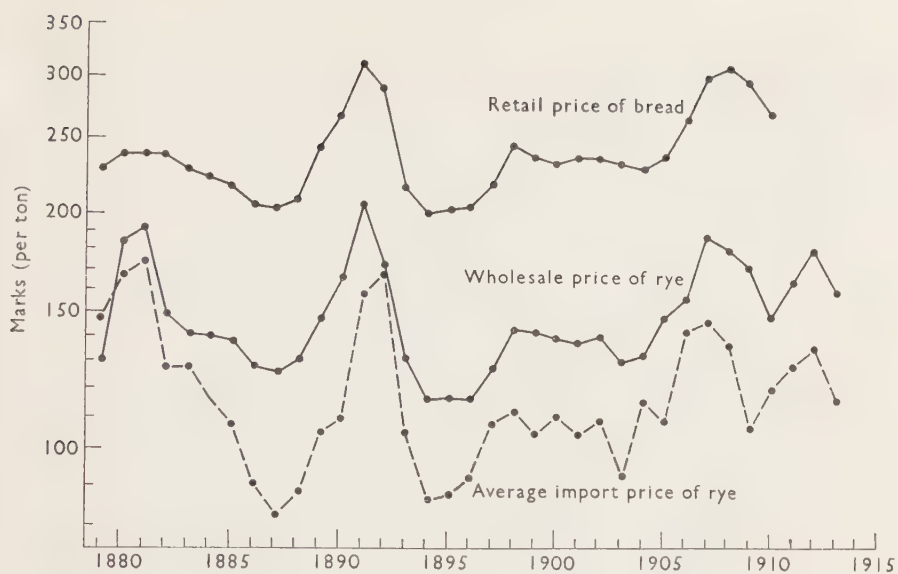


FIG. 2.

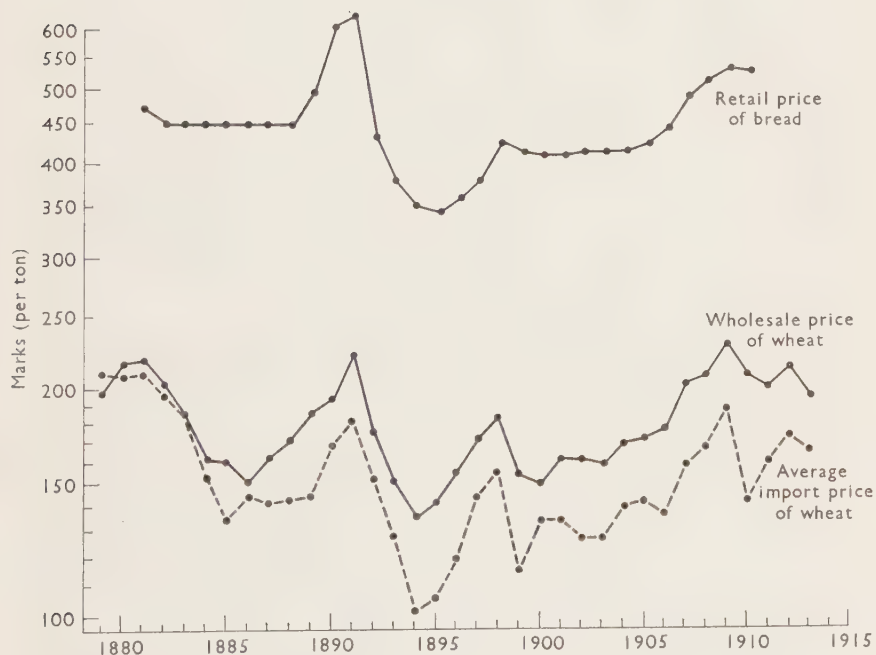


FIG. 3.

the few exceptions occur in the peripheral towns of East Elbia¹—Danzig, Breslau and Königsberg—and in isolated years which were more frequent in the 1880s. Thus imports were apparently a source of low-cost supply which held down the local prices.

However, the impression changes if we take the average import price including the tariff: local prices were often below this level. We have no firm estimates of the average transport costs of imports from the border to the various towns; if they were included in the cost of imports it would be found to have been normally above the local prices. So it would appear that it was the local production that constituted the source of cheap supply; that the local prices were normally determined by the local harvests and demand and imports stepped in only to fill occasional gaps in supply. It was unprofitable to import until the price rose above the local cost of imports; and the effect of tariffs was to discourage imports by raising the local scarcity price at which they would be drawn in.

If this view were correct, we should find a closer correspondence between the cost of imports and the price in years of bad harvests than in normal years. Whether this is so may be judged from Table 6.1 where the tariff has been compared with the difference between local prices in three cities and the average annual import price. We shall call this difference the margin. A year of grain scarcity was chosen in each period in which a particular rate of tariff was current; since normal years could not be defined equally clearly, averages were taken instead for all years in which a tariff rate was current.

Table 6.1 shows a close correspondence between the tariff and local margins in years of scarcity. The changes in tariff are however reflected equally clearly in the average margins for the tariff periods; the grounds are not sufficiently strong for deciding whether imports were a marginal source of supply or not. Fuller use of the available information must be made for a clearer answer; this can be done by recourse to regressions.

The variations in the average import prices were strongly reflected in home prices; high correlation coefficients can be obtained between the two. However, the correlation would not establish the influence of import prices on home prices since it could equally well be due to cyclical covariation. Hence a more roundabout approach to the problem is necessary: instead of home prices, the local margins may be taken as dependent variables in regressions. If variations in import prices found close reflection in home prices, the margins would be insensitive to changes in import prices. How far this was so can be tested by regressing the margins on changes in import prices.

Other independent variables were also included to get more information on price formation—tariffs, being an ascertainable part of the cost of

¹ This term is applied to Prussian provinces east of the Elbe—East and West Prussia, Posen, Pomerania, Brandenburg, and Silesia.

imports, as well as annual changes in harvests and in personal income representing the supply and demand influences at home. Harvest years ran from August to July; so two independent variables were made out of the harvest series—one unlagged and the other leading the rest of the series

TABLE 6.1
Tariffs and local margins¹ (marks per ton)

Rye

	Years of scarcity					Tariff periods				
	1882	1886	1890	1898	1909	1880- 1884	1885- 1887	1886- 1893	1894- 1905	1905- 1913
Tariff	10	30	50	35	50	10	30	50	35	50
Local margins:										
Berlin	22	39	58	31	59	20	36	38	30	41
Königsberg	8	27	40	25	61	7	26	24	21	34
Leipzig	35	48	68	40	67	32	44	46	37	43

Wheat

	1882	1885	1889	1899	1910	1882- 1884	1885- 1887	1888- 1891	1892- 1905	1906- 1913
	10	30	50	35	55	10	30	50	35	55
Tariff										
Local margins:										
Berlin	7	26	43	40	68	8	18	34	31	44
Königsberg	-1	23	32	36	59	1	16	27	25	36
Leipzig	17	32	42	40	61	15	26	35	30	39

by a year. Thus, the regressions were variations of the following equation, differing in the variables included.

$$P_t - I_t = a_0 + a_1(Y_t - Y_{t-1}) + a_2T + a_3(I_t - I_{t-1}) + a_4(H_t - H_{t-1}) + a_5(H_{t-1} - H_{t-2})$$

Here P represents home price, I the average unit value of imports, Y total personal income, T the tariff and H the harvest. Table 6.2 summarizes the results obtained. All results that are significant at the 5 per cent. level are given, as well as a few that were not: coefficients that are not significant at the 5 per cent. level are italicized. There was strong cross-correlation between the tariff and income changes, so no significant results could be obtained in regressions containing both variables.

The results with the income variable are much poorer than with tariffs: the coefficients of determination are lower, and in the case of rye there are few significant results. This does not in itself show that income-induced changes in demand had little influence on grain prices; there are

¹ Tariff rates are as given in N. Jasny, *Die Zukunft des Roggens*, Berlin, 1930, p. 51; margins are calculated from Tables A.15 and A.16.

statistical reasons why income changes should give worse results. There is little variation in the tariff series, and this tends to raise coefficients of determination; and our series of personal incomes is a rough approximation. However, two other considerations tell against regressions involving

TABLE 6.2
Results of regressions on margins, wheat and rye, 1879-1913¹

City	R^2	Constant	Regression coefficients					Standard errors of regression coefficients				
			ΔY	T	ΔI	ΔH	ΔH_{-1}	ΔY	T	ΔI	ΔH	ΔH_{-1}
Berlin	0.380	12.087	..	0.589	-0.215	-0.049	..	..	0.149	0.098	0.025	..
Danzig	0.097	27.440	5.947	..	..	..	..	3.210	..	..	..	..
	0.257	7.159	..	0.512	..	..	..	..	0.154	..	..	..
	0.336	5.094	..	0.584	-0.162	-0.038	..	..	0.153	0.102	0.026	..
Königsberg	0.108	20.035	6.336	..	..	..	..	3.211	..	..	..	..
	0.279	2.822	..	0.543	..	..	..	..	0.154	..	..	..
	0.375	0.438	..	0.622	-0.196	-0.038	..	..	0.153	0.100	0.025	..
Leipzig	0.174	15.070	8.159	..	..	..	..	3.141	..	..	..	..
	0.093	28.912	..	0.290	..	..	..	..	0.161	..	..	..
	0.263	23.401	..	0.479	-0.315	-0.066	-0.047	..	0.173	0.140	0.029	0.032
Mannheim	0.349	30.308	..	0.430	-0.295	-0.043	..	..	0.143	0.093	0.024	..
Munich	0.175	31.267	..	0.375	-0.299	-0.044	-0.033	..	0.189	0.153	0.032	0.035

Wheat												
Berlin	0.664	0.842	..	0.774	..	..	..	..	0.097	..	..	..
Breslau	0.677	1.918	..	0.747	0.084	..	..	..	0.100	0.077	..	..
	0.355	18.613	11.529	..	..	..	..	2.744	..	..	..	..
	0.520	-10.459	..	0.769	..	..	..	..	0.131	..	..	..
Frankfurt	0.503	-10.776	..	0.786	..	..	-0.042	..	0.127	..	..	0.024
	0.136	10.546	8.001	..	..	..	..	3.570	..	..	..	..
	0.408	26.330	..	0.379	..	..	..	..	0.081	..	..	..
Königsberg	0.428	26.209	..	0.385	..	..	-0.016	..	0.081	..	..	0.015
	0.144	36.059	4.573	..	..	..	..	1.975	..	..	..	..
	0.625	-3.470	..	0.722	..	..	..	..	0.099	..	..	..
Leipzig	0.298	13.694	1.016	..	..	..	..	0.276	..	..	..	..
	0.418	10.723	..	0.520	..	..	..	..	0.108	..	..	..
	0.481	10.432	..	0.536	..	..	-0.038	..	0.104	..	..	0.026
Lindau	0.122	24.632	5.717	..	..	..	..	2.714	..	..	..	..
	0.249	49.066	..	0.455	..	..	..	..	0.140	..	..	..
	0.635	25.697	..	0.669	..	..	..	..	0.090	..	..	..
Mannheim	0.702	27.880	..	0.616	0.171	..	..	..	0.085	0.065	..	..
	0.415	42.969	8.249	..	0.212	..	..	2.412	..	0.091	..	..

incomes. First, the regression coefficient of income changes varies greatly between cities; it is difficult to imagine that the influence of incomes on prices in different cities was so different. Second, tariffs give much better results in conjunction with the other variables than income changes; thus, an explanation involving tariffs would be more comprehensive than one involving tariff changes.

It appears from the regressions, therefore, that an explanation which makes the cost of imports the chief determinant of home prices is more tenable. We may note here that the constants in the regressions with tariffs vary roughly with the distance of the city from the borders across

¹ The series used are to be found in Tables A.15, A.16, and A.22.

which grains were imported—the Russian border in the case of rye, and the Russian and Dutch borders and the North Sea ports in the case of wheat. This suggests that transport costs are an important component of the constants in the regressions. Further, since a larger proportion of the requirements of wheat was imported than of rye, we would expect the cost of imports to have exerted a stronger influence on wheat prices. This is confirmed by the higher coefficients of determination as well as higher regression coefficients of tariffs that have been obtained for wheat.

Since home production met more of the rye requirements, we would expect the influence of harvests to be more marked in its case. This is borne out by the results, which in fact show harvests to have had little influence on wheat prices in most cities. Where harvests affected wheat prices, the effect was a gradual one and became apparent in the year following the harvest. The effect of harvests on rye prices was both greater and more immediate; it showed itself in the five months—August to December—following the harvest.

The regression coefficients of changes in import prices are generally not significant for wheat and suggest that import price fluctuations tended by and large to be fully reflected in home prices. In the case of rye, however, the regression coefficients are invariably negative and generally significant; thus, home prices of rye did not fully reflect movements of import prices, and showed greater independence in cities in the interior—for instance, Mannheim and Munich—than in border cities like Danzig and Königsberg. The influence of tariffs as shown by the regression coefficients also wanes as one moves away from the border.

Even if changes in tariffs led to an equal change in margins, we would have got regression coefficients of tariffs below one owing to tare allowances. But they would not be so low as in our results where the highest coefficient is 0.774. Further, a number of constants in the regressions are negative or near zero; since transport costs could not be negative the constants must have some other negative component. So there were apparently factors which pushed home prices below the full cost of imports and which are not accounted for by our independent variables.

The tendency of home prices to stay below the cost of imports was probably due to low elasticity of home supply. The German farmers would wish to dispose of their surplus for whatever price was being offered by traders; hence the price they got was the demand price of wholesale traders who bought from them. Since prices in Germany were above prices abroad, the entire output had to be marketed at home. So the demand price of wholesalers was such that they could be sure of selling all their purchases to millers, retailers, etc., without fear of competition from imports. It therefore had to be lower than the cost of imports; and the greater the ratio of the harvest plus traders' carry-over to the expected annual demand for

the grain, the further below the cost of imports the traders' demand price would lie.

Traders between the purchaser of the harvest and the consumer probably operated with margins that changed only slowly, so that the harvest purchase price determined the prices further down in the chain, right down to the retail price of bread.

A few further facts can be adduced in support of this hypothesis. First, there is the influence of harvests on monthly prices of wheat noted by Perlman, even after 1890 when imports became especially important.¹ The uncertainty of marketing prospects was greatest just after the harvest; as the harvest season receded, it became more and more certain that the harvest would be sold out, and the home prices rose towards the cost of imports. Second, there is the fact that the depressive influence of harvests on home prices in our regressions is more clearly evident in the case of rye than of wheat; it can be explained by the fact that a larger proportion of the requirements of rye was met by home output, so that the uncertainty regarding the marketing of the harvest was also greater for rye than for wheat.

Third, the differences between the constants in regressions for Prussian cities east of the Elbe—Berlin, Danzig, and Königsberg—and the rest are much larger than within the two groups; they could not be justified by transport costs alone even if we ignored American grain and took costs of transport only from the Russian border. The difference is probably due to the differing relation of output to the demand for grain in the regions east and west of the Elbe. East Elbia was sparsely populated, and the productivity of agricultural labour was higher there. It was also a region of large estates run with hired labour and producing grain for the markets. The other areas—Saxony, the Ruhr, and the south—were more densely populated areas with the predominance of small-holdings, and the self-consumption on farms must have been correspondingly higher. They were also more heavily industrialized, with greater urban demand for food. Hence the marketed surplus of wheat and rye was greater in relation to local consumption in east Elbia, and prices there would be expected to be further below the cost of imports.

Thus, the major influences on prices of wheat and rye were the price of imports, the tariff level, the internal cost of transport, the harvests, and the level of home demand. In the following sections we shall turn to the determinants of the harvests and the influence of prices on their trends.

6.12. *Production of wheat and rye*

The area of cultivable land that could be devoted to wheat production

¹ L. Perlmann, *Die Bewegung der Weizenpreise und ihre Ursachen*, Munich and Leipzig, 1914, pp. 27 ff. and 56.

was limited by its soil requirements; this was also true, to a smaller extent, of rye. Within these maxima, however, there was great scope for the variation of the acreage. The proportion of the acreage given to various crops depended broadly on their relative profitability—i.e. on the profit they were expected to bring per hectare. The relative profitability of wheat and rye in the period under our consideration stood under the strong influence of technical innovations, and specifically, of the new inorganic fertilizers that found increasing application. We shall describe the role of the various factors in greater detail in the following sections.

6.121. *The soil conditions*

The cultivation of wheat was excluded from the larger part of the north German plain by its soil requirements. Wheat does better in a soil which is rich in nitrogen in forms readily available to plants; and the nitrogen content of a soil is higher if it receives organic matter and nitrogenous fertilizers and is capable of assimilating it, or if it has recently borne plants which can fixate nitrogen—mainly legumes. For the absorption of nitrogen by roots, it is necessary for them to have access to air; hence the soil needs to be porous and not waterlogged. Nitrogenous fertilizers are soluble in water and can be washed out of the soil if it is leached; hence a fine-grained soil which can absorb a great deal of water is better at retaining them. And for legumes to thrive, the acidity of the soil must be low.

These conditions were not met in the northern plain. It owed its formation to glacial action. When the glacial cover melted, the water flowed westwards to the sea and deposited finer clays in the valleys of the flow; elsewhere the glacier ground down the underlying rock and left sand. The flows in later ages accentuated the distribution of clay and sand that the glaciers had left, removing the finer clay particles and depositing them in the valleys.

The gradients of the valleys left by the melting of the glaciers (*Urstromtäler*) are low, and the rivers flowing through them sluggish. Hence the land in these valleys was ill-drained and unfavourable to the absorption of soil nitrogen by plants. The soils in the higher places were sandy on the other hand, and sandy soils get leached more easily; nor are they suited to the formation of colloids which can store nitrogen compounds. Further, since the capacity of sands to store water is low, more of the water they receive is lost through leaching and evaporation, and they lose correspondingly more of their exchangeable base content through base-exchange reactions. The result of the loss of bases is an increase in the concentration of hydrogen ions—i.e. an increase in acidity. Thus, sandy soils tend to be acid and to lose their exchangeable base content more rapidly.¹

¹ For information on the relationship between the composition of soils and their acidity, see A. D. Hall, *The Soil*, new edition by G. W. Robinson, London, 1945, pp. 146–9, and

For these reasons, the soils of the northern plain were on the whole unfavourable to the cultivation of wheat. Wheat was more at home in the belt of loess at the southern edge of the plain—in the Münster and Cologne bays, in the province and kingdom of Saxony, in southern Posen and Silesia—and in the alluvial valleys of the Rhine and its tributaries—Main, Moselle, Neckar, etc. The soils of these regions were fine, fertile, and well-drained, and were suitable for a great variety of crops including wheat, beet, barley, legumes, and oats.

TABLE 6.3

Distribution of moors and the area under cultivation in Prussian provinces, 1878-1913¹

	<i>Moors as proportion of total area</i>	<i>Area of cultivated land and gardens</i>	
		1878	1913
	<i>per cent.</i>	<i>thousand hectares</i>	
East Prussia	5.1	1883	2046
West Prussia	3.4	1382	1485
Brandenburg	8.7	1843	1774
Posen	7.0	1781	1846
Pomerania	10.2	1661	1657
Silesia	2.2	2234	2225
Saxony	3.3	1533	1522
Schleswig-Holstein	9.3	1085	1047
Hanover	14.6	1250	1296
Rhineland	1.7	1241	1216
Westphalia	1.0	849	868
Hesse-Nassau	0.1	621	619

Besides the sands and clays, the northern plain also had substantial areas of moors and bogs in places where the water table was or had been above the level of the land. However, these lands or their reclamation seem to have been unimportant agriculturally. The above table makes this clear.

It is evident from the table that the largest increases in the area under cultivation took place in East and West Prussia—provinces where moors were rare. There was some increase in Hanover and Posen where moors

C. A. Black, *Soil-plant relationships*, London and New York, 1957, pp. 150-1. For details concerning the soils of Germany, see R. E. Dickinson, *Germany: a general and regional geography*, second edition, London, 1961, pp. 67 ff.; also G. W. Hoffmann, 'Central Europe', pp. 334 ff. and G. Teleki, 'East Central Europe', pp. 510 ff. in *A geography of Europe*, ed. G. W. Hoffmann, London, 1953.

¹ Ratios of moors to area are given in B. Tacke, 'Moorkultur und Moorkolonisation', in *Handwörterbuch der Staatswissenschaften*, ed. J. Conrad and others, 3rd ed., Jena, 1911, vol. vi, p. 776. The same figures are repeated in the first four editions of the *Handwörterbuch*, starting from 1892; hence there was probably little change in the area of moors over the years. The date of the estimates is not given. The sources of the area of cultivated land are as for Table A.18.

were relatively more prevalent; but even if all of it were due to the reclamation of moors, it would make up less than 0·7 per cent. of the 17,600 hectares which were under cultivation in Prussia in 1913. Thus, the reclamation of moors cannot have had a significant influence on agricultural production.

To summarize the facts regarding the soil conditions, the northern plain comprised a belt of predominantly acidic soils which were fit for rye, oats, and potatoes. To the south of the plain lay the loess belt; its soils as well as those of the Rhine valley were fertile, versatile, and non-acidic, so that besides rye, oats, and potatoes they could grow crops which were sensitive to acidity—wheat, barley, beet, legumes, etc. Finally, there were mountain regions in the south where the soil cover was thin and poor; these were grazing lands or they grew rye, barley, and oats. These soil characteristics changed little in the forty-odd years we are considering.

6.122. *Area under wheat and rye*

The total area under cultivation was under two general influences. First, there was a gradual reduction in it owing to the absorption of land for non-agricultural uses. Second, the cultivated area in the east Elbian provinces of East and West Prussia and Posen increased. This was in continuation of a trend which went as far back as 1816. The organization of agriculture in these as well as the other east Elbian provinces of Prussia was feudal till the beginning of the nineteenth century. Between 1807 and 1816, legal reforms were carried out by the Prussian ministers, von Stein and Hardenberg, which were aimed at freeing the serfs and giving them independent holdings. Owing, however, to the qualifications laid down, only a small proportion of the serfs obtained holdings; and lack of capital, loss of the rights of commons and uneconomic size of received holdings forced many of them to sell their land to the former feudal lords. The latter, therefore, obtained all the common land and much of the cultivated land. In the following decades, the urban demand for foodgrains in Britain and in German cities rose rapidly; and so did the population and the labour force in east Elbia. Consequently, the landlords extended cultivation to the hitherto common lands. This increase in the cultivated area continued into the period we are considering, although by then it had slowed down appreciably.¹

Further, the area under crops whose markets developed grew at the expense of minor crops. The proportion of cultivated land under wheat, rye, barley, oats, potatoes, and sugar beet rose from 62·2 per cent. in

¹ See G. Ipsen, 'Die preußische Bauernbefreiung als Landesausbau', *Zeitschrift für Agrargeschichte und Agrarsoziologie*, 1954, pp. 29-54. An excellent account of agrarian changes in the nineteenth century is to be found in T. von der Goltz, *Geschichte der deutschen Landwirtschaft*, Stuttgart and Berlin, 1902-3.

1878 to 71·8 per cent. chiefly at the expense of minor crops like lentils, spelt, and lupin.¹ Wheat and rye benefited with other crops from their easy marketability.

Wheat, rye, and oats were the three major winter crops; as Table A.17 shows, they took nearly half the area under crops. They were staple crops, and most farmers grew at least one of them. Further, since they were grown at the same time of the year, they competed directly for land, especially in the loess belt and the river valleys in the south.

One might expect that the distribution of the land between the three crops depended on considerations of profitability, and that the changes in the relative profitability depended on changes in relative prices in the first instance. It might be presumed therefore that changes in their relative prices would be positively associated with changes in their relative acreages.

Table 6.4 bears out our expectations except in two important instances. In the 1880s the price of wheat fell relatively to those of rye and oats, while its proportion of the area under crops rose; similarly, the price of rye rose less rapidly than of wheat and oats after 1900 while there was an increase in its proportion of the acreage. Evidently, factors other than price changes were affecting the profitability of wheat production in the first case and of rye production in the second. We shall take a closer look at the two cases.

6.123. *The case of wheat*

As Table A.17 indicates, the increase in the proportion of land under wheat between 1878 and 1893 was most pronounced in the provinces of Silesia, Saxony, and Hanover—i.e. in the loess belt. Thus, the increased cultivation of wheat seems to have been bound up with the fine soils of this region. As was mentioned above, these soils were particularly favourable to colloid formation and to the transfer of nitrogen to plants; any factors that encouraged such processes would increase the yield of wheat. There appear to have been two such factors at work—the cultivation of beet and the use of nitrogen fertilizers.

The German beet sugar industry expanded very rapidly in the 1870s and 1880s; its output rose from under 200,000 tons in 1870–1 to around 1.2 million tons a year around 1890. By 1890 Germany had become the world's largest exporter of sugar. Corresponding to the increase in sugar output there was an increase in the production of sugar-beet from 3 to 10 million tons.²

Sugar-beet prefers fine soils, and the loess soils were best suited for it.

¹ See Table A.17.

² H. Paasche, 'Zuckerindustrie und Zuckersteuer', *Handwörterbuch der Staatswissenschaften*, ed. J. Conrad and others, third edition, Jena, 1911, vol. 8, pp. 1068 ff.

TABLE 6.4
Changes in the prices of oats, wheat, and rye and the proportion of land under crops devoted to each, 1878-1913¹

Proportion of area under the crops	Oats				Wheat				Rye			
	1878	1893	1900	1913	1878	1893	1900	1913	1878	1893	1900	1913
	<i>per cent.</i>											
	14.4	14.9	15.6	17.1	7.0	7.8	7.8	7.7	22.8	22.9	22.8	25.0
	1879-1882	1888-1892	1898-1902	1909-1913	1879-1882	1888-1892	1898-1902	1909-1913	1879-1882	1888-1892	1898-1902	1909-1913
Prices:	<i>Average 1898-1902 = 100</i>											
Berlin	..	..	..	..	127.9	116.7	100.0	130.1	116.1	117.0	100.0	117.6
Danzig	104.2	102.5	100.0	125.5	127.5	123.6	100.0	127.8	115.9	116.7	100.0	119.9
Leipzig	98.3	100.5	100.0	118.8	133.7	119.2	100.0	126.5	120.6	116.5	100.0	111.6
Mannheim	98.6	100.4	100.0	119.0	131.0	123.4	100.0	127.8	121.5	116.3	100.0	115.7
Average	100.4	101.1	100.0	120.4	130.0	122.3	100.0	128.7	118.7	116.8	100.0	116.2

¹ Wheat and rye prices are from Tables A.15 and A.16; the sources for oat prices are the same as for wheat, Table A.15. Proportions of area are from Table A.17.

The sugar industry came to be localized in the loess belt, and especially in the provinces of Hanover, Saxony, Posen, and Silesia which were comparatively less industrialized and presumably had cheaper labour than the more industrialized parts of the loess belt—Kingdom of Saxony, Rhineland, and Westphalia. These four provinces produced about 60 per cent. of the sugar-beet produced in 1899–1900.¹

Beet as a crop is highly responsive to the careful preparation of the field and the use of nitrogenous fertilizers, and it provides abundant material for organic manure, since the waste left on the extraction of beet juice for sugar preparation can be used as feed for cattle, which are an excellent source of manure. Hence beet is useful for the cumulative improvement of soils. It is, however, a heavy consumer of soil nutrients; hence beet land has to be intensively manured, and beet is best grown in rotation with another crop. On the one hand, therefore, the cultivation of beet led to a rapid growth in the use of nitrogenous fertilizers, and especially of saltpetre imported from Chile. Saltpetre imports rose from 30,000 tons around 1870 and 50,000 tons around 1880 to 350,000 tons around 1890 and 500,000 tons around 1900.² On the other hand, wheat came to be the crop most frequently grown in rotation with beet. It was also highly responsive to good culture and the application of nitrogen; further, it could be grown as a winter crop, while beet was a spring crop; so they did not compete simultaneously for land. Hence wheat yields benefited from the improvements in cultivation that beet occasioned.

It is impossible to say precisely how much the yields of wheat rose over the period since the methods of crop estimation changed between 1893 and 1899,³ and the resulting discontinuities cannot be corrected. Nevertheless, the error cannot be large in assuming that the bias of estimation, insofar as it was connected with the method in use, was similar in different provinces in the same period, and the yield statistics can legitimately be used for cross-section comparisons. Below, we show the ratio of the average yields of wheat in sugar-producing provinces to the national average in various periods between 1878 and 1916 and the relative importance of wheat and beet cultivation at comparable dates.

Table 6.5 suggests that an increase in the ratio of beet acreage to wheat acreage was associated with a more rapid rise in the wheat yields in a province than the national average, once the ratio exceeded 25 or 30 per cent. Since we have isolated only one of the factors influencing the yields of wheat, we cannot expect to find a very exact relationship; and changes in the extent of beet cultivation would not show their effects on wheat yields

¹ E. Bödeker, 'Die Zuckerindustrie', *Handbuch der Wirtschaftskunde Deutschlands*, Leipzig, 1904, Part III, p. 778.

² *Statistisches Handbuch für das Deutsche Reich*, Berlin, 1907, Part II, Table 4 and its appendix.

³ For details of the changes, see H. W. Finck von Finckenstein, *Die Getreidewirtschaft Preußens von 1800 bis 1930*, Berlin, 1934, pp. 42–43.

unless the wheat-beet rotation had become a fairly common technique in wheat cultivation. Where, however, such a rotation can be expected to have become an established practice, we do find that an improvement in yields over the national average was associated with a rise in the relative increase in the area under beet.

TABLE 6.5

Wheat yields and the prevalence of beet cultivation in sugar-producing provinces¹

	Ratio of wheat yields to the national average				Ratio of area under beet to area under wheat			
	1878-1883	1887-1896	1899-1902	1907-1916	1878	1893	1900	1913
	<i>per cent.</i>							
Silesia	90.4	87.4	90.7	96.1	15.3	26.0	27.5	39.8
Saxony	118.6	125.2	130.1	125.3	60.7	71.3	64.4	62.5
Hanover	106.2	116.1	120.5	116.1	18.6	36.5	39.0	43.8
Posen	79.8	73.4	86.6	100.0	2.0	27.1	50.0	86.6

Why did the intensified use of nitrogen not benefit rye and oats? Rye did not generally enter the rotation with beet because the value of per hectare wheat yields in the fertile loess soils was greater, and because wheat yields benefited more from the rotation. And in the acid northern soils in which most rye was grown, the use of nitrogenous fertilizers could not benefit rye. In fact it might have been harmful, since they lower the resistance of the plant to cold, frost, and winds, all characteristic of the northern plains, and increase its water intake, and hence its susceptibility to drought in sandy soils.² In the loess belt, the proportion of the land under crops given to rye fell in Saxony and Hanover till 1900, and changed little in Hanover.³ Posen, where it rose, had large tracts of sandy soils besides the loess on its southern fringe. A part of these was brought under cultivation after the 1870s and put under rye; hence the proportion of land under it in Posen rose.

Oats might have been grown in rotation with beet, but they were a feed crop, while beet also provided abundant animal feed. Hence a rotation of the two would have required a large and rapid expansion of cattle stock which was not called for by the conditions of demand.

Thus, wheat came to be the beneficiary of the extension of beet cultivation, and of the enrichment of the soil which accompanied it; together with beet, it also proved the crop which brought the best returns on the application of saltpetre. The profitability of growing wheat was increased

¹ Data on wheat yields come from Table A.18, and on acreages from Table A.17.

² Cf. C. A. Black, *op. cit.*, pp. 229-35.

³ Table A.17.

by the technical innovations which the cultivation of beet and the use of saltpetre involved. This is the outstanding reason why its cultivation was extended in the 1880s while its relative price was falling.

6.124. *The case of rye*

As we have seen above, the share of rye in the area under crops rose appreciably between 1900 and 1913, while the ratio of its price to the prices of wheat and oats fell. The share of rye rose in all major provinces except Württemberg where it remained the same; at the same time, the share of wheat fell in eleven out of seventeen provinces, and showed little increase in another five.¹

Two reasons have been suggested for the advance of rye. It has been attributed to the system of import certificates (*Einfuhrscheine*), introduced in 1894 and modified in 1906, which in effect subsidized the exports of rye.² The use of new fertilizers has also been advanced as a possible reason.³

Import certificates were introduced at the time of the imposition of tariffs in 1879 to facilitate entrepôt trade in grains. An importer did not have to pay duty on foodgrains imported by him if they were put in one of the transit warehouses opened by the government, and if he exported an equal quantity of grains stored by him in that warehouse. Thus, whenever he exported grain out of the warehouse he got a certificate permitting him to import an equal quantity of the same grain duty-free. From 1894, the import certificates became freely transferable, and could be used to pay duty on petroleum, cocoa, etc., four months after the date of export. From 1906, import certificates could be used to pay duty on all foodgrains without distinction; e.g. the export of oats earned the right to a rebate equal to the import duty on that quantity of oats on the duty of any foodgrain.

That the export of rye owed much to the import certificate system is indicated by the geographical distribution of the increase in the acreage under rye. As Table A.17 shows, the largest increases in the proportion of land under rye were in Posen, Mecklenburg, West Prussia, Pomerania, and Brandenburg, in that order. Proximity to the Baltic ports was a factor that influenced the diversion of land to rye.

Transport costs help to explain why the import certificate system led to the export of rye rather than wheat. The nearest overseas markets for wheat were the Low Countries and Britain. In these countries, wheat from

¹ Table A.17.

² N. Jasny, *op. cit.*, pp. 54 ff.

³ H. W. Finck von Finckenstein has pointed out the role of potassium salts in raising the yields of rye (*op. cit.*, pp. 27–28). However, his view that potassium salts increased the salinity of rye-growing soils and made them more specialized is unfounded. Chlorides of potassium and magnesium, such as German fertilizers largely were, have no effect on the acidity of the soil in small doses and alkalize it in large doses. (On this point, see H. Teuscher and R. Adler in collaboration with J. P. Seaton, *The soil and its fertility*, New York, 1960, p. 329.)

the loess belt would have been a disadvantage against American wheat, which could be transported more cheaply by sea. For rye on the other hand, there was a market in Scandinavia, where the main competitor in rye exports was Russia; being nearer to the sea and to Scandinavia, the rye-producing regions incurred less transport costs on exports than their Russian competitors.

TABLE 6.6
*Increases in the yields of wheat and rye between 1899-1902
and 1907-16¹ (per cent.)*

	<i>Wheat</i>	<i>Rye</i>
Germany	10.2	15.6
East Prussia	9.0	18.2
West Prussia	8.3	27.3
Mecklenberg	3.5	11.4
Posen	27.3	31.8
Pomerania	6.4	18.4
Brandenburg	8.5	15.4
Hanover	8.7	16.7

While the *de facto* export subsidy to rye helps to explain the shift from wheat to rye cultivation, it is in itself inconsistent with the fall in the relative price of rye, for an export subsidy would tend to raise the demand for a product and hence its internal price. It is evident, therefore, that other factors must have acted to reduce the price of rye.

The figures of yields per hectare suggest that these factors were technological. The basis of estimation of crops did not change between 1899 and the end of the war, and we can use the official estimates to get an idea of the development of yields.

It is evident from Table 6.6 that the yields of rye rose more rapidly than of wheat after 1900. Further, the difference was much more marked in the provinces where there was an appreciable shift from wheat to rye. Posen presents an exception to this; as Table 6.5 above shows, this was because beet cultivation found a considerable extension there in this period and pushed up wheat yields. It also seems that the improvement in rye yields was bound up with the soil; for the provinces where it was more marked are, all except Hanover and Posen, east Elbian provinces with predominantly sandy soils, and these provinces also show above-average increases in the yields of oats and potatoes, the other crops of sandy soils, in this period (see Table A.18). The search for factors which could have caused increases in the yields of a number of crops in widespread areas, but whose effect was restricted to a particular soil group, leads us, as in the case of wheat, to fertilizers.

¹ Calculated from Table A.18.

The table below shows the consumption of various fertilizers in Germany between 1890 and 1911. The fertilizers (other than lime) fall into three groups—nitrogenous, phosphatic, and potassic fertilizers. Among nitrogenous fertilizers, the consumption of ammonium sulphate rose very rapidly; nevertheless, the consumption of the group as a whole rose much less than of phosphatic or potassic fertilizers.

TABLE 6.7
Consumption of lime and fertilizers in Germany, 1890-1911¹

	Weight				Value at 1911 prices	
	1890	1900	1910	1911	1890	1911
	thousand tons				million marks	
Lime and its mixtures	50	50	60	70	10	14
Phosphatic fertilizers						
Bonemeal	99	63	81	73	9	7
Superphosphate and mixtures	500	755	1,267	1,450	30	87
Basic slag	400	879	1,429	1,605	18	72
Nitrogenous fertilizers						
Guano and saltpetre	294	390	582	564	68	131
Ammonium sulphate	60	118	268	320	18	96
Potassium salts	220	833	2,219	2,533	6	66

Among phosphatic fertilizers, the consumption of superphosphate and slag showed large increases. Slag was the by-product of steel manufacture out of phosphatic ores, and being rich in lime as well as phosphorus, it was a very valuable fertilizer. Phosphatic fertilizers were not necessarily more effective on the sandy or acid soils in which rye grew. Phosphorus is however leached out of the soil extremely slowly, and is therefore effective on sandy as well as on heavier soils.²

The consumption of potash salts rose far more rapidly than of any other fertilizer. They were mined in Germany; it had virtual monopoly in their production before the First World War, and exported about 40 per cent. of its output.

They were probably the chief factor responsible for the improvement in rye yields, for they were more effective on sandy soils. They encourage the growth of roots and thus increase the resistance of plants to droughts; this effect is particularly marked in sandy soils which store less water. They also increase the resistance of plants to cold and frost. Further, the immediate availability of applied potassium is greater in sandy soils; clays, on the other hand, tend to store potassium in a non-exchangeable

¹ K. von Rümker, 'Ackerbau', *Verhandlungen des Königlichen Landesökonomie-Kollegiums*, Berlin, 1913, p. 69.

² C. A. Black, op. cit., pp. 268-9; C. E. Millar, *Soil fertility*, New York and London, 1955, pp. 148 and 165; L. T. Kurtz, 'Inorganic phosphorus in acid and neutral soils', in W. H. Pierre and A. G. Norman (Ed.), *Soil and fertiliser phosphorus*, New York, 1953, pp. 72-76.

form and make it available to the plants over a longer period, replenishing exchangeable potassium as it runs out.¹

Thus, in the case of both wheat and rye, the most important single influence on their production trends is seen to be inorganic fertilizers. In the relatively simple soil conditions of Germany, fertilizers gave fairly uniform results over large areas. Hence their use spread rapidly, until they came to be the basis of agricultural prosperity in some regions.

6.2. Meat

The processes determining the prices of meat were considerably more intricate than of cereals. While cereal prices were tethered to import prices, meat prices were affected only indirectly by imports since meat imports were negligible. The factors influencing meat prices were more numerous and the interrelations between them more complicated. And corresponding to the complexity of the interrelations, the gaps and weak links in the information available to explain it are more numerous. Here we shall pick out a few outstanding peculiarities in the behaviour of meat prices and work out explanations for them. In this way we hope to get to the more important features of the price-determining mechanism in the particular circumstances.²

A comparison of the series for meat in Table A.9 with the cost-of-living index in Table A.8 shows that meat prices tended throughout the period to rise faster than the prices of other consumption goods. This tendency is weaker after 1890; but in the 1870s and 1880s meat prices participated little in the general fall in agricultural prices. We shall first discuss the course of events after 1900; with the help of the conclusions we reach there, we shall then seek to explain the behaviour of meat prices before 1900.

6.21. Retail and wholesale prices

As for cereals, annual averages of wholesale and retail prices of beef, veal, pork, and mutton are available for Berlin. They show that the margins between wholesale and retail prices showed no upward or downward trends and that the variations in retail prices were, on the whole, reflections of the variations in wholesale prices.³ We shall assume that this was true of

¹ C. A. Black, *op. cit.*, pp. 292 ff.

² For a more comprehensive and discursive account of the mechanism, see J. B. Esslen, *Die Fleischversorgung des Deutschen Reichs*, Stuttgart, 1912. Esslen's estimates of meat consumption are not, however, the best available; for a critique of them and for improved estimates, see E. Bittermann, *Die landwirtschaftliche Produktion in Deutschland, 1800-1950*, doctoral dissertation, Halle, 1956.

³ Continuous retail price series from 1881 are given in *Statistisches Jahrbuch der Stadt Berlin*, wholesale prices are to be found in *Vierteljahrshefte zur Statistik des Deutschen Reichs* in the first quarter of each year. The absence of trends in the margin between wholesale and retail prices of pork finds a confirmation in the data collected by Gerlich on Berlin pig and pork prices from 1895 to 1910 (H. Gerlich, *Die Preisbildung und Preisentwicklung für Vieh und Fleisch am Berliner Markte für Schweine*, Leipzig, 1911).

the entire country and that conclusions based on wholesale prices apply equally to retail prices and vice versa.

6.22. *The price inflation after 1900*

Estimates of production of the principal kinds of meat are given in Table 3.2 (p. 24). It shows that between 1900 and 1913, the production of veal increased considerably more rapidly than of beef. Figures of the stock of cattle between these years, classified by age and sex, help to explain why this was so.

TABLE 6.8
Cattle population, 1900-13¹ (thousands)

	<i>Calves</i>		<i>Bulls</i>	<i>Cows</i>	<i>Total</i>
	<i>under 3 months</i>	<i>3 months to 2 years</i>			
1900	7,087		1,394	10,458	18,940
1904	1,343	6,126	1,407	10,456	19,332
1907	1,831	6,369	1,464	10,966	20,631
1913	1,915	6,194	1,564	11,320	20,994

Although we do not have separate figures for calves over and under three months for 1900, there is little doubt that there was a large increase in the number of the latter from 1900. The number of cows went up much more slowly. Hence it is likely that the frequency of births to cows increased appreciably. Further, the number of calves between three months and two years old remained stationary. It is evident, therefore, that cows were made to bear more calves and that the additional calves were sold for slaughter at a very early age.

This was probably a response of cattle-owners to price changes: for as Table A.9 shows, the prices of veal rose much faster than of pork or beef. There was, however, another advantage to be derived from more frequent calving: it increased the milk output of cows. In so far as it increased the output per cow of both veal and milk, the practice of more frequent calving must be regarded as a capital-saving innovation.²

The answer to the question why these calves were not allowed to grow up must lie in the conversion ratios: at the current prices of cattle inputs and outputs, the rise in the value of their output (i.e. of their meat, milk, or draught services) must not have kept up with the additional expense

¹ From 'Hauptübersicht über die Ergebnisse der Viehzählung im Deutschen Reich am 1. Dezember 1913', *Vierteljahrshefte zur Statistik des Deutschen Reichs*, 1914, p. IV. 58. The counts were made on 1 December in all the years.

² Esslen cites a more advanced version of this practice: urban dairymen bought cows that had just calved in the country, sold the calf, kept the cow while her milk output was high, and sold her for slaughter too when it fell back to normal (J. B. Esslen, op. cit., pp. 83-84).

of feeding them in the months beyond the age at which they were slaughtered: the conversion ratio of feed into the output of cattle must have been too high for adequate profit to be made by letting them grow up. In other words, the price of beef was too low relatively to that of fodder to encourage an increase in the production of beef. This was the reason why the output of beef rose so slowly after 1900 in comparison to the output of both veal and pork.

Why, then, did the price of beef not rise more to permit a faster increase in its output? The answer is probably that it was restrained by the price of pork. While the pork price in Table A.9 shows much fluctuation, there is no noticeable difference between its behaviour and that of the beef price over longer periods. Its influence on the beef price is also detected in the period after the First World War by Hanau.¹ He could not detect any influence in the other direction; he believes this was because the volume of pork consumption was much larger than—about twice as large as—that of beef consumption. As is evident from Table 3.2, this was true before the war too.

The fluctuations that we see in the pork price are largely a manifestation of the hog cycle. Hanau has shown the prevalence of the cycle in Baden between 1896 and 1913, and with the help of statistics for the state, he has also explained its mechanism: when there was a rise in the ratio of the price of pigs to the price of fodder, a larger number of newly-born sows were retained for breeding; their offspring came into the market around eighteen months after the rise in the price ratio, and raised the supply of pigs. This led to a fall in the price of pigs and in its ratio to the price of fodder, and the number of sows being retained was reduced, causing an eventual fall in the supply of pigs, raising their price, and starting another cycle.²

¹ A. Hanau, *Bestimmungsgründe der Preise für Schlachtrinder*, Berlin, 1929, pp. 31–32.

² A. Hanau, *Die Prognose der Schweinepreise*, 3rd edition, Berlin, 1930. As evidence of this mechanism, Hanau gives the results of a regression. He uses deviations from twelve-month averages of the following as variates:

x_1 —the price of pigs,

x_2 —the ratio of the pig price to the fodder price, centred twelve months before x_1 ,

x_3 —the price of fodder centred five months before x_1 being an index in which half the weight was given to potatoes and a quarter each to barley and maize, and

x_4 —the stock of sows centred twelve months before x_1 .

He fits a linear equation and obtains the following estimates by least squares:

$$x_1 = -0.12x_2 + 0.312x_3 - 0.703x_4.$$

The correlation coefficient is 0.86.

However, this regression is of doubtful value. It has two grave shortcomings. First, no confidence can be placed in the regression coefficients owing to multi-collinearity. The correlation coefficients between x_2 and x_3 , x_3 and x_4 and x_2 and x_4 are -0.7 , -0.48 and 0.69 respectively. Second, the regression obscures the mechanism of Hanau's model by introducing the price ratio (x_2) and the stock of sows (x_4) in the same equation. If changes in the price of pigs act on the supply of pigs through the number of sows retained, the appropriate procedure would have

Thus, Hanau's analysis suggests that the price of pork fluctuated around a level which was proportional to the price of fodder. This is a credible hypothesis, provided the conversion ratio of fodder into meat did not change. The facts we have do not contradict this. The wholesale prices of oats, which were mainly used as feed for horses and cattle but could be fed to pigs, rose 20 per cent. between 1899-1902 and 1909-13, those of potatoes rose 30 per cent., the average import price of oilcake rose 14 per cent. and of bran 10 per cent.¹ Between the same years our retail price index for meat shows a rise of 25 per cent., so it is possible that the rise in feed prices accounted for much of the rise in meat prices. There is a suspicion that meat prices rose more than feed prices; but in the absence of comprehensive information about prices and animal diets we cannot assert this with any great certainty.

6.23. *Meat prices before 1900*

In this period also it is evident that the rise in the ratio of meat prices to those of other foods was accompanied by a rise in the ratio of fodder prices to other agricultural products, so that the relationship which was

TABLE 6.9
Prices of agricultural products in Prussia, 1871-1900²

	Wholesale prices							Retail prices	
	Wheat	Rye	Barley	Oats	Potatoes	Beef	Pork	Beef	Pork
1871-5	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1876-80	89.9	92.7	94.8	94.5	100.3	100.2	98.4	113.4	100.0
1881-5	80.6	89.3	88.7	89.3	87.0	102.8	99.0	115.9	100.6
1886-90	74.0	80.3	83.6	84.2	79.1	102.1	97.6	115.1	99.2
1891-5	71.2	84.8	85.1	89.3	92.0	109.1	103.2	123.0	104.8
1896-1900	68.8	75.8	82.1	83.6	82.8	116.6	102.4	123.2	104.0

noticed after 1900 was present. Here, however, it is more certain that meat prices rose faster than those of fodder. The above price relatives for Prussia make this clear.

been to correlate the price ratio with changes in the stock of sows, the latter with the supply of pigs after a lag, and the supply of pigs with their price. Nevertheless, there is enough evidence of the described mechanism in Hanau's results: he finds a correlation coefficient between the price ratio and the stock of sows of 0.69, and between the stock of sows and the price of pigs (after a lag) of -0.81, all being measured, as was mentioned above, as deviations from a moving average.

¹ The increase in the wholesale prices of oats is given in Table 6.4, and an index of potato prices in Table A.9. Import prices have been calculated from foreign trade statistics; for details see Appendix B.

² Wholesale prices from J. B. Esslen, op. cit., p. 227. Retail prices from *Zeitschrift des preußischen statistischen Landesamts*, 1889 and 1909.

Except for beef prices between 1871-5 and 1876-80, wholesale and retail prices of beef moved together, and so did the prices of pork. Prices of the feedstuffs, barley, oats, and potatoes, fell less in the thirty years than those of wheat and rye. And wholesale prices of beef and pork rose relatively to those of all three feedstuffs.

Of the factors which might have raised the price ratio of meat to fodder, we might rule out a rise in conversion ratios: there is neither evidence nor reason to believe that a unit of fodder was being converted into less meat.

Geographical shifts in husbandry probably played a role in raising the relative price of meat. The consumption of concentrated feedstuffs like oilcake with low transport costs was small in the nineteenth century: bulky feeds like potatoes, hay, oats, barley, etc., were widely consumed. In such circumstances it was more economical to fatten pigs and cattle where the fodder was grown than to keep them in or near the cities. On the other hand, milch cows were best kept near the cities since milk was perishable and costly to transport. Hence there were three belts around a city: one in which the dairies were situated, one which grew the fodder for the dairies and one in which cattle and pigs for slaughter were reared. As the city grew and drew its supplies from a larger region, the second and the third belt moved away, the third more rapidly. As a result, the input of transport per unit of meat rose and increased its cost in the city. The transport input rose more rapidly with beef than with pork; the pork that a hectare could annually produce was much larger than the beef it could produce, for pigs could eat potatoes, whose yield per hectare was considerably larger than of other crops, including hay.

By the 1890s, the meat supplying belts of German towns had pretty well covered Germany, and needed to expand beyond the frontiers. This was however ruled out by the comprehensive restrictions imposed on imports of animals and meat on veterinary grounds.¹ Hence recourse was had increasingly to the stall-feeding of animals on imported feedstuffs. This began earlier and reached larger proportions with cattle since beef production was more land-intensive; imports of barley were already sizeable by 1890 and grew rapidly from then, while other feedstuffs for cattle were also imported in increasing quantities—bran, maize, oilcake, oilseeds, etc.

While the increase in transport inputs and the necessity of greater stall-feeding contributed to the rise in relative prices of meat, a part of the latter must have gone to raise the relative profitability of meat production. This is clear in the case of feedstuffs whose prices went up relatively to the cereals with whom they competed for land, and probably in the case of meat production.

This rise in profitability of meat production did not, as in the case of cereals, come about as a result of technical improvements, but rather as a

¹ J. B. Esslen, *op. cit.*, pp. 113 ff.

result of a rise in prices. It is highly unlikely that the costs of production of meat rose relatively to other agricultural products, or that agriculturists pushed up meat prices by monopolistic action. Hence the stimulus to the rise in prices probably came from demand; the rate of growth of demand for meat was higher than that of supply at the current set of relative prices, and the relative prices of meat had to rise to make them equal.

It is unlikely that the technical improvements in the growing of wheat and rye, which we have discussed above, had much effect on the relative profitability of fodder crops and through it on meat prices; for as we saw, the improvements in cereal production were such as also increased the yields in fodder crops. Apart from increasing the yields of hay, application of saltpetre and the wheat-beet rotation also increased the output of beet waste left in sugar manufacture, which could be fed to cattle. Similarly, the application of potash can be seen in Table A.18 to have improved oat yields.

Import prices of cereals and tariffs influenced meat prices by determining the profitability of cereals, and hence the profits meat production had to bring to maintain a particular level and rate of growth. The higher the rate at which the output of meat had to grow, the greater the proportion of the land to be devoted to fodder production, the higher the profits meat production had to bring relatively to fodder production and the higher the prices of fodder and meat relatively to cereals. Hence apart from cereal prices, the rate of growth of demand for meat also influenced its prices.

6.3. *Conclusion*

As has been shown in this chapter, the prices of wheat and rye were subject to a ceiling imposed by the cost of imports, which included the import price, the tariff and costs of internal transport; and the greater the proportion of demand met by home production, the further below the cost of imports prices were. The output of both wheat and rye rose appreciably with the use of fertilizers and new rotations; the output of rye increased so much that it met the entire home demand and was exported under subsidy in the years that just preceded the First World War.

Meat prices were also subject to the indirect influence of import costs of cereals and fodder, but they were more responsive to changes in home demand. Owing to the possibilities of international trade, the prices of wheat and rye were tethered to the international prices. Imports of meat, however, were prohibited; hence home supply and demand had greater influence on the prices of meat than of cereals.

Principal Determinants of Rent

IN this chapter we shall concern ourselves with the determinants of the movements of urban dwelling rent. In particular, we shall seek an explanation of two features of them—the comparative stability of rent up to about 1895 and its steady rise thereafter.

As a first approximation, we begin with the supposition that rents were determined by the marginal cost of housing space—i.e. by the annual servicing costs of new houses. Servicing costs depend on the wage and material costs of building on the one hand and on interest rates and terms of repayment of mortgage loans on the other. Since the interest rates are found to be closely related to the yield on long-term securities, we also investigate the determinants of the latter. From the gathered information on the various elements of costs, we build up an index of servicing charges, and compare it with the index of rents.

Some differences are found in the course of the two, and further factors have to be brought into the explanation. Among them we first look at variations in the demand for new urban houses, and then investigate how far and in what circumstances changes in the costs of new housing space communicated themselves to the rents of old houses.

While we are interested in the explanation of the secular trends in rent, some of the evidence at our disposal is cyclical. Since we have no reason to think that cyclical interrelations between factors did not obtain over longer periods, we shall draw on analysis of cyclical movements at some points in the chapter.

7.1. Servicing costs of new houses

The running costs of houses are low in comparison to their capital costs, especially in the first few years; their role in determining the rents to be charged is, therefore, generally small. On the other hand, urban houses were built largely out of borrowed money in Germany before the First World War, and it is fair to assume that the servicing costs of the debt incurred on a house played an important role in determining the rent it had to bring. Hence we shall first of all work out how servicing costs varied over the years and compare them with the movements of rent. Servicing costs depend on the capital costs of the house and on the rate

of return that must be earned on them. We shall first take up the discussion of the required rate of return and then go on to capital costs.

7.11. *Financial institutions*

It is difficult to know precisely how much of the building finance¹ was borrowed by the owners; it is likely that the proportion borrowed was generally over 75 per cent.²

The chief sources of finance were mortgage banks, savings banks, and life insurance companies; between them they must have provided 80 to 90 per cent. of the borrowed funds. Mortgage banks were almost the sole source of finance till the 1890s, but then lost ground to savings banks and insurance companies. They might have provided about 40 per cent. of the funds just before the war, savings banks about 25 per cent., and the life insurance companies perhaps 15 to 20 per cent. Banks generally entered the field by buying up mortgage banks and running them as subsidiaries.³

Mortgage banks used little capital of their own; their chief source of finance was the issue of mortgage debentures.⁴ The value of debentures they sold was limited by the amount of mortgage loans they gave; this was their custom till 1900 and was embodied in a law enacted in that year.⁵

The character of security behind different debentures was very similar; most were backed by mortgages on residential buildings, and interest on them was paid out of rents, a stable source of revenue. Hence the capital and income risks were uniformly low and there was not much to choose between debentures in their respect. Owing to their general homogeneity, the elasticity of demand for the debentures of an individual bank was high; consequently, the spread in the yields of different debentures was small. Except in the early seventies, the nominal yields of over 95 per cent. of the issued debentures fell within a range of 0.5 per cent.⁶

The typical rate of interest on newly issued debentures was 4.5 per cent. in the early seventies. It fell to 3.5 per cent. till the 1890s and then rose frequently to 4 per cent. in the years up to the beginning of the war. There were two reasons for this stability. First, the difference between mortgage banks' borrowing and lending rates was very narrow (generally

¹ In this chapter we shall, for brevity, use the term 'building' in the sense of 'residential building'. This usage does not, however, extend to Chapter 8, where 'building' denotes all building excluding railway construction.

² K. Hunscha suggests 75 per cent. as the proportion typically borrowed; R. Eberstadt says it was between 90 and 96 per cent. (K. Hunscha, *Die Dynamik des Baumarckts*, Berlin, 1930, p. 23; R. Eberstadt, *Die Spekulation im neuzeitlichen Städtebau*, Jena, 1907, p. 153).

³ E. Reich, *Der Wohnungsmarkt in Berlin von 1840 bis 1910*, Munich, 1912, p. 15.

⁴ K. Hunscha, *op. cit.*, p. 25.

⁵ H. Kleiner, *Emissions-Statistik in Deutschland*, Stuttgart, 1914, pp. 11 ff. Under this law, a custodian of the interests of debenture holders was appointed, whose signature or seal was necessary for the validity of debentures. He kept a stock of unsigned debentures of the mortgage banks and issued them to the banks as they registered new mortgages with him.

⁶ *Statistisches Jahrbuch für das Deutsche Reich*, 1915, p. 298, Table VIII.11a.

1 per cent., and rarely over 2 per cent.), and increases in the rate of interest on debentures were immediately reflected in the lending rates. If the lending rates rose, the return on new houses had to rise; a rise of 1 per cent. in the lending rate might entail an increase of 10 to 15 per cent. in the rents, assuming that building costs did not change. Hence mortgage banks were reluctant to start issuing debentures with higher yields until they were convinced that the rate of return on new houses was high enough to justify a higher lending rate.¹ Second, the mortgage banks tried to protect their debenture holders against capital losses by stabilizing the debenture prices, and bought up debentures from the market when their prices fell. The resulting stability of prices also entailed the stability of debenture interest rates.²

As a result of their efforts to keep the debenture rates stable, the net borrowings of mortgage banks rose when the market rates were low—i.e. in slumps. This caused anti-cyclical variations in their volume of lending. Further, the volume of demand for loans that mortgage banks could not satisfy and the rates the borrowers were ready to pay rose in booms, and generally whenever interest rates were high.

Like the mortgage banks, savings banks were also keen on maintaining the stability of their borrowing rates—i.e. their deposit rates. They were not allowed to invest in shares, so the rate of return on their investments did not rise in booms. Their deposit rates had to be kept stable, and funds tended to move out of savings-bank deposits in booms and back in slumps. There was thus a tendency towards anti-cyclical variations in the funds available to savings banks for lending. It was, however, weaker than with mortgage banks since the interest paid on deposits was generally left in the accounts.³

The principal channels of investment of savings banks' funds were government securities, municipal loans, and mortgage loans. As we saw above, the number of borrowers left unsatisfied by mortgage banks and their demand price for loans rose during booms. Savings banks could therefore earn higher rates of interest on mortgage loans given in booms and select their recipients more rigorously. Mortgage loans became more attractive as investments in booms; hence the proportion of their funds in such loans rose. Since, however, their investible funds tended to decline in booms, the volume of investment in mortgage loans rose in the years of recovery and then remained comparatively stable.

¹ While there seems to be much agreement among writers on this point, no precise quantitative information is forthcoming. Hunscha believes the general rate of return on houses to have been 7 per cent., and concludes from this that a rise in mortgage banks' lending rates of 1 per cent. would have entailed a rise of 14 per cent. in the rents. A return of 7 per cent. seems, however, to be too low with a lending rate of over 4.5 per cent.; it leaves too small a margin for the amortization of loans.

² H. Kleiner, *op. cit.*, p. 12.

³ K. Hunscha, *op. cit.*, pp. 26–27.

Life insurance companies were also marginal lenders to builders; their resources were much smaller than of mortgage banks and savings banks.¹

That the anti-cyclical variations in the funds of credit institutions did affect building activity is suggested by the volume of residential building shown in Table A.20. Building of non-agricultural dwellings reached peaks in years of depression or recovery—in 1875, 1884, 1892, 1903, and 1910—and although it rose in the last years of booms, its growth during booms was generally small, and accelerated after the end of the boom.

As we said above, the lending rates of mortgage banks were closely related to the rate of interest on their debentures. We have no information about the rates at which savings banks and life insurance companies lent, but we can assume that they were somewhat higher than of mortgage banks, since the share of their institutions in credits given to house-owners tended to go up in booms. Thus, the average rate at which house-owners obtained credit was probably equal to mortgage banks' lending rate in years of easy money, and rose above it when money was tight: it depended partly on the mortgage banks' lending rate, and therefore on the rate they paid on their newly issued debentures (which we shall call their debenture rate), and partly on the general credit conditions. We shall next take a closer look at the course of both.

7.111. The debenture rate and the bond rate

In Figure 4 we have plotted the average debenture rate of all mortgage banks with the average rate of interest on federal and state securities. The corresponding series are given in Table A.19. The similarity in their course is obvious, and the differences are small. They are explained in part by the fact that rates on new issues of mortgage banks generally took discrete values like 3.5 per cent., 4 per cent., etc., while the average bond rate, which was based on the market yields of securities, was subject to no such restrictions. This, for example, is why the debenture rate was above the bond rate from 1898 onwards: when the bond rate rose over 3.5 per cent., mortgage banks changed over to 3.75 and 4 per cent. debentures. When interest rates fell, the debenture rate generally fell faster. This was due to the conversion activity of mortgage banks: they took advantage of the falling rates by buying up their old debentures and selling new ones bearing lower interest.

The general similarity between the debenture rate and the bond rate is not surprising. As was remarked in the previous section, the income and capital risks on mortgage debentures were low. In these respects they

¹ K. Hunscha, *op. cit.*, pp. 27–28.

were comparable with state securities; and owing to the efforts of mortgage banks to stabilize the price of their debentures, the illiquidity risk on them might even have been lower than on securities. In any case, the market made little distinction between the two, and the rate of interest at which mortgage banks could obtain funds from the market was determined by the same forces as the long-term rate of interest. We shall take the latter as

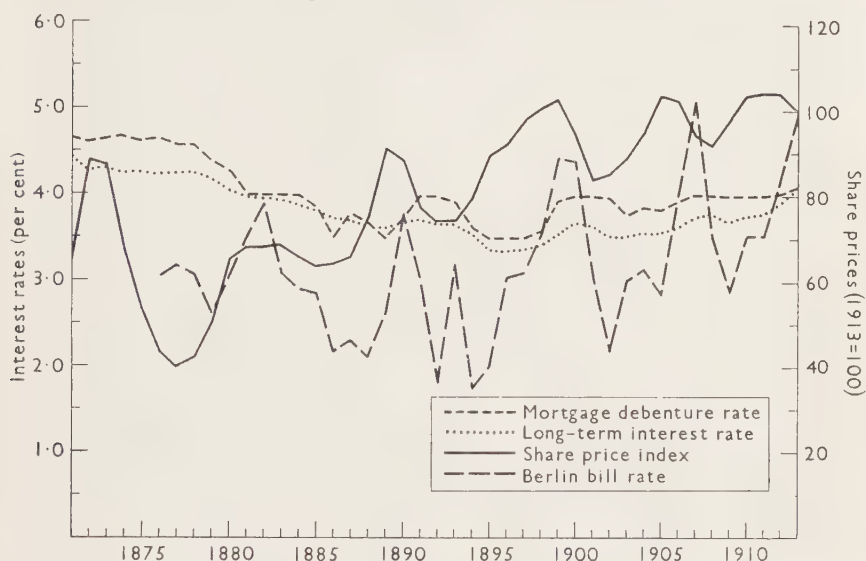


FIG. 4.

representative of the yields of all fixed-interest assets and go on to discuss its determinants.

7.112. *The bond rate and the capital market*

It will be convenient to discuss first the inter-relations in the long-term capital market and to bring in next the relation between the short-term and long-term markets.

The change in the price of a long-term financial asset tends to generate expectations of a further change in the same direction and thus to make itself cumulative. Hence unless the direction of movement of the price changes, it is impossible to say whether extraneous factors were acting on it. For deductions regarding the determinants of the bond rate, therefore, we must look at the points when the direction of movements of prices and yields changed.

The yield on bonds is inversely related to their price, and it is a matter of indifference which we choose for analysis. The dividend rates on nominal values of shares and their market values show a close positive correlation.

In Figure 4 we have also plotted an index of share prices. The underlying series is given in Table A.14.¹

Both share prices and bond yields show cyclical fluctuations; and their relationship undergoes a change four times in a cycle. At the beginning of the recovery, share prices rose while the bond rate fell. In the next phase, the bond rate also began to rise. Then the crisis followed, in which share prices fell while the bond rate continued to rise. When the crisis passed, both fell for some time. All these four phases were, however, present only in the 1892-1901 cycle; one or both phases of rising bond rate were missing in the preceding cycles, and the bond rate failed to fall after the crisis of 1907. Thus, a falling trend up to 1896 and a rising trend after it were superimposed on the cyclical movements of the bond rate.

We might use the issue statistics of financial assets, given in Table A.21, to derive some conclusions regarding the supply of financial assets. The statistics are much more reliable for issues of securities and mortgage debentures than of company assets—shares and debentures.² The latter were disposed through a great number of channels besides being sold through the stock exchange: they were sold privately by companies, exchanged for benefits received, given to banks in settlement of debts, or sold through banks. Hence it was impossible to keep track of their issues.

Of the various assets, the ones whose issues show clear cyclical variation are mortgage debentures and shares—both industrial and banking shares. Share issues reached their peak with the booms, and between booms they tended to follow the trade cycle. It is also interesting that the issue prices of shares were generally far above their normal values. Apparently, companies issued much fewer shares than there was demand for, and made capital profits out of issues. Since demand considerations were so important to the issues, the cyclical variations in issues are probably a sign of such variations in the demand for shares.

Industrial debentures were, it seems, an alternative source of finance to shares: their issues rose when share issues fell, and vice versa. But in the years just preceding the booms both did sometimes rise together. Just after the boom had passed, share issues fell drastically while debenture issues rose; if, however, recovery did not follow soon after, both fell to low levels then.

¹ The share price index has been computed by Donner as follows. The ratio of market price to nominal value of shares was computed and was averaged unweighted from 1870 to 1889, and then weighted by the share capital. The number of companies included was thirteen in 1870 and rose to eighty-eight in 1905 after which it was constant. The firms covered till 1889 were in banking, mortgage lending, railways, coal-mining, and iron-making; from 1890 the index also covered firms in shipping, electricity, public utilities, machines, metals, chemicals, textiles, paper, cement, real estate, glass and porcelain, and brewing. Indices were calculated for periods in which the sample of firms remained constant and linked in adjacent years with an index for firms which were included in both bits.

² A summary and an excellent critique of the available issue statistics are given in H. Kleiner, *op. cit.*

As we have mentioned in the previous section, issues of mortgage debentures followed an anti-cyclical pattern. The remaining major group of financial assets, state and municipal bonds, showed no relation to the cycle. Imperial issues played an important role among state issues; they were dominated by the course of military expenditure. There was a burst of imperial borrowing in 1887-94; and after a short pause, imperial issues rose again in 1899, and continued to be high till 1913. Municipal issues rose sharply in the 1890s with the advent of electric lighting and tramways and the building of municipal gasworks, and were substantial till the beginning of the war.

From this information about the behaviour of prices and the supply of various financial assets, we can infer the behaviour of demand for them. The demand for both shares and bonds increased in the recovery; this was presumably due to the revival of profits, for it was out of these, and in particular out of distributed profits, that the demand for financial assets came. As the recovery proceeded and share prices rose, expectations of their further rise came to be more confidently held, their expected effective yield (including capital gains) rose relatively to that of bonds and other fixed-interest assets.

These boom conditions continued until, somewhere in the economy, the rate of growth of demand fell short of the rate of growth of production, and stocks began to build up. The stock accumulation reduced the cash holdings of firms and forced them to reduce their purchases. Thus, the check to demand became cumulative; some firms faced accumulating stocks while the others feared its possibility. Both tried to increase their cash holdings; more of the profits came to be held in the form of stocks and cash and less were available for the purchase of long-term financial assets. The prices of both fixed-interest assets and shares fell. This continued till a better balance was achieved between production and demand. Then profits became available again for buying long-term financial assets. Until, however, profits and dividends began rising again, the effective yield on shares was low, and the demand went to bonds. As the revival of profits continued, the demand for shares also revived.

With the help of this analysis, two reasons can be inferred for the rise in the interest rates after 1896. First, years of recovery and upswing were more frequent, expectations of rises in share prices were more often and more strongly held, and the proportion of new demand for assets going to fixed-interest assets was smaller. Second, the supply of fixed-interest assets was greater, and especially the supply of public bonds whose supply was inelastic. There was a third reason for which, however, we need to look at the market for short-term credit.

7.113. *The bond rate and the credit market*

As we saw above, the demand for cash holdings rose greatly in the weeks before and after the crisis because firms were accumulating stocks or expecting to have to accumulate them. In these circumstances, they tried to borrow money. The more respectable among them sold short-term bills, and the rate of interest on these bills was an indicator of the shortage of cash. When the shortage of cash could not be met through credits from firms, banks, and individuals with idle balances to firms short of cash, the excess demand for cash was met by the central bank, which purchased bills offered to it, provided they were drawn and endorsed by three persons of known standing.¹ As lender of last resort, it never refused to discount a bill which met this condition; but when there was excess demand for cash it could and did dictate the rate of discount on bills. And the rate it charged was greatly influenced by the state of its gold reserves as a result of the banking legislation.

Cash consisted almost entirely of currency and banknotes. Bank deposits were not common. A giro system was operated by Reichsbank, the central bank, and widely used by businessmen, but there were no overdraft facilities.

The right of issue of banknotes was restricted by the Bank Act of 1875 to thirty-two banks and the Reichsbank, which took over business from the Preussische Bank as the central bank in 1876.² Maxima were laid down for the fiduciary issue of each bank.³ If it exceeded the maximum it had to pay an annual tax of 5 per cent. on the excess. Owing to this penal tax, no private bank would exceed its permitted fiduciary issue. Hence when the demand for cash could no longer be met out of the fiduciary issues of the thirty-two banks, discounting of bills was concentrated on the Reichsbank.⁴ Consequently, it was the Reichsbank whose note issue increased after this point. It discounted bills freely if its own fiduciary issue was not in danger of being exceeded. If it was, however, the Reichsbank raised its discount rate above 5 per cent., the rate of tax on the excess.⁵

¹ K. R. Bopp, 'Die Tätigkeit der Reichsbank von 1876 bis 1914', Part I, *Weltwirtschaftliches Archiv*, vol. 72, 1954, p. 41.

² For details of the Banking Act of 1875, see M. Ströll, 'Deutsche Banken im neunzehnten Jahrhundert bis zur Gegenwart', *Handwörterbuch der Staatswissenschaften*, ed. J. Conrad, etc., 3rd edition, vol. 2, Jena, 1909, pp. 388 ff.

³ For defining this fiduciary issue, reserves were taken to include current German coins, Imperial treasury notes, notes of other banks, gold bars, and foreign coins. Treasury notes (*Reichskassenscheine*) were notes issued by the Imperial government to the States in 1875 to compensate them for the withdrawal of their paper money from circulation. An issue of 184 million marks was made initially, and it declined to 120 million marks in 1890, after which it remained constant. The notes were in denominations of 5, 20, and 50 marks and were used as currency (M. Ströll, *ibid.*).

⁴ This is the situation we described earlier as excess demand for cash.

⁵ There was another limit to the Reichsbank's note issue: that it could not exceed three times the Reichsbank's holdings of current German coin, Imperial treasury notes and gold in

The Reichsbank had no opportunity to influence the bill rate till 1889, for there was no excess demand for cash. In 1871-3, Germany received an indemnity of about 4,500 million marks from France. Much of this was either spent by the governments who got a share in it, or used to repay loans; i.e. found its way to the public.¹ Thus, there was an enormous increase in the cash holdings of the public; and with the decline of prices in the following depression, their real value increased. In this period, the Reichsbank had no assets for open market operations, and could not therefore vary the stock of cash. Hence whether it liked it or not, it had no control on the bill rate.²

In 1889 however, and in every boom thereafter, there was an excess demand for cash, and it coincided with the Reichsbank's exceeding its fiduciary issue. Hence the Reichsbank's discount rate and, with it, the market bill rate, rose above 5 per cent. each time. This was appreciably above the bond rate; owing to the high rate of return it offered on short-term investment, it effectively cut down the demand for bonds and similar assets, and raised the bond rate. Even when the Reichsbank's quota was not being exceeded, it was often in great worry and forced up the bill rate. As a result, the general level of the bill rate was higher after 1895 than it had been in the eighties; and this raised the level of the bond rate too. The Berlin discount rate is given in Table A.19; it will be noticed that after 1888, the times when the discount rate was above the bond rate were also times when the bond rate rose.

In the previous section we found two reasons for the steady fall in the mortgage debenture rate up to 1896 and its rise thereafter. First, whereas the issues of state and municipal securities had been negligible before, they rose greatly in the 1890s and after, partly because of increased military expenditure and partly owing to the advent of new public utilities. Second, fixed-interest assets encountered more competition from shares after 1895 owing to rising profits, dividends, and share prices which attracted funds to shares. To these two we must add a third. For short rates to be low enough not to impinge on the market for long-term assets, it was necessary that the demand for cash from the Reichsbank should be within its fiduciary quota. Since this quota was fixed, the necessary condition was that the Reichsbank's gold reserves should expand rapidly enough to permit the increase in currency circulation required by the economic activity, and that the balance of payments should be favourable enough to permit the gold reserves to expand that rapidly. The balance of payments turned out to be favourable, and the Reichsbank's gold reserves expanded rapidly. This was an absolute limit, and there was no provision about exceeding it (M. Ströll, *ibid.*). However, the Reichsbank was never in danger of exceeding it. (Statistics of the Reichsbank's reserve ratio are given in the *Statistische Jahrbücher für das Deutsche Reich.*)

¹ M. Müller-Jabusch, *op. cit.*, pp. 21-25; A. Soetbeer, *op. cit.*, pp. 7 ff.

² *The Reichsbank 1876-1910*, National Monetary Commission, Washington, 1910, pp. 219 ff.

bank's reserves expanded steadily, but after 1895 it was not favourable enough to meet the needs of currency fully. Hence the Reichsbank drove up short-term interest rates with increasing frequency. This led also to a rise in the level of long-term rates, the mortgage debenture rate among them.

7.12. *Building costs*

In the estimation of building costs we are on hazardous ground: we have to piece together data which are neither comprehensive nor belong together with respect to their sources. However, the fluctuations in building costs were so large that the effect of refinements in data is likely to be small in comparison. We have made estimates of building costs at five-year intervals, for the same years as we have information about rent.

We have a series of building wages in Tables A.1 and A.2. In order to get changes in wage costs we should divide changes in wages by changes in output per head. Estimates of productivity in building show an increase of 20 per cent. between 1891-1900 and 1908-13, of which 11 per cent. was between 1890-9 and 1900-7.¹ In Table 7.1 we have put output per head in 1895 as 100; it was probably somewhat below the 1890-9 level, since the period 1895-9 was a more prosperous one than 1890-5, and productivity probably rose faster after 1895 than in 1890-5. Again, the output per head was, presumably, somewhat higher in 1913 than in 1908-12. We have put it at 30 per cent. above the 1895 level. Productivity increased 8 per cent. between 1901-8 and 1908-13; for simplicity, we have assumed a rise of 10 per cent. of the 1895 level between 1905 and 1910, and attributed another 5 per cent. between 1900 and 1905. We have attributed 10 per cent. to 1895-1900, on the grounds that this being the period of a boom, productivity must have risen faster in it than in the following years which were comparatively depressed.

With the help of the statistics of building activity in Table A.19 and occupation census estimates of building employment (described in Appendix B.31), we have estimated the increase in productivity between 1882 and 1895 at 12 per cent. of the 1895 level. Consequently, we have assumed that there was an increase in productivity of four points every five years between 1880 and 1895. For 1875 we have no information. It is likely that productivity in that year was higher than in 1880; in 1875, the building industry was still fully occupied, while the activity was lower in 1880, unemployment presumably higher, and labour efficiency lower. We have put the output per head in 1875 at 90 per cent. of the 1895 level; but this is much more of a guess than the later figures.

The foregoing description should make it evident how approximate our estimates of wage costs are. There are further elements of doubt

¹ The basis of these estimates is described in Appendix C.

regarding productivity estimates for an industry such as building. Consequently, the figures given in Table 7.1 are not fit for anything but the roughest comparisons.

For costs of materials the data are not comprehensive enough to permit the calculation of national indices. Hence we have used local prices given by Jacobs and Richter—prices of pine wood in Potsdam and of spruce wood in Erfurt (both markets for wood situated near forests), and prices

TABLE 7.1
Wage costs in building, 1875-1913¹

	1875	1880	1885	1890	1895	1900	1905	1910	1913
Wages per head	97.1	85.6	91.2	97.5	100	128.4	161.1	161.8	175.2
Output per head	90	88	92	96	100	110	115	125	130
Wage costs	107.9	97.3	99.1	101.6	100	116.7	140.0	129.4	134.8

of other materials in Berlin. Jacobs and Richter have calculated an index of building material costs, giving the materials weights based on estimates of the value of national consumption. The assumption underlying these weights, that the materials were used in building only, is unjustified; wood found extensive use in railway sleepers and as roof supports in mines,² and lime was used for improvement of agricultural soils. Hence we have reduced the weights of these materials, and correspondingly

TABLE 7.2
Index of costs of building materials, 1875-1913³

	Jacobs-Richter weights	Our weights	1875	1880	1885	1890	1895	1900	1905	1910	1913
Bricks	32	50	205.9	105.8	144.1	144.1	100.0	152.9	144.1	123.5	115.3
Tiles	4	2	145.4	106.0	98.1	112.8	100.0	113.6	105.2	98.2	110.6
Lime	8	5	147.1	111.8	100.0	105.9	100.0	100.0	98.2	102.9	102.9
Cement	6	3	192.2	147.1	137.3	127.5	100.0	98.0	88.2	83.3	107.8
Pine wood	38	30	114.5	165.4	114.5	103.6	100.0	169.1	181.8	178.2	181.8
Spruce wood	12	10	117.9	88.1	71.6	106.0	100.0	135.8	125.4	143.3	149.3
Our index		100	185.1	108.2	121.4	132.2	100.0	151.0	148.8	139.2	137.7
Jacobs-Richter index	100		174.3	109.5	118.9	127.0	100.0	143.2	116.2	124.3	135.1

increased the weight of bricks which were used almost exclusively for building. Ehrke gives the proportion of building expenditure going to

¹ Wages from Tables A.1 and A.2; movements of output per head guessed as described in the text.

² I am indebted to Dr. Franz Grumbach for information on this point.

³ A. Jacobs and H. Richter, *Großhandelspreise in Deutschland von 1792 bis 1932*, Hamburg, 1935, pp. 24, 72-73, and 79.

cement as 2 to 3 per cent.,¹ so we have reduced its weight to 3 per cent. The resulting fixed-weight index of material costs is given in Table 7.2.

As a comparison of our index with that of Jacobs and Richter shows, the change in weights makes a large difference in certain years; hence the arbitrariness of the weights is rather disturbing. On the other hand, both indices share certain broad features. Both of them are very sensitive to the trade cycle; they reach very high levels in years near booms like 1890 and 1900. Both show a large fall in prices between 1875 and 1880, and a large rise in 1895-1900. This suggests that the very approximate nature of weights probably does not obscure the broad features of the price movements. Since the price movements are so large and so sensitive to the trade cycle, it is also likely that our index, though based on local materials, brings out features which were of general significance. The use of fixed weights in the index might lead to an upward bias owing to substitution of cheaper for more expensive materials, especially after 1895 when material costs rose rapidly.² However, it is impossible to form an idea of its magnitude.

TABLE 7.3
*Index of building costs, 1875-1913*³

	Weights	1875	1880	1885	1890	1895	1900	1905	1910	1913
Wage costs	35	107.9	97.3	99.1	101.6	100.0	116.7	140.0	129.4	134.8
Material costs	65	185.1	108.2	121.4	132.2	100.0	151.0	148.8	139.2	137.7
Building costs	100	157.2	104.4	113.2	121.5	100.0	139.0	145.7	135.8	136.7

The index of building costs reflected changes in building activity. In 1890 and 1900, when building activity reached peaks, building costs were considerably higher than five years earlier. Thus when the building industry experienced prosperity, its wage-earners and suppliers of materials shared in it, and building costs went up. The latter, therefore, were much dependent on the rate of increase in building activity.

From the indices of wage costs and material costs, we have calculated an index of total building costs which is shown in Table 7.3.

We might finally mention an assumption which is implicit in our use of this index: that wages, productivity, and material costs moved in the

¹ K. Ehrke, *Die Übererzeugung in der Zementindustrie von 1858 bis 1913*, Jena, 1933, p. 15.

² There were two periods of rapid technical progress in the industry producing bricks and similar materials: ring furnaces were introduced in the manufacture of bricks in 1875-90, and bricks of mortar, which saved on the fuel costs involved in brick manufacture, came to be widely used after 1900. The use of reinforced concrete also began before the war. The effects of these developments are to be seen in the index of brick prices in Table 7.2. Cf. G. Clausing, *Die Übererzeugung in der Ziegelei von 1867 bis 1913*, Jena, 1931; G. Paschke, 'Deutschlands Ziegelpreise der Jahre 1892-1912', *Schriften des Vereins für Sozialpolitik*, vol. 143.I, Munich and Leipzig, 1914, pp. 99-102.

³ The weights have been taken from K. Hunscha, *op. cit.*, p. 51.

same way for residential and for all building. There is no apparent reason to suspect this assumption.

7.13. *Land values*

On land values we have no information worth reproducing. Since the value of land varies enormously with location, we need comprehensive indices of the value of all land being currently built upon; indices that are based on restricted or inappropriate coverage can be extremely misleading. Hence instead of such indices we shall look for a hypothesis about land values which is likely to give the least erroneous results.

The role of land values in the determination of rent was the subject of extensive discussion among German economists before the First World War, and they have left us a number of theories regarding factors influencing them.¹

The real estate business was specialized and was in the hands of companies with large financial resources (*Terraingesellschaften*) which bought land, made it ready for building by laying out the streets, pavements, water supply, etc., divided it into plots and sold them to prospective builders. Since they bought land in huge blocks and sold them in small plots, the view was commonly held that they were monopolists who pushed up land prices.

The characteristics of a monopolist are partly circumstantial—that the demand for his goods is inelastic—and partly behavioural—that he charges prices yielding profits above the competitive level. On the question of circumstances, it was argued that the area of land required to get a monopoly of building land in a town was small; that since people would wish to build on the fringe of the town, all that was required was a thin strip of land all around it.² Two assumptions underlay this argument: that land was bought in thin concentric strips encircling towns, and that people did not settle except on the fringe. Neither of these assumptions was fulfilled; and the real estate companies were not, by mere virtue of their land ownership, in monopoly position.

Evidence of two kinds was brought forward to show that the behaviour of real estate companies was monopolistic. One kind related to the increase in the price of particular pieces of land that these companies brought about—details regarding the difference between their buying and selling price of land. Such evidence is selective, and can be suspected of bias. Besides, it throws little light on the profits of real estate companies. The

¹ For a summary of some of the issues raised, see C. J. Fuchs, 'Wohnungsfrage', *Handwörterbuch der Staatswissenschaften*, ed. J. Conrad, etc., 3rd edition, Jena, 1911, vol. 8, pp. 873–928; also A. Weber, *Boden und Wohnung*, Leipzig, 1908.

² See, for example, K. von Mangoldt, *Die städtische Bodenfrage*, Göttingen, 1908, p. 8; P. Mohr, 'Beiträge zur Frage der Bodenspekulation und ihrer Gewinne', *Schmollers Jahrbuch*, Leipzig, 1907, p. 1083.

cost of development inevitably raises the cost of land by a multiple of its original price. At least a third of it is taken up by streets and unbuilt areas; municipal regulations in some towns required an even higher proportion of it to be left unbuilt.¹ Weber puts the cost of paving and drainage at 75 per cent. of the original price;² this gives an idea of its order of magnitude. Data about the difference between the buying and selling price of land cannot, therefore, show what profits real estate companies made, and what was their general rate of profit.

The second kind of evidence presented concerned profits. It was subject to its own shortcomings. It related only to public companies, and excluded limited partnerships (*Gesellschaften mit beschränkter Haftung*), which did not publish their accounts. Further, there was no way of making reliable estimates of the realizable value of the land the companies still held; and hence there was no way of assessing the profits of companies still in business. Published accounts were generally grossly misleading in this respect; companies normally undervalued their land and understated their profits, although the reverse could also happen to companies which had been unlucky in their purchases. The only reliable evidence was that concerning companies that had already wound up.

Ballod collected such evidence regarding forty real estate companies.³ The sample was first used by Weber to show on the basis of the dividends they had paid that they had made pitiful profits and that their shareholders' expectations had been disappointed,⁴ and Ballod used it to rebut Weber's argument. He showed that owing to the uncertainty of their realized profits, real estate companies distributed little, and paid a higher proportion as profits on liquidation. If these profits were considered together with dividends, the average rate of profits on shareholders' capital was 5 to 6 per cent. This did not however include profits made by the organizers and managers of companies who used them for personal benefit—e.g. by selling their own land to the company at a profit or buying cheap land from it.

Thus, the rate of return on investment in real estate companies was not any higher than was common on shares and debentures of industrial companies. The claim that real estate companies made abnormal profits remained unsubstantiated.

Another widely held belief was that land prices were forced up by speculators.⁵ The same kind of evidence as in the monopoly question was put forward for this view, and evidence of very high profits, in so far as it is

¹ C. J. Fuchs, op. cit., p. 893.

² A. Weber, op. cit., pp. 61–62.

³ C. Ballod, 'Zur Frage nach den Gewinnen der Terraingesellschaften', *Schmollers Jahrbuch*, 1908, pp. 941 ff.

⁴ A. Weber, *Über Bodensrente und Bodenspekulation in der modernen Stadt*, Leipzig, 1904.

⁵ This view was held, for example, by R. Eberstadt, and put forward in many publications: among them, *Die Spekulation im neuzeitlichen Städtebau*, Jena, 1907, and *Handbuch des Wohnungswesens und der Wohnungsfrage*, 3rd edition, Jena, 1917.

available, fits this view better than the monopoly hypothesis—it relates generally to pieces of land in a favourable location which were cornered by shrewd or lucky people.

It is clear that the speculative demand can contribute to rising prices. Speculative demand can however persist only in the presence of confidently held expectations of a price rise and must collapse if the price rise comes to a halt for some length of time. Since land was used for building houses which brought a return, every increase in the price of land entailed a rise in the rent which would bring a particular rate of return on the cost of the building. The rents were, however, not free to rise beyond limit. As a proportion of income, they show a fall. In inquiries made in Berlin, Hamburg, Breslau, Leipzig, and Dresden between 1874 and 1882, the proportion of incomes of people earning between 600 and 1,200 marks a year paid in rent was between 18.4 and 24.7 per cent. The proportion for the same income group in the 1907 budget inquiry was 17 per cent.¹ Thus, working-class rents were rising less rapidly than incomes; and whether speculation pushed land prices and rents up or not, it did not raise rents faster than incomes.

It is possible that within these limits, speculation raised land prices and hence rents. If it did, its contribution to the rise in rents would be greatest when the demand for land was rising most rapidly and when building activity was also high—i.e. at trade cycle peaks. As we have seen, the index of building costs also tended to rise at the peaks of cycles. Hence we should expect that total costs of building, including the cost of land, would show variations similar to those of the index of building costs; if the cyclical variations in land prices were more extreme than in building costs, variations in total costs would also be greater than the variations in building costs, and vice versa. The direction of movements in total costs would be the same as in building costs, but the magnitude would be modified by variations in land values.

Finally, there was the hypothesis that land values were determined by the rate of return the houses built on them brought; that they were in the nature of scarcity rents, and could not themselves influence house rents.² Under this hypothesis, land values would depend on building costs and expected rents, and would rise when the ratio of expected rents to building costs rose and vice versa.

For this hypothesis, rents mean rents in any use, and not merely residential

¹ The 1907 budget inquiry is described in Chapter 1, section 3.21 above, and the expenditure pattern shown by it is given in Table A.10. The figures for 1874–82 are taken from M. Neefe, 'Hauptergebnisse der Wohnungstatistik deutscher Großstädte', *Schriften des Vereins für Sozialpolitik*, vol. 30, Leipzig, 1886, p. 196, Table 39.

² Such views were held, among others, by Horacek and Paul Schwarz, both of whom did empirical work on land values. See E. Horacek, 'Die Bodenwertbewegung in Prag und Vororten', pp. 3 ff., and P. Schwarz, 'Die Entwicklung der städtischen Grundrente in Wien', p. 39, both in *Schriften des Vereins für Sozialpolitik*, vol. 94.I, Leipzig, 1901.

rents. In the case of industrial building, rents were the part of profits attributed to the building. Hence expected rents varied with expected profits; they went up in booms and declined in slumps. For industrial building, therefore, the scarcity rent hypothesis leads us to the same conclusions regarding the behaviour of land values as the speculation hypothesis.

In the case of residential building, the conclusion that the scarcity rent hypothesis yields is less clear. On the one hand, the rate of growth of industrial employment and incomes was higher in booms, and so therefore was the rate of growth of demand for dwellings. On the other hand, residential rents rose less than building costs in booms, and the ratio of rents to building costs went down. Land values would therefore rise or decline in booms according as the first or the second of these influences dominated. We are inclined to believe that the first influence dominated for the following reason. Every boom brought about an increase in the demand for urban housing which could be viewed as more or less permanent. At the levels of rent and building costs in the boom, it was unprofitable to build dwellings; besides, it was difficult to borrow money for houses (section 7.11); but it could be expected that when the boom subsided, the consequent fall in building costs would make residential building remunerative, while the demand for it would persist. Hence the expected ratio of rents to building costs which was relevant to buying land in a boom was the one that would prevail after it; this post-boom ratio improved during the boom and raised the demand for land for residential building. Hence we think land prices would show cyclical rather than anti-cyclical variations; and this is the view we shall adopt in the next section. But we must emphasize that we have no direct empirical evidence to support our hypothesis; nor can we say whether the speculation hypothesis or the scarcity rent hypothesis agreed better with facts. Both lead to the same conclusion in our particular case—that land values, in common with material costs and building costs, would show cyclical variations.

7.14. Initial servicing charges

In Table 7.4 we give an index of the costs of interest and repayment in the first year on the debt incurred for a house built entirely out of borrowed funds in the years for which we have earlier given estimates of residential rent (Table A.9) and building costs (Table 7.3).

The index is based on the following assumptions:

- (1) The rate of interest on the debt was 1 per cent. higher than the current rate on newly issued debentures of mortgage banks.
- (2) The loan was to be repaid in equal annual instalments in twenty-five years.
- (3) Land values varied in proportion to building costs.

The index falls sharply in 1875–80 and rises again by over 50 per cent.

in 1895-1900. It also shows a tendency to rise in booms and fall in slumps which was evident in the building costs. We shall now see how far these features are likely to be modified by the removal of the assumptions made above.

TABLE 7.4
Index of initial servicing charges, 1875-1913¹

	1875	1880	1885	1890	1895	1900	1905	1910	1913
Interest (per cent)	5.5	5	5	4.5	4.5	5.5	5.5	5.5	5.5
Repayment (per cent)	4	4	4	4	4	4	4	4	4
Total servicing (per cent)	9.5	9	9	8.5	8.5	9.5	9.5	9.5	9.5
Capital costs	157.2	104.4	113.2	121.5	100.0	139.0	145.7	135.8	136.7
Index of servicing charges	175.7	110.5	119.9	121.5	100.0	155.4	162.8	151.8	152.8

It was said in section 7.11 that the rate of interest on loans of mortgage banks stood in a close relation to their debenture rate, but that the average rate of interest on money lent to residential builders by all financial institutions was probably near to the mortgage banks' debenture rate in years of easy credit and rose above it in booms. Hence the rate of interest probably showed larger cyclical fluctuations than we have allowed.

We have tried out alternative rates of loan repayment between 2 and 4 per cent. The variation changes the magnitude of the changes in servicing charges; the lower the rate of repayment, the more extreme are the variations in servicing charges. The direction of the variations is not, however, affected.

We have argued in section 7.13 that the direction of variation in land values was probably the same as in building costs, though nothing could be said about its magnitude.

Thus, none of the conclusions we have drawn from the index in Table 7.4 would be affected by the removal of the assumptions. The index only refers to servicing charges in the first year; but with a constant rate of repayment, the servicing charges in any subsequent year will bear a constant relation to the charges in the first year, and the conclusions based on the index apply to all years.²

From a comparison of the servicing charges in Table 7.4 with rents in Table A.8, it appears that rents were also sensitive to the trade cycle, but

¹ Interest is based on the rate of interest on newly issued debentures, given in Table A.20. Index of capital costs is taken from Table 7.4.

² Assuming a debt equal to a , a rate of interest equal to r (i.e. 100 r per cent. per annum) and annual repayment equal to d , the sum owing in the year t will be equal to $a(1-dt)$, and the

that they did not rise quite as much as servicing charges. Second, the large fall in servicing charges between 1875 and 1880 is hardly reflected in the rent index. Third, the rise in servicing charges between 1895 and 1900, which was not reversed in the following years, corresponds to a much slower rise in rents which went on right up to 1913. Thus, the relation between the servicing costs of new houses and rents, if it does exist, is greatly disturbed by other factors.

Owing to the high proportion of the finance for new houses that was borrowed, it is highly unlikely that the variations in servicing charges did not influence the rents of new houses. Since, however, new houses were always a small proportion of the stock of dwellings, the effect of changes in servicing charges on rents in general depended on how far the changes in rents on new houses communicated themselves to old houses—on the competition between old and new houses. Further, it is possible that the rents of new houses might rise more or fall less than servicing charges in conditions of excess demand for housing space. We shall investigate these possibilities and suggest explanations for the discrepancies between the course of rents and servicing charges on their basis.

7.2. *Demand for housing*

As a first approximation, it might be assumed that the demand for houses depended on the number of people resident in towns. It is difficult to measure the growth of urban population from the available statistics since they classify towns by their population, and figures of population growth of towns are vitiated by some of them jumping from one size class to the next owing to the rise in their population. We have however found a way of circumventing this difficulty to some extent, by grouping together towns which passed the 100,000 limit in the same decade. We shall call the census year following the decade in which a particular group of towns passed the 100,000 limit their x -year.

Table 7.5 brings out the steady acceleration in the growth of towns throughout the period: in each decade, towns grew faster than in the preceding one. The only exception is the largest cities between 1871–80 and 1880–90. Incidentally, the table also illustrates the error involved in assessing the growth of towns from a fixed sample of them: since their growth tends to slow down as their size increases, a fixed sample will underestimate the actual growth in urban population.¹

servicing charges will be $d + ar(1 - dt)$, Thus, they will decline each year by the constant amount adr .

¹ For this reason, Hunscha's figures of movement of population into and out of towns (op. cit., p. 59, Table 1) give a misleading impression of their trend: the slackening of net immigration after 1900 applies to the twelve towns selected by him, but not to towns in general. The same applies to Reich's statistics of migration into Berlin (E. Reich, op. cit., pp. 124–5, Table 1); the usefulness of her statistics is further impaired by the exclusion of the growing suburbs of Berlin which lay outside its municipal limits.

It might be argued that the demand for dwellings depends not on the growth of population, but on the net increase in the number of families. The average annual rate of net natural increase in the number of families in forty-two Prussian towns was 3.6 per mille in the 1881-9 trade cycle, 4.3 in 1890-9, 4.5 in 1900-7, and 4.2 in 1908-13. These figures are subject to the downward bias of a fixed sample mentioned above; nevertheless, they confirm that the demand for houses grew at an increasing rate.¹

TABLE 7.5

Decennial increase in the population of towns, 1871-1910² (per cent.)

	1871- 1880	1880- 1890	1890- 1900	1900- 1910
Increase in the first decade following the <i>x</i> -year	33	21	37	66
Increase in the last decade preceding the <i>x</i> -year	37	44	72	105
Increase in the last decade but one preceding the <i>x</i> -year	27	43	53	
Increase in the last decade but two preceding the <i>x</i> -year	29	39		
Increase in all 41 towns with population in 1910 over 100,000	32	40	36	36

Did the accelerated growth of demand evoke a matching increase in supply? A comparison of the demand and supply is made in Table 7.6. As an indicator of demand we have taken the growth of population in the forty-one towns covered in Table 7.5; for supply we have taken the volume of non-agricultural residential building.

The figures of the growth of population, being for a fixed number of towns, underestimate the growth of urban population; and non-agricultural residential building does not quite coincide with new urban housing space. But both sets of figures are probably sufficiently representative and comparable to justify decennial comparisons.

The table strongly suggests that the observable discrepancies between rents and servicing costs did not arise from demand conditions. In 1875-80, rents failed to fall with servicing costs; one would expect this if there was excess demand for houses. In the 1870s however, there was far more building in proportion to the increase in urban population, and the pressure of demand for dwellings can hardly have increased. In fact, as the annual series in Table A.21 shows, building activity in the seventies was so great

¹ K. Hunscha, op. cit., p. 59, Table 1. The figures refer to the net natural increase, i.e. the difference between marriages and dissolutions of marriage through death of one party or divorce. They do not include the increase in the number of families through immigration.

² Adapted from S. Schott, *Die großstädtischen Agglomerationen des Deutschen Reichs, 1871-1910*, Breslau, 1912, p. 39. He has used official census statistics obtained mainly from statistical offices of various cities.

that it discouraged building in the eighties, right up to 1887. These years are more likely to have been characterized by excess supply rather than excess demand for housing.

TABLE 7.6

Decennial growth of population of forty-one towns and volume of residential building, 1871-1910¹ (1890-1900 = 100)

	1871- 1880	1880- 1890	1890- 1900	1900- 1910
Increases in urban population	46	79	100	136
Volume of residential building	56	59	100	141

Similarly, the failure of the rise in servicing costs in 1895-1900 to have much impact on rents was possible in conditions of excess supply. However, population can hardly have increased much less rapidly than residential buildings between 1890-1900 and 1900-10. Building activity was much greater in the nineties than the eighties, but as we saw above, this was due to the after-effects of the building boom of the seventies which kept down building activity in the eighties. Thus, the demand conditions do not take us any further in the explanation of rent movements over long periods.

This should not be taken to mean that demand had no role to play in the determination of rents. The rent index in Table A.9 shows the largest increases in 1885-90, 1895-1900 and 1905-10, all periods containing booms. Hunscha has also brought out the connexion between cyclical variations in demand for housing space and corresponding variations in rents in Hamburg.² Nevertheless, rents rose less than building costs and servicing costs in booms; and if there were secular changes in the latter such as we have discovered, their influence on rents was contingent on other factors besides demand variations.

7.3. Competition between old and new houses and the influence of transport

Table 7.5 brings out another interesting fact: that towns of each particular size grew faster after 1890 than before. Let us, for example, compare the growth of towns in the decade in which they passed the 100,000 mark with their growth in the following decade. The increase in population

¹ The increases in population have been estimated from the last line of Table 7.5, by expressing the population of the 41 towns in each census year as a proportion of the 1890 population, deriving the increases in population in each year as proportions of the 1890 population from it, and expressing them as proportions of the increase in 1890-1900. Decennial volumes of residential building have been derived by adding up figures of annual volume of residential non-agricultural building in Table A.19 for ten-year periods 1871-80, 1881-90, 1891-1900, and 1901-10, and expressing them all as proportions of the volume of building in 1891-1900.

² K. Hunscha, *op. cit.*, p. 19.

fell from 37 to 21 per cent. between 1871-80 and 1880-90, from 44 to 37 per cent. between 1880-90 and 1890-1900, and from 72 to 66 per cent. between 1890-1900 and 1900-10. In other words, the slow-down in growth after passing the 100,000 mark became milder after 1890. It can be shown by similar comparisons that the acceleration in growth in the decade in which the mark was passed increased. Thus, towns were growing faster; the obstacles to their expansion were weakening.

Two sets of obstacles to their expansion suggest themselves. One of them has been encountered in the previous chapter (section 6.23): we discussed there the expansion of the region supplying a town with meat as the town grew, and the consequent increase in the transport input per unit of meat consumed. Such an increase in the transport input could also occur in the case of other products of agriculture; and if sufficiently widespread, it could raise the cost of living in larger towns relatively to smaller ones, reduce real wages there and redistribute labour more equally between towns.

It is very unlikely that this was the obstacle that weakened. For agricultural products were transported to towns largely by means of ships, river barges, and railways, and none of these means of transport showed any striking extension or improvement after 1890.

The other impediment was the growing inconvenience of internal transport. Given the means of transport, the distance people can conveniently travel is limited by the time and the cost that travel involves; and a town cannot expand beyond limits in which people can travel in their daily business without unbearable inconvenience. The limit is twofold: people cannot give more than a certain proportion of their time to travel, and they can spend a limited amount on transport. And as a town grew, the average length of journeys to be made by inhabitants increased, and so did the frequency of longer journeys. By and large, people's work-places, dwellings, and the shops where they bought their requirements, grew up near to each other in large as well as in small towns. But in all towns there would be accidents of location which put a greater than average distance between the places of work and residence of some people; e.g. when a factory grew beyond the size at which its workers found residence in its immediate neighbourhood, some of the workers might have to travel far to work. Such accidents of location, which increased the frequency of longer journeys, were more common in larger than in smaller cities.

Both the limits set by internal transport were widened by the electric tramway. Electric trams came to carry almost all the suburban passengers in German towns in a space of twenty years. In 1890 there were 35 electric trams as against 4,044 horse-drawn ones and 141 steam trams; the proportion of car-kilometres run by them could not have exceeded 3 per cent. In 1912 they ran more than 650 million car-kilometres as against

60,000 run by horse trams. Motor buses and suburban trains were coming into their own by the beginning of the war, but electric trams were the mainstay of suburban transport.¹

It is impossible to tell how important a factor the reduction in travelling time brought about by electric trams was. The importance of their cost reduction is, however, plain. While the cost of living rose about 15 per cent. between 1901 and 1911, the fare collected per passenger in 89 towns with electric trams fell from 10·1 pfennigs to 9·7.² The reduction is even more striking for towns where we know of a change-over from horse-drawn to electric trams.

TABLE 7.7

Reduction in fares in cities which introduced electric trams, 1900-12³

	<i>Bonn</i>	<i>Cologne</i>	<i>Mainz</i>	<i>Metz</i>	<i>Potsdam</i>	<i>Würzburg</i>
Fare per journey (pf.)						
1900	12·1	10·1	10·1	14·3	10·6	9·9
1912	9·9	8·9	9·7	11·1	9·9	8·8
Reduction (per cent.)	18	12	4	22	7	11

These six cities operated exclusively horse-drawn trams in 1900 and began operating electric ones between 1900 and 1902. The variation in reductions is rather large, but four of the six cities show reductions over 10 per cent. These are reductions in the fare per journey. In so far as the length of the average journey increased, the reductions in fares per kilometre must have been even larger.

The reduced cost and increased ease of movement within towns that electric trams brought cannot but have affected the conditions of competition between old and new houses. On the average, old houses were situated in more favourable locations—nearer to the market-places, work-places, transport facilities, etc., and for this advantage in location they earned a differential rent. Rents, and servicing costs, of new houses can affect rents of old houses if the latter are very different from the rents of new houses plus the rents of differential advantage. The latter are not definite, and owing to the length of tenancies, rents of houses change only slowly; hence rents of old and new houses have to be substantially out of line for rents of old houses to change.

¹ *Statistisches Jahrbuch deutscher Städte*, Breslau, vol. 3, 1893, p. 118; vol. 20, 1914, p. 245. Horse-buses had been important in Berlin and remained so till after 1900; it was, however, the only city where they persisted so long. See *Statistisches Jahrbuch deutscher Städte*, vol. 8, 1900, p. 95.

² *Statistisches Jahrbuch deutscher Städte*, vol. 12, 1904, p. 130; vol. 20, 1914, pp. 245-6. The towns are eighty-nine out of the ninety-four whose population exceeded 50,000 in 1910.

³ Calculated from *idem*, vol. 11, 1903, pp. 214-17; vol. 21, 1915, pp. 186-9.

The explanation of the failure of rents to fall in 1875-80 is probably that owing to the inadequate means of transport, the limits of expansion had been reached in many towns, and the differential advantage of old houses was large; further, the newer a building, the less favourable its location, and the higher the differential rent of old houses over it. Hence the building of houses with substantially lower servicing charges had little effect on rents of old houses, and since new houses were a small proportion of the stock of houses, the index of all residential rents also showed little impact of lower servicing costs.

With the advent of the electric tram however, the differential advantage of old houses crumbled, and their rents became more responsive to rents of new houses. This came about only gradually as trams spread. So the increase in servicing costs in the last years of the nineteenth century continued to affect the average rents right till the beginning of the war.

7.4. Conclusion

As will be evident from the previous section, the market for housing services is extremely imperfect, rents are subject to great variations based on location and the competition between houses is strongly influenced by the transport facilities available. Rents tended to move in step with servicing costs on debts incurred in building houses; but the connexion between the two depended closely on the suburban transport facilities, whose improvement increased the substitutability between houses in different locations.

The servicing charges were largely determined by the ruling interest rates and by building costs. The dependence of interest rates on institutional arrangements was heavy: on the monetary legislation, which linked short rates to the rate of importation of gold, and hence to the state of the balance of payments; on the habits and usages whereby self-financing of investment was unknown among the house-owners, federal and state governments, and local authorities, and which ensured that residential building activity, public investment, and military expenditures were financed to a large extent out of public borrowings, and on the reliance of public borrowers and mortgage banks on fixed-interest securities. Within this frame of institutions, interest rates rose after 1895 because the growth of new public utilities and military expenditure increased the supply of fixed-interest securities while higher dividends and improved prospects of capital gains on shares shifted demand from fixed-interest assets to them. With their rise went an increase in the cost of finance to house builders. At the same time, building costs rose because the rate of growth of building rose. Thus, the rise in the cost of new housing space could be attributed to the investment boom in this period, which raised the rate of growth of demand for buildings and the rate of return new residential buildings had

to earn. The increase in the cost of housing services communicated itself to the rents of old houses gradually as electric trams increased the competition between them and new houses. The stability of rents before 1895 is explained by the lack of competition between them.

8

The Explanation

WE can now proceed to combine the arguments in Chapters 5, 6, and 7 into an explanation of the slow-down in the rise of real wages around the turn of the century.

8.1. *The mechanism determining real wages*

It was shown in Chapter 5 that money wages responded to increases in the cost of living and to the growth of employment in expanding industries. Cost-of-living increases caused wage demands that were granted more readily in industries where the productivity of labour was rising and labour costs were falling relatively rapidly. The efforts of expanding industries to attract labour led them to raise wages. Wage increases thus brought about were diffused over other industries by leap-frog activity. There was general uniformity in the rates of wage increase in different industries.

As a result of this uniformity of wage changes, variations in the profits of different industries were highly correlated with variations in the value of output per worker. Thus, profits rose most rapidly in industries where either the physical output per worker or product prices rose fastest.

Product prices rose where supply at the current price could not keep pace with the increase in demand. A distinction might be made here between consumer goods and materials on one hand and capital goods on the other. The demand for consumer goods depended on consumers' incomes and hence on the value of total output. The demand for materials depended on the demand for the final goods they helped to produce. If they were used in the production of consumer goods, their demand would depend on the value of total output; if they helped to produce investment goods, their demand would depend on the rate of investment. Hence increases in the prices of both consumer goods and materials could be traced to boom conditions brought about by spurts in investment.

Increases in investment were highly correlated with increases in productivity. While we have no usable direct estimates of investment, output increases over periods as long as a cycle must require investment, and Table 5.1 shows high correlation between changes in output and in output per head between both cycles III and IV and cycles IV and V.

Thus, while investment booms tended to create inflationary conditions and raise profits all round, the impetus to greater investment itself came

from a rise in profits in industries where a rise in output per worker was reducing wage costs. Labour-saving innovations were responsible for increases in profits which then started profit-investment feedback processes.

Industries which expanded in these booms increased their labour force, and if they found it difficult to attract enough labour they raised wages. This was the first force tending to raise real wages, and its effect depended on the pace of industrial expansion on the one hand and the growth in the labour force on the other.

The increase in employment and wages resulting from the expansion of industries led to larger incomes and increased demand for consumer goods. The increase in demand led to a rise in the output of consumer goods; and where the necessary increase in output was not forthcoming at current prices, prices rose to provide the funds as well as the profit incentive for faster expansion of output. The rise in prices was reflected in the cost of living and led to wage demands for the maintenance of real wages. This was the second influence on real wages; its strength depended on the growth in the demand for consumer goods on the one hand and the opportunities for innovation and expansion in their production on the other. Both influences spread throughout the economy through competitive increases in wages.

Let us now see how these influences operated in the German economy.

8.2. *Events before 1890*

It was noted at the beginning of Chapter 4 that according to the available evidence, industrial real wages rose rapidly in the 1871-3 boom, fell till about 1880, rose rapidly in the 1880s and less rapidly in the 1890s. The cost of living rose rapidly in 1871-3, then fell till 1879 and was fairly stable for the following twenty years. So the movements in the real wages were associated with similar movements in the cost of living and in money wages.

The sample of industries for which we have wage data in the 1870s and 1880s is so small that we should look for explanations of wage movements that are specific to them. The 1873 boom was essentially one in railway construction, and the following slump was due to its cessation. It is therefore to be expected that the impact of the cycle would be felt most by wages in the capital goods industries, four of which are represented in our sample. The increase in real wages in the 1873 boom might be explained partly by the high rates of growth of employment that necessitated rapid wage increases and partly by increases in productivity which made them possible. Conversely, the wage reductions after 1873 were occasioned by declines in productivity and profits and pushed through with the help of reductions in employment.

The rate of increase in real wages in the 1880s was much higher in the four capital goods industries than in textiles or printing (Table A.14). Further, Table 5.4 shows that iron and coal were among the few goods whose relative prices rose between cycles II and III. So it is likely that the acceleration of investment described in section 8.3 began in the 1880s and that the increases in employment, output, and productivity it brought about led to rapid wage increases in the capital goods industries. Later, when the investment boom gathered momentum in the 1890s and after, the problem of attracting or competing away labour presumably became less acute with expanding labour supply and better training arrangements in capital goods industries, while uses of profits other than the raising of wages—primarily reinvestment—became more important.

8.3. *Developments after 1890*

There were two industries whose development owed most to their own technical progress and least to derived demand—electricals and chemicals. In view of our treatment of technical progress as an autonomous factor they may be considered the industries that led the economic expansion after 1890.

The technical development of the electrical industry has a long history; the innovations which were important to the boom in the 1890s were those relating to the long-distance transmission of electricity and its application to traction. Their effect was to make electric trams an economic proposition. Once trams became profitable, the equipment for the generation of electricity and its distribution in the towns was also useful for public and private lighting. Hence there was a rapid increase in the demand for equipment. The solution of problems connected with electrical traction also led to the discovery of other uses of electricity. Thus, the nineties also saw the development of lifts, electric cranes, and coal conveyors.¹

Along with the extension of uses of electric motors, their mass production became possible. This resulted in appreciable increases in productivity. For example, the output of the motor-producing factory of the Allgemeine Elektrizitäts-Gesellschaft increased from 20,000 HP in 1893–4 to 270,000 HP in 1900–1, while the employment rose from 2,000 to 17,000 in about the same period.² Similar examples can be cited for the principal companies in the field.

It is obvious from the balance sheets of these companies that their business was extremely profitable. The open reserves of the AEG were

¹ See E. Kreller, *Die Entwicklung der deutschen elektrotechnischen Industrie und ihre Aussichten auf dem Weltmarkte*, Leipzig, 1903, pp. 6 ff.; also J. Loewe, 'Die elektrotechnische Industrie', *Schriften des Vereins für Sozialpolitik*, vol. 107.IV, pp. 81 ff.

² E. Kreller, *op. cit.*, p. 14.

28.5 million marks in 1899 against an issued capital of 60 million marks; Siemens were equally well provided.¹ The high profits led to an abundance of investible funds, and the companies were on the lookout for investment opportunities. The richest field of opportunities was urban electricity works and tram companies. A number of ways of financing them, varying from building electricity works and selling them at a profit when they got going to buying up horse-tram companies through financial intermediaries, introducing electric trams and then reselling the shares at a profit, were developed; they enabled the profits made in the manufacture of electrical equipment to be used for financing electricity works and trams.²

The development of the electrical industry had far-reaching effects. It directly encouraged the production of iron and steel, copper, lead, and other metals. Electricity generation increased the consumption of coal; and electric tramways led to the expansion of wagon-building. Further, trams facilitated the expansion of towns and encouraged urban building.

The technical development of chemicals was as versatile as of electricals, and their uses even more versatile. Germany had established a lead in the production of coal-tar dyes by the 1880s. The following two decades saw a consolidation of this lead and development of synthetic indigo. The latter was introduced in the market in 1897; its price was so much lower than that of natural indigo that by 1906 Germany produced 80 per cent. of the world's indigo and exported three-quarters of its output valued at 28.5 million marks.³ Indigo was not the only chemical in which Germany had an overwhelming lead. By 1910 Germany was producing 85 per cent. of the world's output of coal-tar dyes, and had a virtual monopoly in the world market for potassium products.

Apart from coal-tar dyes, the output of inorganic chemicals increased rapidly. The chief among them were superphosphate and ammonium sulphate fertilizers. Between 1890 and 1911, the output of superphosphate tripled and that of ammonium sulphate increased fivefold (Table 6.7). Inorganic chemicals found further uses in the manufacture of glass, soap, bleaching materials, explosives, etc. In contrast to electricals, chemicals did not help other industries so much by creating demand for their products; rather, they contributed to the improvement of techniques in a number of industries, and increased the scope for their expansion by raising exports and thus widening the payments bottleneck.

As was noted above, the industries which benefited from the growth of electricals were primarily capital goods industries—metals, machines, mining, and building. Their expansion was favoured by two other factors. First, some of them experienced very rapid technical progress. Between

¹ E. Kreller, *op. cit.*, pp. 15, 21–22.

² J. Loewe, *op. cit.*, pp. 119 ff.

³ F. Redlich, *Die volkswirtschaftliche Bedeutung der deutschen Teerfarben-Industrie*, Leipzig and Munich, 1914, pp. 50 ff.

1892 and 1911, output per head increased by 80 per cent. in lignite mining, 98 per cent. in iron-ore mining, 61 per cent. in pig-iron production, and 63 per cent. in the production of steel goods.¹ This led to an accumulation of profits and investible funds in those industries, and they grew rapidly. Second, their expansion generated much demand for one another's products. Some of them were highly mechanized, so their expansion created demand for machines; the expansion of the machine industry in turn created demand for iron, steel, coal, and building materials.

The high level of demand made reinvestment of profits attractive, and led to a rapid growth in the output and the labour force of capital goods industries. Labour supply was also abundant at the time. In the 1880s the supply of labour was growing faster than demand, and there was substantial emigration till 1892 (section 5.1). The increase in labour supply was even more rapid in the 1890s as a result of the high birth rates of the 1870s, when the thirty-year cycle of high birth rates caused by the Napoleonic wars coincided with the boom in births that followed the Austro-Prussian and Franco-Prussian wars. As a result the growth of working population accelerated in the 1890s, and the acceleration continued into the first years of the century owing to a progressive fall in death rates.² Hence there were no general labour shortages in spite of an accelerated rate of growth of employment, and the increase in real wages that accompanied the increase in employment was small. Between 1895 and 1907, workers' average earnings in mining, metal, and machine industries rose 33 per cent. while the cost of living rose 21 per cent.³ The rise in employment in capital goods was 65 per cent. in the same period.⁴

The slowness of the increase in real wages affected the pattern of demand in two ways. On the one hand, profit margins and rates of profit in capital goods industries rose. Since a high proportion of profits was reinvested, investment accelerated, and both the demand and the output of capital goods grew faster.

Second, relatively more of the increase in the demand for consumer goods went to basic goods like food, housing, fuel, and light; the diversification of demand for consumer goods was inhibited. The effect of the increase in demand on the prices and production of the major consumer goods—cereals, meat, and housing services—has been analysed in

¹ Calculated from *Statistisches Jahrbuch für das Deutsche Reich*, 1913, pp. 80-85, Tables V.7 to V.14.

² See A. Lösch, *Bevölkerungswellen und Wechsellagen*, Jena, 1936, pp. 9 ff.; also G. Mackenroth, *Bevölkerungslehre*, Berlin, Göttingen, and Heidelberg, 1953, pp. 57 ff., and *Statistik des Deutschen Reichs*, vol. 495.I, p. 14.

³ Calculated from Tables A.2 and A.8.

⁴ Calculated from W. Böhmert, 'Wandlungen der deutschen Wirtschaft 1882-1907', *Der Arbeiterfreund*, 1910, pp. 136-7. Labourers only, in mining, quarrying, porcelain, glass, metals, machines, and chemicals. There is a slight discrepancy of coverage between the figures of employment and earnings.

Chapters 6 and 7. They were seen to fall between two extreme types in their price formation. The price of one type was determined in the international market with little influence from Germany. Cereals and coffee came closest to this type, and sugar and textiles must have been quite near to it since they were fairly standardized homogeneous goods and a substantial proportion of their output was exported. The home output of these goods was determined by the home costs of production and the international price as modified by tariffs, and the changes in home demand were reflected in their net imports and exports. The second type of commodity was one whose price was determined internally. The price was influenced on the supply side by the changes in wages and material prices and the rate of technical progress, and on the demand side by the level of demand and its expected rate of growth. Coal and gas were the most representative of the second type among consumer goods; and the provision of housing services, for all its complexity, conformed to this type—a rise in the rate of growth of demand led to a rise in rents so as to make a higher rate of investment in building attractive (section 7.4). Meat fell between the two types, being dependent on international markets through its competition with cereals for land and also being sensitive to changes in actual and expected demand (section 6.23).

The demand for both types of goods—international demand in the case of the first type, domestic demand in the case of the second—grew more rapidly than supply, their prices rose and the rise of real wages lagged behind that in money wages. As Table 5.1 shows, the rise in wages between cycles III and IV was mainly under the influence of increases in employment: the rapidly expanding industries raised wages to draw labour. After 1899 however, the rise in the demand for consumer goods began to raise the cost of living, which exercised the major influence on wages between cycles IV and V.

8.4. *The role of international trade*

A distinction was made in the last section between goods whose prices were under domestic influence and those whose prices were under international influence. The question arises, what was the relative importance of the two types of goods? To put it more widely, how important was the role of international trade in raising prices?

The proportion of consumer goods that were entirely imported—notably spices, tea, coffee, cocoa, tobacco, and mineral oil—was quite small; not more than 10 per cent. of consumers' expenditure could have gone to them. But the prices of important agricultural commodities—for example, cereals, butter, and sugar—were under direct international influence, and competition for land transmitted this influence to other agricultural commodities. Some products—cotton and wool textiles in

particular—were manufactured from imported materials. So over half of the consumer expenditure must have been devoted to goods whose prices were under more or less direct international influence; international inflation must have exercised a substantial influence on the course of prices in Germany after 1895.

Nevertheless it can be argued that international influences on the course of real wages were negligible. For what matters here is the terms of trade and, not merely the import prices; and the terms of trade were determined by domestic factors. Germany's geographical position and industrial development led to the growth of exports of goods whose prices were fixed independently of international markets.

Germany lay between the industrial nation-states of Britain, France, and the United States in the west and the sprawling agricultural kingdoms of Russia and Austria-Hungary in the east. It had no outlet on the Mediterranean. Its colonies failed to develop into important markets or sources of materials. In spite of a rapid growth in its trade with Asia, Africa, and Australasia, those continents accounted for less than 15 per cent. of German trade in 1910-11; the proportion was even less in earlier years.¹ Thus, Germany's trade was largely limited to its European and American neighbours.

All countries of Europe and North America except Canada were sovereign states; all except Britain were protectionist. Most of them protected consumer goods industries and industries with settled techniques; hence their trade in such products stagnated or declined. On the other hand, imports of goods that were considered essential for the development of home industries, notably raw materials and equipment, bore low tariffs and rose rapidly; so also did their imports of goods in whose production Germany had such a technological lead that it could offer them at competitive prices in spite of tariffs.

So although Germany started as an exporter of consumer goods like textiles, leather goods, and sugar, its exports of those products did not make much headway; on the other hand, exports of machinery, chemicals, electricals, and metal goods, in whose manufacture Germany wrested a technological lead, rose rapidly. There were some exceptions to this rule; for example, exports of agricultural and textile machinery to Russia and Austria-Hungary owed more to their proximity than to the cheapness or quality of the machines, and exports of mineral potash salts and coal were due to their abundance rather than to any processing. But by and large the expansion of markets for German goods, especially from the 1890s onwards, was based on their technical characteristics. This is confirmed by Table 8.1. Foodstuffs and raw materials constituted two-thirds of German

¹ See G. Gothein, *Der deutsche Außenhandel, Materialien und Betrachtungen*, Berlin, 1901; R. Barmm, *Deutschlands Stellung im Welthandel und Weltverkehr*, Hamburg, Brunswick, and Berlin, 1914.

imports in 1872, and the proportion rose to four-fifths in 1913. Their proportion in exports fell from two-fifths to about a quarter in the same period, while the proportion of machinery, metal goods, and chemicals rose from 12 to 42 per cent.

A product which is recognized as a technical innovation or improvement starts with a large market to exploit. Its marketing and pricing problems are subordinate, and its producer has greater freedom in fixing its price; he can take account of his costs and his needs of internal finance. In so far as a rise in import prices impinged on his costs, he could make an offsetting increase in his selling price.

TABLE 8.1

Composition of imports and exports, 1872, 1895, and 1913¹ (per cent.)

	<i>Imports</i>			<i>Exports</i>		
	1872	1895	1913	1872	1895	1913
1. Foodstuffs	26.0	29.2	25.7	20.5	11.8	12.4
2. Raw materials and fuels	41.1	43.3	53.4	22.3	20.7	17.0
3. Metals and ores	4.5	2.7	3.8	2.6	1.1	2.3
4. Textiles	11.6	6.5	4.2	25.8	20.5	13.9
5. Animals	3.0	4.5	2.1	2.8	0.8	..
6. Metal goods, machinery, and transport equipment	5.7	1.6	5.7	8.9	13.6	32.1
7. Chemicals	4.6	1.7	4.1	2.9	4.4	9.4
8. Other goods	3.5	10.5	1.0	14.2	27.1	12.9
	100.0	100.0	100.0	100.0	100.0	100.0

This supposition is supported by the terms of trade statistics given in Tables A.23, A.24, and A.25. Between 1895 and 1913, average import prices rose 33 per cent.; export prices rose about 15 per cent., and so offset about half the increase in import prices; the decline in the terms of trade was about 15 per cent. Besides, there was some shift to lower-priced imports and higher-priced exports which is not reflected in the terms of trade series in Table A.25, which has 1895 weights. An index with 1913 weights would show a decline of only 6 per cent. between 1895 and 1913—a decline which was surely more than offset by the increase in the efficiency of export industries.

8.5. Conclusion

The cause of the slower rise in real wages is to be found in the distribution of technical progress and the rate of growth of the labour force.

In the 1870s and 1880s there was rapid technical progress in consumer goods industries, and particularly in the production of foodstuffs. Extensive mechanical agriculture began to spread across the United States, and railways and iron ships carried its produce at lower costs to Europe.

¹ Calculated from statistics of foreign trade in *Statistik des Deutschen Reichs*, old series vol.3, new series vols. 85 and 271.

Under the stimulus of its competition techniques also improved rapidly in German agriculture. The consequent decline in the real costs of consumer goods was reflected in prices, and real wages rose sharply.

From the nineties onwards technical progress slackened in consumer goods industries and quickened in capital goods industries. The rate of investment rose rapidly, and led to a rise in employment and incomes which generated increasing demand for consumer goods. Supply kept pace with the demand only at rising prices, which were a drag on the rise in real wages.

If there is a shortage of consumer goods, faster increase in real wages can be achieved only by lowering the rate of growth of employment. The growth of employment was rapid in the nineties and the following decade: the high rate of investment created employment opportunities, and there was a large increase in the population of working age owing to a rise in birth rates fifteen years earlier. As much of the increase in the supply of consumer goods went to the newly employed, less of it was available for a rise in real wages.

Appendix A

TABLES

TABLE A.1
Money earnings, 1871-86
(Marks and pfennigs)

	<i>Printing</i>		<i>Building</i>		<i>Coal-mining</i>		<i>Machines</i>		<i>Cotton textiles</i>		<i>Steel</i>	
1871	545	79	416	51	700	35	555	08	421	40	666	89
1872	664	48	470	28	1065	77	638	33	482	18	781	95
1873	759	42	557	60	1172	35	739	60	524	76	913	51
1874	759	42	550	88	943	99	804	43	557	17	943	68
1875	759	42	530	72	898	25	805	63	582	45	883	43
1876	735	66	510	61	700	35	763	61	594	61	783	50
1877	735	66	490	45	609	05	789	12	568	30	705	01
1878	711	91	483	73	624	24	775	65	573	32	720	83
1879	711	91	456	84	593	77	723	90	563	22	716	08
1880	711	91	456	84	639	42	747	10	553	12	693	86
1881	711	91	456	84	654	70	740	40	563	22	734	32
1882	711	91	483	73	715	54	762	17	548	04	758	95
1883	711	91	477	00	746	01	753	08	554	09	755	75
1884	711	91	483	73	730	82	730	59	586	51	763	62
1885	711	91	497	17	715	54	699	89	570	30	764	48
1886	759	42	510	61	685	17	693	83	580	46	747	80

Calculated from the following sources:

Building: J. Kuczynski, *Geschichte der Lage der Arbeiter in Deutschland*, vol. 1, pp. 178-9.

Machines: Ibid., pp. 248-9, series for 'München Lokomotivbau'.

Cotton textiles: Ibid., pp. 251-2, series for 'Hofer Baumwollindustrie; Baumwollspinnerei; mechanische Weberei' and 'Allgäu Baumwollindustrie; Weberei'.

Printing: G. Bry, *Wages in Germany 1870-1945*, p. 333, average for three cities.

Mining: Ibid., pp. 346-7, series for 'Hewers and haulers'.

Steel: W. Däbritz, *Bochumer Verein für Bergbau und Gußstahlfabrikation in Bochum*, Appendix Table 4.

TABLE A.2. Money earnings, 1887-1913
(Marks and pfennigs)

Section I

	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Non-ferrous metals	736 51	758 97	750 85	730 84	728 79	772 07	777 77	787 63	792 90	818 39	861 43	828 23	860 48	891 55
Pottery	586 74	652 64	663 13	669 12	671 10	677 11	676 16	678 77	690 02	703 14	715 39	742 48	762 59	772 18
Chemicals	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Linens textiles	505 20	497 64	536 86	541 29	548 68	550 88	551 47	564 39	565 50	556 73	580 31	600 06	618 74	663 72
Paper	567 01	559 43	574 54	592 14	..	591 46	599 23	594 33	614 88	632 90	650 58	671 76	693 70	720 07
Leather	..	705 94	756 26	775 81	792 16	785 99	778 20	785 84	809 89	798 90	771 14	853 94	856 70	877 53
Milling	..	..	..	..	..	..	..	..	..	..	..	724 22	744 12	754 97
Brewing	..	942 73	971 29	982 73	958 49	963 41	955 72	931 75	909 16	950 48	972 59	1051 93	1069 66	1113 08
Tobacco	472 32	480 07	482 06	488 65	499 43	505 12	515 89	514 68	519 56	527 84	536 23	537 35	541 87	549 20
Warehouses	811 17	865 51	867 78	896 42	920 24	916 15	945 27	912 15	942 11	990 90	910 58	944 31	977 37	1104 16
Inland shipping	578 88	513 99	626 82	627 78	637 67	649 12	657 33	653 33	613 46	662 95	646 41	681 57	701 70	717 53
Overseas shipping	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Non-ferrous metals	874 42	861 40	879 98	866 85	928 04	969 87	906 64	1055 85	1066 25	1089 84	1136 59	1163 03	1140 73
Pottery	796 26	804 85	814 22	817 20	834 27	874 49	926 13	899 33	892 08	938 40	959 02	977 67	1001 35
Chemicals	..	..	998 48	1008 27	1026 46	1074 88	1125 93	1147 54	1155 54	1181 98	1202 78	1258 05	1302 37
Linens textiles	680 49	691 35	689 04	699 23	720 05	756 52	794 32	810 04	817 94	836 65	842 15	864 23	882 49
Paper	715 28	709 43	754 54	786 60	792 46	751 16	778 09	876 44	886 54	913 95	925 27	992 13	1031 06
Leather	806 70	912 30	938 87	942 52	961 00	1037 94	1040 63	1057 20	1070 94	1093 33	1119 78	1159 45	1176 02
Milling	779 69	814 69	820 61	852 79	861 15	894 72	947 68	974 72	1007 68	1041 03	1077 90	1144 09	1176 89
Brewing	1136 82	1094 92	1114 15	1114 20	1109 10	1174 11	1258 44	1335 47	1251 50	1280 70	1305 16	1314 04	1488 39
Tobacco	526 71	526 77	531 06	543 04	553 59	574 77	601 51	612 14	616 17	614 82	628 47	650 56	671 76
Warehouses	1079 14	1047 10	1072 67	977 09	1029 01	1155 43	1035 23	1020 01	1035 47	1067 74	1130 90	1181 41	1184 01
Inland shipping	720 62	713 15	782 15	766 38	822 50	884 38	913 85	970 86	960 17	992 24	992 61	1069 51	1077 63
Overseas shipping	..	837 89	840 66	918 46	923 02	940 63	939 80	938 92	952 27	986 09	977 42	969 82	1100 35

TABLE A.2 (cont.)

Section 2

	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900
Mining	726 80	762 20	809 55	883 05	905 28	876 42	861 16	867 77	876 40	914 78	956 17	980 82	1018 65	1084 97
Stone quarries	327 02	329 48	320 79	328 37	334 29	330 41	354 59	354 85	359 11	367 17	330 88	314 15	313 10	329 31
Building	570 89	531 53	521 18	560 27	536 22	525 97	533 13	533 44	546 39	571 72	596 92	656 94	675 26	701 11
Iron and steel	820 63	795 73	821 42	834 30	845 03	828 59	832 96	837 53	839 87	866 09	870 01	912 62	932 96	941 54
Machines	820 01	857 11	886 00	913 17	912 91	903 40	912 50	915 38	923 00	949 42	965 19	992 32	1025 32	1059 49
Glass	657 09	652 57	673 15	680 50	699 28	677 43	683 21	699 39	739 95	739 95	739 95	737 87	741 79	741 79
Bricks	386 46	377 43	413 15	383 21	399 39	412 40	441 73	375 12	359 31	395 26	477 70	528 37	570 49	567 33
Cotton and wool textiles	552 88	554 13	559 66	569 55	586 52	575 25	567 32	602 97	604 22	619 08	627 63	596 12	649 60	659 67
Silk textiles	590 09	595 83	605 38	616 95	643 25	642 35	649 62	640 94	668 80	681 34	692 53	714 44	729 89	748 39
Paper products	664 35	642 53	649 70	704 18	684 99	697 67	725 51	627 32	655 40	689 70	732 99	736 73	717 42	727 61
Sugar	332 50	369 24	389 42	418 60	440 82	432 62	434 19	452 80	402 66	463 82	478 06	491 67	495 23	523 28
Clothing and laundering	525 63	494 65	523 91	527 42	550 95	554 08	568 83	564 54	584 06	598 96	611 65	614 27	618 49	602 79
Printing	759 42	759 42	759 42	794 97	794 97	794 97	794 97	794 97	985 39	830 60	830 60	830 60	830 60	866 23
Tramways	...	...	...	...	...	...	...	...	985 39	949 83	949 83	1057 42	1060 72	1172 46
Conveyance	...	637 83	645 40	652 25	638 41	667 75	666 23	670 93	671 41	645 58	...	...	672 79	690 17

	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Mining	1140 34	1085 04	1151 30	1156 69	1108 19	1246 27	1407 30	1399 26	1323 87	1336 87	1395 59	1504 76	1587 51
Stone quarries	340 01	343 64	346 09	349 35	355 12	366 98	387 22	406 27	409 40	420 81	422 09	436 63	471 29
Building	726 16	723 81	728 26	852 94	880 05	860 14	834 74	839 78	866 92	883 93	916 70	944 72	957 02
Iron and steel	968 26	975 85	1025 42	1043 07	1081 09	1145 77	1182 20	1170 99	1172 21	1219 51	1264 22	1235 66	1357 32
Machines	1086 98	1079 50	1099 89	1139 01	1179 39	1242 70	1314 51	1274 11	1265 31	1303 93	1352 76	1393 47	1423 46
Glass	742 46	823 73	835 88	846 88	887 04	908 72	934 87	905 90	952 01	987 49	1001 24	1054 02	1082 96
Bricks	559 57	567 35	590 59	623 46	621 66	659 53	682 59	668 86	707 32	726 10	772 08	821 30	853 14
Cotton and wool textiles	670 38	680 62	692 48	703 48	704 04	737 81	756 78	766 80	790 55	796 04	808 23	837 17	860 84
Silk textiles	755 20	764 67	781 45	790 14	822 17	856 73	900 86	881 43	899 54	932 05	945 36	965 54	977 00
Paper products	787 58	804 74	810 12	822 35	839 24	859 26	884 98	895 42	898 68	914 78	928 35	950 70	969 42
Sugar	546 50	517 50	507 72	487 14	515 52	564 86	576 87	507 30	505 16	593 58	576 98	620 50	666 05
Clothing and laundering	636 33	654 59	743 73	771 62	781 71	813 84	851 06	858 96	868 67	889 59	886 97	905 39	920 40
Printing	866 23	844 30	878 10	878 10	891 15	938 75	947 19	969 95	987 60	987 60	996 33	1033 73	1043 84
Tramways	1145 90	1111 97	1169 44	1202 19	1194 35	1225 22	1261 67	1317 84	1334 59	1351 37	1375 67	1429 23	1440 90
Conveyance	...	...	794 60	808 89	832 94	888 84	919 46	886 25	909 38	953 26	987 65	1012 71	1058 08

Source: Calculated from *Amliche Nachrichten des Reichsversicherungsamts*, Berlin, 1889-1915.

TABLE A.3
Estimates of earnings excluded from Table A.2
(Marks and pfenngs)

	1887	1888	1889	1890	1891	1892	1893	1894
Chemicals	902 34	885 94	927 48	980 47	891 28	887 33	862 79	830 64
Leather	810 27	..	..	..	..	..	..	..
Milling	668 32	630 00	620 38	611 68	629 65	627 41	636 14	618 97
Brewing	797 10	..	..	..	..	..	..	..
Overseas								
shipping	599 71	599 71	592 21	600 62	624 18	609 73	615 91	603 66
Glass	..	..	..	..	..	594 42	604 21	611 85
Tramways	321 65	356 42	366 27	507 49	488 17	513 16	521 16	501 20
Conveyance	726 00	..	..	..	..	..	..	..
Printing	764 65	771 60	783 10	809 04	819 66	825 84	832 91	827 40

	1895	1896	1897	1898	1899	1900	1901	1902
Chemicals	845 04	810 77	869 59	914 45	868 09	920 55	870 68	859 80
Leather	..	..	..	..	..	..	..	..
Milling	613 07	612 94	624 88	..	..	..	..	..
Brewing	..	..	..	..	..	..	..	..
Overseas								
shipping	590 89	618 09	604 98	577 94	594 72	648 43	688 40	..
Glass	572 44	541 70	..	..	..	..	..	..
Tramways	..	..	..	..	..	..	..	..
Conveyance	..	..	..	..	..	..	..	..
Printing	843 47	853 75	866 87	887 82	905 70	929 39	966 47	962 48

Sources: As for Table A.2.

Appendix A

TABLE A.4

*Average earnings in industry, transport, and distribution,
1871-1913¹*

(Marks and pfennigs)

	<i>A</i> six industries 1882 weights	<i>B</i> all complete series current weights	<i>C</i> all series current weights	<i>D</i> index of av. earnings
1871	528 27	..	..	493 27
1872	651 07	..	..	605 84
1873	740 91	..	..	688 19
1874	719 55	..	..	668 61
1875	700 17	..	..	650 85
1876	640 69	..	..	596 32
1877	600 51	..	..	559 49
1878	603 12	..	..	561 88
1879	582 59	..	..	543 06
1880	585 01	..	..	545 28
1881	597 18	..	..	556 43
1882	635 34	..	..	591 42
1883	621 48	..	..	578 71
1884	627 77	..	..	584 48
1885	624 10	..	..	581 11
1886	623 50	..	..	580 56
1887	664 69	617 51	..	626 51
1888	664 00	606 89	..	615 89
1889	672 17	616 24	..	625 24
1890	704 32	640 77	..	649 77
1891	705 76	645 27	..	654 27
1892	691 51	643 93	..	652 93
1893	691 36	665 51	..	674 51
1894	701 00	650 18	..	659 18
1895	709 06	656 13	..	665 13
1896	..	690 33	..	699 33
1897	..	729 01	..	738 01
1898	..	747 99	..	756 99
1899	..	784 69	..	793 69
1900	..	775 20	..	784 20
1901	..	799 14	..	808 14
1902	..	796 67	..	805 67
1903	..	804 65	813 10	813 10
1904	..	818 98	828 45	828 45
1905	..	839 96	849 10	849 10
1906	..	886 43	895 02	895 02
1907	..	924 81	932 84	932 84
1908	..	938 75	947 27	947 27
1909	..	942 11	951 51	951 51
1910	..	972 50	979 30	979 30
1911	..	1000 54	1008 72	1008 72
1912	..	1074 01	1056 32	1056 32
1913	..	1074 02	1083 44	1083 44

¹ Details of calculation are given in Section 2.3.

Sources: Calculated from Tables A.1 and A.2.

TABLE A.5
Distortion ratios, 1902-13¹

	Estimated		Actual									
	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913
Mining	0.98	..	..	..	..	..	..	..	..	..	..	..
Stone quarries	1.00	..	..	..	..	..	..	..	..	..	..	..
Building	..	0.995	1.008	0.993	1.005	1.003	..	..	..	..	..	..
Iron and steel	0.98	0.980	0.982	0.987	0.995	0.995	0.992	0.989	1.000	1.007	0.952	0.993
Machines and ironware	0.99	0.991	1.000	1.012	1.023	1.059	1.022	1.011	1.024	1.042	1.050	1.010
Non-ferrous metals	1.00	..	..	..	..	1.022	1.024	1.024	1.025	1.025	1.029	1.000
Glass	1.00	0.997	1.008	1.016	1.016	1.019	1.022	1.018	1.025	1.017	1.014	1.007
Pottery	1.00	1.003	0.983	0.983	0.990	1.009	1.000	0.970	0.998	1.001	..	..
Bricks	1.02	..	..	..	..	..	..	..	..	..	..	..
Chemicals	1.03	1.030	1.030	1.031	1.030	1.032	1.034	1.036	1.040	1.035	0.999	1.030
Linen textiles	0.99	0.989	0.992	1.000	1.010	1.013	1.015	1.007	1.005	1.008	1.008	0.984
Cotton and wool textiles	1.00	0.999	0.998	..	..	..	..	..	..	..	..	..
Silk textiles	0.98	..	..	..	..	..	..	..	..	..	..	..
Paper-making	1.01	1.008	..	1.009	0.923	1.008	1.020	1.010	1.010	1.011	1.010	1.008
Paper products	0.95	0.946	0.954	0.955	0.964	0.970	0.967	0.964	0.956	0.962	0.971	0.998
Leather	0.98	0.981	0.980	0.983	0.989	0.991	0.991	0.991	0.993	0.996	1.003	0.983
Milling	1.02	1.020	1.039	1.021	1.026	1.032	1.031	1.034	1.037	1.040	1.024	1.026
Sugar	1.055	1.065	1.048	1.048	1.042	1.047	1.050	1.054	1.051	1.055	1.052	1.035
Brewing	1.00	1.006	1.007	1.003	..	..	..	..	..	..	..	..
Tobacco	1.015	1.015	1.015	1.015	0.016	1.015	1.016	1.016	1.016	1.016	1.017	1.016
Clothing and laundering	0.97	..	..	..	..	..	..	..	..	..	..	..
Tramways	1.03	..	..	..	..	..	..	..	..	..	..	..
Warehouses	0.97	0.973	0.968	0.935	0.975	0.980	0.977	0.985	0.980	0.987	1.001	0.942
Conveyance	1.00	1.002	1.001	1.001	1.002	1.008	1.008	1.009	1.012	1.014	1.014	1.007
Inland shipping	1.00	1.001	0.923	1.008	1.013	1.113	1.014	1.057	1.024	1.032	0.968	0.933
Sea shipping	1.06	1.086	1.061	1.063	1.065	1.061	1.054	1.057	1.061	1.072	1.070	1.070

¹ The detailed description is given in Section 2.15.

Source: Calculated from *Ämtliche Nachrichten des Reichsversicherungsamts*, 1905-15.

TABLE A.6
Number of insured persons, 1886-1913
 (Thousand)

	Mining	Building	Stone quarries	Iron and steel	Other metals	Machines	Glass	Pottery	Bricks	Linen textiles	Cotton and wool textiles	Silk textiles	Paper	Paper goods	Leather
1886	343.7	542.7	82.6	311.7	72.2	61.1	41.7	48.0	175.0	35.8	473.7	33.7	44.9	48.0	35.5
1887	346.1	628.0	187.9	383.0	78.0	69.5	43.9	48.2	190.5	34.1	502.1	35.5	49.6	48.9	38.1
1888	357.6	784.3	202.5	418.7	82.2	74.5	48.0	52.7	217.9	37.6	523.4	37.0	53.3	51.5	45.6
1889	375.4	920.1	231.3	463.0	94.0	81.9	50.6	55.7	232.7	38.6	550.8	40.7	55.2	55.9	45.5
1890	398.4	891.0	251.4	496.5	107.8	86.4	54.1	58.3	272.7	41.0	559.1	46.9	57.1	58.5	47.3
1891	421.1	992.7	253.3	503.4	102.0	89.4	56.4	60.5	254.1	42.2	409.2	43.9	58.5	60.7	46.3
1892	424.4	966.9	252.8	505.6	100.7	92.1	65.6	60.0	253.0	41.2	563.5	43.7	58.8	63.6	47.0
1893	421.1	970.2	227.5	508.0	105.5	95.4	65.1	61.6	226.5	42.3	573.3	47.5	60.2	61.1	49.4
1894	426.6	962.8	226.3	525.0	108.9	101.8	66.2	61.7	253.9	42.1	574.9	46.3	62.1	73.1	50.2
1895	430.8	960.5	228.2	547.2	116.4	107.8	71.3	63.1	276.6	43.7	608.3	50.9	61.5	74.6	53.6
1896	446.3	1035.2	232.2	606.5	127.6	120.9	82.0	68.5	277.6	47.0	629.2	53.0	63.7	77.5	56.6
1897	469.0	1061.7	330.9	675.1	135.4	135.9	65.2	71.1	264.0	47.5	628.1	54.0	65.6	79.9	62.8
1898	495.1	1103.8	369.3	706.3	144.6	143.5	65.2	71.9	280.7	49.1	643.4	57.0	66.5	83.0	61.7
1899	521.4	1137.3	416.1	778.4	149.8	156.7	69.5	74.1	283.3	50.5	652.6	60.4	67.1	91.5	63.2
1900	565.1	1156.9	419.1	825.5	156.4	165.8	74.2	75.8	289.0	50.0	660.0	60.3	69.2	96.9	65.1
1901	607.4	1096.6	384.1	789.2	161.9	157.8	76.3	76.1	271.9	49.0	651.8	62.6	72.2	99.7	65.4
1902	601.1	1117.4	379.0	769.6	164.4	161.0	75.3	75.4	264.4	50.9	675.2	66.5	72.0	101.4	64.6
1903	610.8	1204.7	391.2	779.1	173.5	168.8	73.8	78.4	271.2	52.0	695.8	67.5	72.0	106.7	69.7
1904	624.5	1263.5	406.6	829.8	187.1	181.3	76.9	84.2	282.4	53.5	702.3	66.7	73.6	112.8	71.6
1905	647.5	1321.5	427.1	885.4	196.8	194.1	78.2	88.6	289.7	56.5	732.4	67.7	76.9	117.0	74.4
1906	689.2	1342.9	460.0	954.9	204.1	211.3	82.2	90.1	288.9	56.8	748.0	70.6	80.4	122.4	76.0
1907	732.6	1305.2	477.0	1022.6	216.7	227.1	85.6	91.4	291.1	58.8	783.2	72.0	83.3	131.4	79.1
1908	798.4	1270.3	460.0	986.9	203.0	223.3	84.8	89.0	278.0	59.4	761.9	69.2	86.9	131.2	76.8
1909	810.0	1275.2	416.7	977.0	200.1	221.3	81.5	86.6	260.1	60.7	787.8	72.6	86.3	133.7	81.0
1910	825.5	1337.5	422.8	1026.2	230.2	236.5	84.8	92.0	268.4	63.4	816.5	75.2	88.4	137.9	86.4
1911	838.3	1448.2	450.7	1089.2	238.8	254.8	87.8	96.9	268.0	63.8	823.5	75.5	90.1	142.2	86.5
1912	866.5	1430.2	455.3	1173.2	248.3	279.3	91.0	100.2	251.4	66.9	843.6	76.9	94.4	147.4	89.9
1913	918.8	1386.0	433.7	1217.0	248.0	288.1	92.2	101.5	232.4	68.6	849.4	76.6	96.0	150.9	96.4

TABLE A.6 (cont.)

	Milling	Sugar	Brewing	Tobacco	Clothing and laundering	Tramways	Warehouses	Conveyance	Inland shipping	Overseas shipping	Chemicals	Printing	Total
1886	83.0	127.2	51.7	89.5	82.6	29.8	40.0	50.3	11.9	..	78.4	51.8	3473.4
1887	82.7	106.8	61.6	90.7	86.2	44.3	54.3	54.6	53.6	20.5	82.0	55.8	3861.6
1888	86.7	95.4	63.5	90.6	96.2	31.0	59.1	02.4	59.3	37.6	85.2	58.8	4320.7
1889	86.9	97.2	67.1	98.3	99.6	34.5	68.2	64.7	53.2	40.4	91.4	59.7	4742.6
1890	86.3	100.0	70.6	103.5	107.2	28.2	75.4	64.6	55.2	42.5	98.4	60.4	4926.7
1891	86.4	99.1	72.5	109.1	104.7	31.9	80.3	60.4	55.2	43.3	101.1	60.8	5091.4
1892	87.0	98.9	76.8	107.5	106.1	31.8	82.0	67.7	54.0	43.0	103.0	74.1	5013.4
1893	86.2	97.9	79.6	110.7	109.9	32.8	84.5	68.5	53.1	42.2	107.0	80.3	5109.0
1894	86.4	101.2	83.5	110.5	116.6	30.9	92.4	69.2	52.9	43.1	111.4	85.4	5244.0
1895	86.3	100.1	89.4	123.1	125.2	21.7	94.7	72.3	56.8	44.1	115.7	90.9	5409.2
1896	85.5	100.7	91.2	130.4	135.4	24.8	96.9	79.4	55.9	43.2	124.4	101.0	5734.7
1897	85.6	100.7	95.1	136.1	149.6	28.6	115.4	70.9	59.1	45.3	131.1	101.1	6042.6
1898	74.7	98.2	93.0	140.9	161.8	33.0	120.1	76.5	59.1	48.6	136.7	102.0	6316.8
1899	73.3	97.0	96.9	141.0	173.2	39.5	126.3	88.3	59.8	48.6	144.5	110.3	6638.6
1900	71.9	97.1	97.6	140.5	195.0	45.0	131.5	90.8	60.8	53.2	154.5	116.6	6928.9
1901	67.0	99.8	100.9	140.2	204.9	48.8	143.6	82.2	61.5	56.3	161.1	130.9	6884.0
1902	67.5	97.2	106.5	144.9	207.1	49.7	163.6	82.3	60.8	60.2	165.9	133.3	7100.5
1903	68.5	95.6	106.2	147.1	213.2	51.2	197.4	82.4	59.8	64.5	174.7	144.0	7466.5
1904	67.3	94.6	109.6	150.1	229.2	53.6	251.6	80.1	60.2	68.4	183.5	147.4	7849.1
1905	65.8	97.2	108.6	153.7	242.1	58.5	271.3	86.8	61.4	71.3	192.4	154.8	8195.7
1906	64.1	95.6	112.3	156.4	254.2	62.6	291.3	95.1	61.4	74.7	202.2	156.0	8625.5
1907	63.9	93.4	110.2	165.3	267.6	67.3	346.8	97.8	63.7	79.0	214.9	160.8	8918.4
1908	63.7	93.8	116.0	175.9	278.9	69.1	368.2	104.2	59.2	77.3	216.8	174.7	8917.8
1909	63.0	93.9	111.2	174.7	297.8	71.5	384.2	104.8	61.6	78.2	219.6	178.5	9003.9
1910	63.5	93.5	110.6	165.8	316.0	75.0	399.4	105.7	62.3	79.2	230.4	202.2	9381.9
1911	62.8	90.7	113.5	172.6	332.1	80.9	468.4	109.8	63.1	83.0	244.7	197.3	9846.6
1912	61.5	94.0	116.2	174.9	349.1	85.6	425.7	114.0	63.3	86.2	258.1	206.2	10178.6
1913	62.1	96.2	117.1	178.8	358.9	93.0	339.5	115.5	66.7	89.8	282.2	217.5	10630.0

Source: As for Table A.2.

TABLE A.7
Employment in establishments subject to factory inspection, 1896-1913

(Thousand)

	Mining, etc.	Non- metallic mineral products	Metals	Machines	Chemicals	Oils, wax, soap, etc.	Textiles	Paper	Leather	Wood products	Food products	Clothing	Cleaning	Building	Printing
1896	200.0	498.2	359.1	459.4	93.8	47.0	714.0	185.1		244.1	505.3	157.0		..	98.5
1897	205.4	518.9	376.7	520.6	97.7	49.2	740.1	196.2		264.6	530.7	167.0		..	107.4
1898	222.8	576.7	413.6	592.8	107.0	51.9	756.7	204.8		285.3	546.8	185.8		..	115.9
1899	..	..	..	..	..	..	..	..		..	..	..		..	..
1900	813.8	596.0	413.8	665.5	105.8	52.2	764.9	135.2	75.9	278.7	553.9	178.0		112.2	127.0
1901	834.2	597.0	400.4	670.0	111.2	59.1	752.6	136.6	73.0	283.7	595.8	186.6		101.0	134.2
1902	830.9	597.2	406.3	646.7	114.4	58.4	780.5	137.5	75.1	284.7	508.0	187.9		107.3	134.3
1903	863.1	592.3	420.2	684.6	116.1	60.6	802.4	145.0	78.5	300.3	514.5	205.6		110.9	140.6
1904	894.7	615.1	458.3	738.0	121.1	65.3	810.7	149.9	81.7	319.3	532.3	203.6 ¹		122.3	147.3
1905	915.0	628.4	497.1	789.6	127.2	66.3	827.1	156.5	87.4	342.0	551.5	326.1		126.0	155.3
1906	958.0	646.2	534.7	847.0	133.8	69.6	847.8	163.9	91.5	361.8	569.8	348.8		135.9	164.2
1907	1021.4	656.3	555.8	886.4	142.3	77.5	857.7	170.4	94.5	377.3	597.5	364.3		136.7	171.6
1908	1063.7	634.1	541.4	867.1	143.4	73.0	851.1	171.5	94.0	371.9	622.0	372.0		127.8	174.7
1909	1081.2	620.4	551.7	863.1	147.2	74.3	879.2	173.7	97.5	379.5	630.1	392.0		126.7	177.4
1910	1110.3	733.7	589.6	946.3	148.1	75.3	911.2	180.8	106.4	403.0	645.4	385.5	45.8	237.0	183.6
1911	1134.4	657.1	623.7	1028.2	156.4	77.9	922.8	188.2	110.9	430.0	669.9	399.8	49.8	280.2	190.3
1912	1184.3	663.0	662.0	1130.7	168.3	81.2	947.3	195.7	116.6	451.7	694.3	423.6	52.8	286.3	197.2
1913	1196.8	647.6	680.1	117.5	180.6	81.8	956.1	199.0	120.8	453.8	713.9	431.1	55.6	276.9	200.2

¹ Includes some 90,000 workers in clothing establishments from this year.

Source: *Jahresberichte der Gewerbe-Aufsichtsbeamten*, Berlin, 1896-1924.

TABLE A.8
Cost-of-living index, 1871-1913¹
 (1895 = 100)

	<i>Food</i>	<i>Clothing</i>	<i>Fuel</i>	<i>Lighting</i>	<i>Rent</i>	<i>Total</i>
1871	102.3	128.4	136.3	..	..	105.8
1872	109.4	132.8	178.0	..	..	115.0
1873	116.5	111.0	210.8	..	..	120.5
1874	118.7	114.7	205.2	..	..	122.2
1875	111.0	126.2	141.7	..	96.5	112.7
1876	110.9	103.3	119.9	..	..	108.7
1877	112.3	91.5	104.0	..	..	107.3
1878	104.8	82.6	89.1	..	..	100.1
1879	102.5	86.7	89.1	..	..	98.9
1880	107.9	95.2	94.5	..	92.7	104.0
1881	108.0	94.4	94.5	..	..	104.0
1882	104.8	101.8	93.8	..	..	102.6
1883	105.0	92.6	95.4	..	..	100.0
1884	101.5	91.1	92.0	..	..	99.2
1885	99.6	92.2	106.9	..	92.1	98.6
1886	99.1	84.8	109.4	..	..	97.7
1887	97.8	88.5	117.0	..	..	97.8
1888	98.7	80.0	117.0	..	..	97.3
1889	100.0	84.5	120.7	..	..	103.8
1890	102.8	92.2	117.0	112.1	99.9	102.2
1891	110.1	92.2	112.7	105.0	..	105.8
1892	108.1	92.2	114.5	97.6	..	104.8
1893	101.7	94.8	105.1	92.8	..	100.9
1894	101.2	97.3	101.2	86.0	..	100.3
1895	100.0	100.0	100.0	100.0	100.0	100.0
1896	99.4	101.1	100.0	104.8	..	99.8
1897	102.0	102.1	100.9	99.9	..	102.1
1898	103.9	103.1	101.9	95.1	..	103.9
1899	100.6	104.6	108.2	99.4	..	101.8
1900	103.0	106.2	130.9	104.5	109.3	106.4
1901	107.0	107.3	112.0	104.1	..	107.1
1902	108.5	108.4	112.9	101.7	..	108.0
1903	108.1	109.5	110.4	104.0	..	108.0
1904	107.5	112.1	111.1	103.5	..	108.2
1905	112.4	114.8	115.0	99.2	112.3	112.4
1906	115.5	115.5	115.1	101.7	..	115.1
1907	119.0	116.4	124.6	101.0	..	118.7
1908	121.5	119.2	126.1	103.2	..	121.2
1909	123.8	121.6	124.4	105.4	..	123.3
1910	124.8	124.0	124.6	103.8	124.6	124.2
1911	126.9	126.5	121.4	95.4	128.1	125.3
1912	132.0	129.1	123.3	98.0	135.9	131.3
1913	128.7	131.6	124.4	108.5	135.9	129.8

¹ For details of calculation see sections 3.2-3.5.

Sources: As for Table A.9.

TABLE A.9
Price series of commodities entering the cost-of-living index
(1895 = 100)

	Pork	Beef	Veal	Mutton	Lard	Eggs	Butter	Salt	Sugar	Wheat	flour	Rye	Wheat	Rye	Potatoes	Coffee	Milk	Beer	Coal	Fuel gas	Lighting	Oil	Clothing	Remt
1871	80.0	78.2	..	..	..	..	105.3	..	101.4	..	..	..	..	..	87.1	97.1	83.5	..	136.8	..	..	..	128.4	..
1872	96.1	88.4	..	..	..	..	104.4	..	105.0	..	..	..	..	..	98.4	123.8	83.5	..	178.0	..	..	..	132.8	..
1873	106.4	96.3	85.7	94.3	109.6	97.9	113.0	..	184.6	188.3	154.5	..	..	..	104.3	147.2	83.5	..	210.7	..	..	..	111.0	..
1874	105.6	97.0	83.3	93.5	109.8	94.9	120.6	..	174.5	184.7	159.1	..	..	..	112.4	151.6	94.1	..	205.1	..	..	..	114.7	..
1875	99.3	88.4	76.7	86.9	112.3	99.5	118.7	..	108.6	140.2	136.4	..	..	..	87.1	144.1	94.1	..	141.6	..	..	..	126.2	96.5
1876	103.3	88.4	80.0	87.7	115.3	99.5	117.3	..	103.6	153.8	140.9	..	..	..	88.1	131.3	94.1	..	119.8	..	..	..	103.3	..
1877	101.7	90.0	81.6	88.5	113.5	93.3	112.5	..	183.2	157.7	145.5	..	..	..	90.1	137.6	94.1	..	103.6	..	..	..	91.5	..
1878	96.9	91.6	82.4	89.4	108.6	93.3	102.9	..	155.4	146.2	127.3	..	..	..	75.9	113.1	94.1	..	89.1	..	..	..	82.6	..
1879	90.7	90.0	80.0	88.5	101.2	89.5	98.2	..	151.4	142.3	122.7	..	..	..	85.0	104.6	94.1	..	89.1	..	..	..	86.7	..
1880	90.1	89.2	80.0	88.5	104.3	90.4	105.3	..	154.1	153.8	145.5	..	..	..	103.3	108.9	94.1	..	94.4	..	..	..	95.2	92.7
1881	100.7	80.2	80.0	89.4	100.8	93.3	108.7	..	160.0	153.8	154.5	132.2	120.4	97.2	90.7	94.1	101.7	94.4	94.4	..	..	..	94.4	..
1882	100.7	90.8	82.0	91.0	112.0	91.7	109.0	..	160.0	150.0	140.9	126.7	117.4	83.6	83.1	94.1	101.7	93.8	93.8	..	..	..	101.8	..
1883	100.7	94.1	84.5	94.3	113.9	92.5	110.0	..	160.0	142.3	127.3	126.7	111.8	103.9	68.0	94.1	101.7	95.3	95.3	..	..	..	92.6	..
1884	94.9	94.4	83.6	93.5	108.3	91.2	105.4	..	143.1	130.7	122.7	126.7	126.7	111.5	82.7	75.6	94.1	101.7	92.0	..	..	..	91.1	..
1885	94.9	94.1	84.0	92.6	107.0	91.7	101.8	..	127.7	123.2	118.2	126.7	107.3	86.6	75.6	94.1	97.2	106.9	106.9	..	..	..	92.2	92.1
1886	94.2	93.0	83.4	91.0	104.1	90.4	101.2	..	134.6	115.3	113.6	126.7	102.2	89.6	87.3	94.1	97.2	109.4	109.4	..	..	..	84.8	..
1887	91.4	80.2	82.5	88.5	105.9	88.5	99.8	..	119.6	115.3	109.1	126.7	100.5	95.1	91.4	94.1	97.2	116.9	116.9	..	..	..	88.5	..
1888	92.4	88.3	82.0	87.7	104.9	90.8	100.4	..	122.7	119.2	113.6	126.7	102.2	100.3	89.2	94.1	97.2	116.9	116.9	..	..	..	80.0	..
1889	101.2	92.5	86.9	91.8	100.7	93.5	106.5	..	126.4	127.0	122.7	141.1	111.5	111.5	86.8	102.8	94.1	97.2	124.5	..	..	..	84.5	..
1890	109.3	99.8	96.5	99.2	112.4	98.3	105.7	100.0	117.7	130.8	131.8	115.6	115.6	100.5	88.6	103.9	94.1	97.2	116.9	118.3	100.6	113.2	92.2	99.9
1891	103.3	100.9	96.5	102.5	107.1	101.1	106.1	100.0	119.6	146.2	154.5	127.8	135.0	114.2	102.1	94.1	97.2	112.7	112.7	117.5	100.6	105.3	92.2	..

TABLE A.9 (cont.)

	Pork	Beef	Veal	Mutton	Lard	Eggs	Butter	Salt	Sugar	Wheat flour	Rye flour	Wheat bread	Rye bread	Potatoes	Coffee	Milk	Beer	Coal	Fuel gas	Lighting gas	Oil	Clothing	Rent
1802	103.9	99.3	95.4	100.0	107.0	100.5	108.8	100.0	120.0	130.8	145.4	118.9	120.6	114.1	101.4	94.1	97.2	114.5	117.5	100.6	97.4	92.2	..
1803	104.0	95.1	96.5	96.7	106.8	103.5	110.0	100.0	110.1	111.5	113.6	105.6	106.6	97.6	104.4	94.1	97.2	93.8	117.5	100.6	92.1	94.8	..
1804	104.2	98.4	97.1	97.5	104.2	97.0	105.2	97.5	108.6	100.0	100.0	101.1	101.1	93.1	100.9	100.0	98.9	101.1	105.3	100.0	84.2	97.3	..
1805	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1806	95.4	98.3	97.8	99.2	95.0	96.3	101.3	97.5	105.4	103.8	145.5	101.1	102.2	92.0	93.8	100.0	100.0	100.0	99.2	99.4	105.3	101.1	..
1807	101.6	98.1	98.4	99.2	97.1	97.7	103.1	100.0	100.4	115.3	109.1	108.9	111.0	96.8	89.5	98.0	100.0	100.9	98.3	98.9	100.0	102.1	..
1808	107.9	99.7	100.9	101.6	100.7	100.5	103.5	99.0	101.9	130.8	118.2	120.0	119.2	103.5	77.9	94.1	98.9	102.0	100.0	98.9	94.7	103.1	..
1809	104.7	99.7	103.4	102.5	98.8	102.8	105.6	100.0	112.4	115.3	113.6	117.8	117.0	96.9	78.6	94.1	100.0	108.7	100.9	97.2	100.0	104.6	..
1900	102.3	99.5	103.3	103.3	97.1	106.5	107.8	100.0	108.2	111.5	118.2	116.7	119.7	94.3	80.6	94.1	100.0	133.2	100.9	98.3	105.3	100.2	109.3
1901	109.0	99.8	104.7	104.9	101.1	107.3	109.2	102.5	117.3	115.3	118.2	114.4	120.3	94.3	78.6	100.0	100.0	121.6	100.9	94.9	105.3	107.3	..
1902	116.5	103.1	108.7	108.2	107.4	106.9	108.8	102.5	117.3	115.3	113.6	115.6	119.2	89.4	76.1	104.7	100.0	114.0	100.9	94.7	102.6	108.4	..
1903	109.1	104.9	111.8	111.5	106.4	106.9	108.9	102.5	109.1	115.3	113.6	121.9	103.3	103.3	75.2	105.9	100.0	111.4	100.9	94.9	105.3	109.5	..
1904	104.0	105.9	113.6	113.9	100.7	110.1	112.0	100.0	85.0	115.3	113.6	114.4	121.9	112.7	77.3	105.9	100.0	112.3	100.9	94.4	105.3	112.1	..
1905	121.8	112.7	121.4	120.5	107.3	117.7	115.1	102.5	95.0	119.2	113.6	116.7	123.6	112.8	75.4	105.9	100.0	116.7	100.9	93.8	100.0	114.8	112.3
1906	131.3	119.7	131.1	130.3	113.7	120.0	116.1	102.5	84.1	119.2	122.7	121.1	129.1	94.7	75.4	110.0	101.7	120.3	101.8	95.5	102.6	115.5	..
1907	117.4	120.9	120.8	132.0	107.5	122.9	117.1	99.0	87.7	130.8	130.4	128.9	145.5	113.7	75.4	117.7	101.7	127.4	105.3	91.0	102.6	116.4	..
1908	118.5	118.1	136.2	131.2	106.7	122.9	121.8	104.0	90.0	142.3	145.5	137.8	149.4	107.2	75.4	117.7	101.7	123.4	101.9	90.5	105.3	119.2	..
1909	127.4	120.9	137.6	135.3	112.0	134.1	125.2	104.0	91.9	150.0	140.9	138.9	151.0	105.1	69.9	117.7	106.7	127.4	106.1	91.0	107.9	121.6	..
1910	129.3	125.8	144.5	139.4	119.4	126.7	128.9	105.0	104.6	142.3	131.8	136.7	145.0	118.4	80.7	122.3	111.1	127.0	111.4	94.9	105.3	124.0	124.6
1911	119.2	131.5	147.8	143.5	112.0	130.4	134.1	106.5	100.9	142.3	131.8	134.4	134.6	148.8	90.7	131.2	112.8	123.4	110.5	84.3	97.4	126.5	128.1
1912	133.4	141.5	156.7	151.6	119.0	139.0	138.2	102.5	103.6	142.3	140.9	135.6	137.2	136.7	100.1	137.1	112.8	126.1	111.4	87.1	100.0	129.1	135.9
1913	136.9	143.2	163.1	161.5	123.0	149.5	133.3	102.5	91.9	142.3	140.9	135.6	135.1	112.1	88.9	125.6	127.8	112.8	109.6	84.4	113.2	131.6	135.9

TABLE A.9 (cont.)

Sources:

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TABLE A.9 (cont.)

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TABLE A.10. *Weights underlying the cost-of-living index*

<i>Head of expenditure</i>	<i>Representative products</i>	<i>Budget study proportions</i>	<i>Weights in the index</i>			
			1890-1913	1880-90	1873-80	1871-3
Meat and sausages	Beef, veal, mutton, pork	11.4	14.9	15.1	18.0	27.9
Fish		0.5	..	..	..	..
Butter	Butter	4.6	6.0	6.1	7.2	11.4
Lard and margarine	Lard	1.8	2.3	2.3	2.8	..
Cheese	Eggs	0.8	..	..	..	..
Potatoes	Potatoes	1.6	2.1	2.1	2.5	..
Vegetables		2.6	3.1	3.2	3.7	5.8
Salt, spices, and oil	Salt	1.8	..	..	..	..
Sugar, syrup, honey	Sugar	0.9	1.2	..	..	..
Cereals, lentils, flour	Wheat and rye flour	1.4	1.8	1.8	2.2	3.4
Fruit		2.3	3.0	3.0	3.6	..
Bread and bakery goods	Wheat and rye bread	1.0	..	..	..	..
Coffee	Coffee	10.0	13.1	13.3	..	..
Tea, chocolate, cocoa		1.9	2.5	2.6	3.0	4.7
Milk	Milk	0.3	..	..	..	..
Other drinks	Beer	5.8	7.5	7.7	9.2	14.1
Other food, tobacco		2.3	3.0	3.0	..	..
Rent	Room rent	3.2	..	..	..	..
Cleaning, decoration		17.0	22.2	22.4	26.8	..
Heating and fuel	Coal, gas	3.0	..	..	..	..
Lighting	Petroleum, gas	4.5	5.9	5.9	7.1	11.2
Clothing	Rough cotton cloth, various garments	1.7	2.2	2.2	2.7	4.1
Linen		7.1	9.2	9.3	11.2	17.4
Laundering		0.8	..	..	..	..
Transport		1.3	..	..	..	..
Newspapers, clubs, books		0.6	..	..	..	..
Entertainment		2.3	..	..	..	..
Other		0.5	..	..	..	..
		7.6	..	..	..	..
		100.0	100.0	100.0	100.0	100.0

Source: 'Erhebung von Wirtschaftsrechnungen minderbemittelter Familien im Deutschen Reiche', *Reichsarbeitsblatt*, supplementary issue no. 2, 1909, pp. 156-8.

TABLE A.11

Proportion of the population of selected cities living in dwellings with one and two heatable rooms, 1875-1910
(per cent.)

	1875		1880		1885		1890		1895		1900		1905		1910	
	<i>No. of heatable rooms</i>															
	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>	<i>I</i>	<i>2</i>
Old Leipzig	21.4	25.9	21.7	27.3	19.1	26.4	15.9	25.9	15.1	25.7	..	..	..	..	..	..
Dresden	..	..	48.3	21.9	48.1	22.8	42.9	25.9	41.8	27.1	37.4	28.4	..	..	..	..
Berlin	45.3	26.6	43.9	27.7	44.1	28.6	44.2	28.9	43.7	29.5	43.0	30.7	41.0	33.8	..	..
Breslau	..	..	..	..	37.1	14.8	48.4	26.3	44.3	30.1	40.9	32.5	37.1	34.2	..	..
Hamburg	..	..	..	..	29.5	31.3	24.1	31.6	20.6	31.5	19.2	31.2	16.6	30.9	25.5	34.8
Leipzig	..	..	..	..	19.1	26.3	30.4	33.8	28.2	36.2	21.9	37.2	19.0	38.5	12.7	40.5
Lubeck	..	..	..	..	..	..	45.0	24.8	39.3	28.4	37.6	31.4	34.6	34.0	27.0	31.8
Magdeburg	..	..	..	..	..	..	49.7	24.5	49.1	23.3	45.4	23.5	42.3	23.8	40.7	24.2

Sources:

1875 and 1880: H. Lindemann, 'Wohnungsstatistik', *Schriften des Vereins für Sozialpolitik*, Munich and Leipzig, vol. 94 I, 1901, p. 291, Table IX.

1884: *Statistisches Jahrbuch deutscher Städte*, Breslau, vol. 1, 1890, p. 74, Table 4.

1890: Idem. vol. 3, 1893, p. 41, Table 6.

1895: Idem. vol. 7, 1898, p. 61, Table 5.

1900: Idem. vol. 11, 1903, p. 76, Table 4.

1905: Idem. vol. 16, 1909, p. 445, Table 5A.

1910: Idem. vol. 21, 1916, p. 866, Table 13.

TABLE A.12
Average rents of dwellings with one and two heatable rooms, 1875-1910
(Marks per year)

	1875		1880		1885		1890		1895		1900		1905		1910	
	I	2	I	2	I	2	I	2	I	2	I	2	I	2	I	2
	No. of heatable rooms															
Lubeck	..	..	..	..	..	..	124	192	129	194	146	238	156	238	180	270
Leipzig	..	..	..	..	..	..	176	289	181	281	212	315	215	302	255	356
Magdeburg	..	..	..	..	..	..	145	241	145	243	160	252	168	256	185	292
Hamburg	..	..	..	..	..	..	222	323	216	299	227	308	243	328	254	334
Breslau	..	..	..	..	192	299	143	244	141	227	152	251	167	271	174	289
Berlin	..	..	191	324	197	336	229	379	220	365	232	379	257	419	..	..
Dresden	..	..	158	294	143	264	166	288	192	326	..	..	..	..	..	..
Old Leipzig	189	327	182	310	188	323	200	344	210	332	..	..	..	..	..	..

Sources: H. Lindemann, 'Wohnungsstatistik', *Schriften des Vereins für Sozialpolitik*, Leipzig, vol. 94.I, 1901, p. 291, Table IX.

Statistisches Jahrbuch deutscher Städte, Breslau, vol. 1, 1890, p. 74, Table 4; vol. 3, 1893, p. 41, Table 6; vol. 7, 1898, p. 61, Table 5; vol. 11, 1903, p. 76, Table 4; vol. 16, 1909, p. 445, Table 5A; vol. 21, 1916, p. 866, Table 13.

TABLE A.13
Real wages, 1871-1913
(Constant 1895 prices)

Section 1

	1871	1875	1880	1885	1890	1895	1900	1905	1910	1913
	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.
Non-ferrous metals										
Pottery	..	..	..	..	715 17	792 90	838 16	825 44	877 60	878 52
Chemicals	..	..	..	..	654 77	690 02	725 93	742 03	755 66	771 18
Linen textiles	..	..	..	..	..	..	..	912 97	951 80	1003 01
Paper	..	..	..	..	529 68	565 50	623 97	640 44	665 67	679 64
Leather	..	..	..	..	614 88	670 95	676 95	704 85	737 97	794 06
Milling	..	..	..	..	824 97	809 89	824 97	854 75	880 41	905 70
Brewing	..	..	..	..	759 18	..	709 75	765 94	838 30	906 37
Tobacco	..	..	..	..	..	..	1046 42	1039 84	1031 30	1146 27
Warehouses	..	..	..	..	961 66	909 16	516 31	492 39	495 09	517 35
Inland shipping	..	..	..	..	478 17	519 56	1038 03	915 78	859 81	912 85
Overseas shipping	..	..	..	..	877 20	942 11	674 56	731 56	799 01	829 93
	..	..	..	..	614 32	615 46	..	820 97	794 06	847 42

Section 2

	1871	1875	1880	1885	1890	1895	1900	1905	1910	1913
	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.	m. pf.
Mining	661 91	621 41	614 89	725 34	864 12	876 40	1019 99	1085 72	1076 14	1226 05
Stone quarries	..	..	..	..	321 33	359 11	309 59	315 86	338 86	362 96
Building	393 67	453 05	439 31	503 98	548 26	546 39	659 12	782 75	711 79	737 04
Iron and steel	630 33	695 18	667 24	774 95	816 41	839 87	885 15	961 48	982 02	1045 33
Machines	524 05	677 54	718 43	709 48	893 59	923 00	996 04	1049 00	1050 00	1006 26
Glass	..	..	..	..	665 91	..	697 36	788 97	795 19	834 03
Bricks	..	..	..	..	374 99	359 31	533 35	552 93	579 87	657 04
Cotton and wool textiles	398 30	527 59	531 90	578 11	557 34	604 22	619 79	626 20	641 02	662 97
Silk textiles	..	..	..	..	603 72	668 86	703 57	731 27	750 54	752 43
Paper products	..	..	..	..	689 08	655 40	684 03	746 45	736 64	746 59
Sugar	..	..	..	..	409 63	452 66	491 94	458 52	477 99	512 05
Clothing and laundering	..	..	..	..	516 11	584 06	566 69	695 28	716 35	708 84
Printing	515 87	652 74	684 59	721 66	777 93	830 60	814 35	792 62	714 75	863 90
Tramways	..	..	..	..	..	985 39	1102 24	1002 30	1088 20	1096 95
Conveyance	..	..	..	..	638 27	671 40	648 84	740 85	767 62	891 88
Total	466 23	577 51	524 31	589 36	635 78	665 13	737 03	755 22	788 59	834 40

Sources: Calculated from Tables A.1, A.2, and A.8.

TABLE A.14. Annual growth rates of real wages and productivity, 1871-1913¹
(per cent.)

Section 1										
	Quality of output series	Real wages				Output per head				
		1871-5	1875-90	1880-90	1890-1900	1900-13	1880-95	1895-1913	1882-95	1895-1913
Non-ferrous metals	..	..	..	..	1.6	0.4	..	0.6	..	..
Linen textiles	..	..	..	..	1.7	0.7	..	1.0	..	..
Paper	..	..	..	..	1.6	1.2	..	1.4	..	..
Warehouses	..	..	..	..	1.7	-1.0	..	-0.2	..	..
Inland shipping	..	..	..	..	1.0	1.6	..	1.7	..	..
Brewing	A	..	..	..	0.8	0.7	..	1.3	0.1	-0.2
Milling	B	..	..	..	..	1.9	..	..	1.5	2.5
Tobacco	B	..	..	..	0.9	0.0	..	0.0	0.8	-1.7
Leather	C	..	..	..	0.8	0.7	..	0.6	0.1	-0.1

Section 2										
Glass	..	..	..	..	0.5	1.4	..	..	..	..
Silk textiles	..	..	..	..	1.6	0.5	..	0.5	..	..
Paper products	..	..	..	..	0.0	0.7	..	0.5	..	..
Clothing and laundering	..	..	..	..	1.0	1.8	..	1.1	..	..
Tramways	..	..	..	..	..	0.0	..	0.6	..	..
Conveyance	..	..	..	..	0.2	2.5	..	1.6	..	..
Printing	6.1	1.0	1.3	..	0.5	0.1	1.3	-0.2	..	..
Machines	6.6	0.1	2.2	1.1	1.1	0.7	1.7	0.7	..	..
Sugar	A	..	..	..	1.9	0.3	..	0.5	5.9	2.7
Building	A	3.6	-2.2	2.2	1.9	1.1	1.4	1.7	1.0	1.1
Iron and steel	A	2.5	-3.2	2.1	0.8	1.3	1.5	1.2	2.0	2.3
Mining	..	-1.6	-5.0	3.7	1.7	1.4	2.5	1.9	..	..
Coal	A	..	..	..	..	..	..	..	-0.1	0.6
Lignite	A	..	..	..	..	..	..	..	1.9	4.6
Iron ore	A	..	..	..	..	..	..	..	3.9	3.5
Cotton and wool textiles	B	7.3	0.6	0.7	1.1	0.5	1.0	0.5	1.9 ¹	-0.1 ²
Stone quarrying	C	..	..	..	-0.4	1.2	..	0.3	2.1	1.0
Bricks	C	..	..	..	3.6	1.6	..	3.4	2.5	1.5
Total	..	5.7	-2.0	2.0	1.5	1.3	1.6	1.3	..	..

¹ Geometric averages.

² All textiles.

Sources:

Real wages—calculated from Table A.13.

Output and employment in coal, lignite, and iron ore—*Statistisches Handbuch für das Deutsche Reich*, Berlin, 1907, Part 1; *Statistisches Jahrbuch für das Deutsche Reich*, 1915.

Output of other industries—estimates of Professor W. G. Hoffmann.

Employment in other industries:

1882: *Statistik des Deutschen Reichs*, neue Folge, vol. 2, Table 1.

1895: *Ibid.*, vol. 102, Table 1.

1907: *Ibid.*, vol. 202, Table 1; *Statistisches Jahrbuch für das Deutsche Reich*, 1909, Table I.10

1913: calculated from the 1907 figures by assuming the proportional variation in employment between 1907 and 1913 was such as can be derived from employment statistics in

F. Grumbach and H. König, 'Beschäftigung und Löhne der deutschen Industrie-wirtschaft 1888-1954' in *Weltwirtschaftliches Archiv*, 1957, pp. 128-9, for iron and steel, pottery, bricks, milling, sugar, and brewing;

Jahresberichte der Gewerbe-Aufsichtsbeamten, Berlin, 1907 and 1913, for stone quarries, building, chemicals, textiles, and leather.

TABLE A.15
Prices of wheat and wheat bread, 1872-1913

	Wholesale prices							Average import price	Berlin bread price
	Berlin	Breslau	Frankfurt	Königsberg	Leipzig	Lindau	Mannheim	M./ton	pf./kg.
	Marks per ton								
1872	..	..	..	..	..	..	..	240·0	..
1873	..	..	..	..	..	..	..	258·0	..
1874	..	..	..	..	..	..	..	240·0	..
1875	..	..	..	..	..	..	..	210·0	..
1876	..	..	..	..	..	..	..	220·0	..
1877	..	..	..	..	..	..	..	220·0	..
1878	..	..	..	..	..	..	..	200·0	..
1879	197·9	..	213·7	191·9	201·4	236·3	226·5	210·0	..
1880	217·9	202·9	237·4	206·1	228·7	261·2	247·4	207·0	..
1881	219·5	206·6	241·8	208·5	232·9	259·9	249·8	210·0	47
1882	204·2	191·7	236·8	195·8	214·0	241·8	237·5	197·0	45
1883	186·1	154·8	205·4	181·2	174·7	227·7	..	184·5	45
1884	162·2	156·7	187·7	164·2	176·4	209·8	185·1	151·0	45
1885	160·9	146·0	181·2	157·7	167·2	196·0	187·4	135·0	45
1886	151·3	141·8	174·4	153·5	162·6	203·5	189·3	146·0	45
1887	164·4	153·4	180·2	159·2	170·1	201·7	190·1	142·0	45
1888	172·2	165·1	188·2	166·1	180·9	206·8	206·2	144·0	45
1889	187·7	173·8	197·2	176·5	186·5	220·2	211·3	145·9	50
1890	195·4	185·1	209·1	185·8	191·7	233·1	218·3	154·8	61
1891	224·2	217·1	233·6	221·5	224·1	257·9	241·5	180·5	63
1892	176·4	180·9	194·8	183·5	188·3	237·3	204·5	153·7	43
1893	151·5	142·0	163·4	143·0	155·1	205·5	178·5	126·4	38
1894	136·1	129·3	143·2	126·9	133·3	187·1	150·7	102·2	35
1895	142·5	140·0	150·6	139·7	139·8	176·8	155·0	108·0	35
1896	156·2	151·4	162·2	147·8	157·8	186·2	168·4	119·8	36
1897	173·7	162·5	177·5	167·7	162·1	223·4	194·8	247·3	38
1898	185·5	168·1	200·0	182·5	189·6	244·9	209·4	156·6	43
1899	155·3	143·9	162·9	151·3	154·6	208·3	179·3	131·6	42
1900	151·8	137·2	161·7	173·5	146·3	196·4	177·5	132·2	41
1901	163·3	155·9	169·1	154·7	165·4	193·8	177·0	132·5	41
1902	163·1	159·2	168·0	158·8	164·1	192·1	174·0	130·9	42
1903	161·1	148·9	164·8	151·8	153·1	186·6	175·7	130·9	42
1904	174·4	168·7	176·4	167·8	171·9	193·0	184·0	139·0	42
1905	174·8	162·4	182·0	164·6	122·7	195·3	188·2	144·0	43
1906	179·6	168·0	184·3	172·6	172·7	197·4	196·2	133·9	45
1907	206·3	198·2	209·5	198·5	205·2	233·2	223·5	156·7	49
1908	211·2	201·0	211·2	200·2	206·9	241·1	236·9	167·1	52
1909	233·9	222·7	237·1	222·2	230·4	263·8	252·1	187·6	54
1910	211·5	191·8	212·8	202·6	205·4	234·4	228·6	161·0	54
1911	204·0	184·6	209·0	194·7	198·9	232·1	223·1	160·3	..
1912	217·0	194·3	220·7	209·8	209·1	246·7	236·7	172·3	..
1913	198·9	..	205·3	..	193·5	241·8	231·6	163·9	..

Sources:

Wholesale prices—'Zur Statistik der Preise', *Vierteljahrshefte zur Statistik des Deutschen Reichs*, 1903; *Statistisches Jahrbuch für das Deutsche Reich*, 1913 and 1914.

Average import price—as for Table A.23.

Price of bread—G. Brutzer, 'Die Verteuerung der Lebensmittel in Berlin . . .', *Schriften des Vereins für Sozialpolitik*, vol. 139, Leipzig, 1912, pp. 46-47.

TABLE A.16
Prices of rye and rye bread, 1872-1913

	Wholesale prices						Average import price	Berlin bread price
	Berlin	Danzig	Königsberg	Leipzig	Mannheim	Munich		
	Marks per ton							
							M./ton	pf./kg.
1872	..	..	..	..	..	..	162·0	..
1873	..	..	..	..	..	..	180·0	..
1874	..	..	..	..	..	..	180·0	..
1875	..	..	..	..	..	..	160·0	..
1876	..	..	..	..	..	..	170·0	25
1877	..	..	..	..	..	..	170·0	22
1878	..	..	..	..	..	..	150·0	22
1879	132·8	125·7	122·7	153·6	156·2	159·6	150·0	23
1880	187·9	180·9	176·1	206·0	202·7	205·0	170·0	24
1881	195·2	188·2	182·0	210·0	212·6	215·4	178·0	24
1882	152·3	141·4	137·5	165·3	181·3	178·5	132·0	24
1883	144·7	136·1	131·3	151·1	..	149·6	130·0	23
1884	143·3	138·7	132·4	153·4	160·4	158·3	118·0	23
1885	140·6	131·3	130·0	148·1	160·8	158·1	110·0	22
1886	130·6	120·2	118·5	139·9	148·0	145·0	97·0	21
1887	120·9	105·0	104·1	129·9	142·6	141·6	85·0	21
1888	134·5	121·9	117·3	144·1	151·6	150·8	90·0	21
1889	155·5	148·6	141·9	166·8	136·9	160·1	107·0	25
1890	170·0	159·4	150·7	179·7	177·8	179·2	111·5	27
1891	211·2	208·1	199·3	215·2	218·6	210·4	162·8	32
1892	176·3	174·2	168·3	181·2	188·8	181·9	162·0	30
1893	133·7	123·4	120·4	138·4	154·6	145·1	105·3	22
1894	117·8	110·4	106·8	120·0	130·3	122·5	83·4	20
1895	119·8	116·2	112·4	126·5	128·8	134·7	83·0	21
1896	118·8	111·8	107·3	130·8	132·9	146·8	82·9	21
1897	130·1	119·3	118·0	135·6	141·3	153·7	93·7	22
1898	146·3	142·3	140·4	154·7	160·4	170·5	112·2	25
1899	146·0	139·5	138·7	154·5	160·8	161·9	115·6	24
1900	142·6	133·1	130·3	153·4	155·4	153·7	107·5	24
1901	140·7	134·0	129·8	150·5	147·6	157·5	103·6	24
1902	144·2	139·4	137·7	148·6	150·3	151·9	107·4	24
1903	132·3	125·1	125·1	137·2	146·8	145·4	101·4	24
1904	135·1	131·0	131·4	136·4	145·1	172·5	104·5	24
1905	151·9	142·1	139·6	153·0	158·7	145·4	118·9	24
1906	160·6	150·9	150·3	166·1	172·5	174·1	112·0	27
1907	193·2	186·2	183·3	198·1	199·0	193·7	146·6	31
1908	186·5	177·0	176·6	188·9	144·8	188·6	150·7	32
1909	176·5	171·8	168·7	174·7	179·5	172·4	140·3	30
1910	152·3	150·0	148·3	154·4	164·1	157·1	109·1	28
1911	168·3	162·0	159·7	170·9	178·9	190·5	123·8	28
1912	185·8	179·6	177·8	185·4	198·0	200·7	139·0	30
1913	164·3	161·5	161·5	164·4	175·3	167·2	119·6	30

Sources: As for Table A.15.

TABLE A.17
Share of principal field crops in total area under crops, 1878-1913¹
(per cent.)

	Wheat				Rye				Barley				Oats			
	1878	1893	1900	1913	1878	1893	1900	1913	1878	1893	1900	1913	1878	1893	1900	1913
Prussia	5.9	6.8	6.9	6.8	25.7	25.9	25.9	28.7	5.0	4.9	5.2	5.3	14.2	14.6	15.3	16.8
East Prussia	4.9	5.3	5.1	4.2	21.0	21.4	21.4	23.4	4.7	4.6	4.7	5.7	15.1	15.0	15.3	17.9
West Prussia	5.5	5.8	5.9	5.4	25.5	26.4	26.9	30.4	3.9	4.4	5.2	6.1	10.2	10.7	10.9	12.1
Brandenburg	2.6	3.1	3.5	3.6	32.9	34.2	34.3	37.4	4.0	3.8	4.2	4.3	11.4	11.4	12.6	14.4
Pomerania	3.1	3.8	4.0	3.7	24.7	25.5	25.7	29.2	3.7	3.5	3.7	3.4	14.4	14.4	15.8	19.0
Posen	5.1	5.9	5.2	4.5	28.9	31.4	33.2	40.2	4.4	4.6	6.0	7.2	8.2	7.8	7.8	9.1
Silesia	7.2	9.6	9.8	9.8	28.6	26.9	25.5	27.4	7.4	7.0	7.5	6.8	14.9	15.8	16.4	17.7
Saxony	8.4	10.8	11.8	13.3	23.4	22.4	21.5	22.7	10.5	9.6	10.1	9.6	13.0	13.3	14.2	14.6
Schleswig-Holstein	4.3	4.3	4.7	5.3	13.0	13.7	13.5	14.2	5.0	4.9	5.0	5.0	17.4	17.7	18.3	21.0
Hanover	5.9	7.4	7.7	7.3	33.5	33.4	33.4	35.9	2.7	2.3	2.2	2.0	17.4	17.3	18.3	20.1
Westphalia	8.9	9.3	9.3	9.0	27.1	27.8	27.3	29.3	3.8	3.0	2.7	2.6	17.9	18.3	19.1	19.6
Hesse-Nassau	10.1	11.0	11.2	10.7	23.2	22.7	22.7	24.2	6.0	5.5	4.6	4.1	20.5	21.5	23.1	24.5
Rhineland	9.6	9.5	8.1	8.5	20.9	20.0	20.4	22.0	2.8	3.1	2.9	2.8	17.9	19.2	20.9	21.3
Bavaria	9.7	10.6	10.3	9.9	18.8	18.1	18.2	18.7	10.4	11.6	11.9	12.7	14.3	14.7	15.5	16.8
Kingdom of Saxony	5.6	6.2	7.5	8.0	27.5	26.7	24.3	25.1	4.4	3.5	3.6	2.9	21.4	21.8	22.8	22.9
Württemberg	2.4	3.7	3.6	5.7	4.5	4.3	4.5	4.5	10.2	11.3	11.4	11.9	15.2	15.3	16.7	17.6
Mecklenburg-Schwerin	5.7	5.8	6.9	5.2	21.7	22.4	21.4	25.3	2.4	2.5	3.1	3.0	15.0	15.0	15.7	18.7
Alsace-Lorraine	27.9	25.4	23.0	20.4	5.9	7.3	7.1	8.5	8.1	7.3	7.8	7.3	13.5	14.5	16.3	16.9
Germany	7.0	7.8	7.8	7.7	22.8	22.9	22.8	25.0	6.2	6.2	6.5	6.6	14.4	14.9	15.6	17.1

¹ The area under crops denotes the sum of the area under cultivation and the area bearing two crops in the year.

TABLE A.17 (cont.)

	Potatoes				Sugar beet				Clover			
	1878	1893	1900	1913	1878	1893	1900	1913	1878	1893	1900	1913
Prussia	10.8	11.8	12.6	13.6	0.8	1.8	2.1	2.6	6.7	6.3	6.7	6.7
East Prussia	7.2	8.0	8.4	9.2	0.0	0.1	0.1	0.1	9.7	9.9	11.0	12.9
West Prussia	11.0	12.1	13.6	14.8	0.1	1.6	2.0	2.3	8.6	8.0	8.7	8.4
Brandenburg	14.7	16.5	17.5	18.4	0.2	0.6	0.9	1.5	4.6	3.9	4.5	4.0
Pomerania	9.3	10.6	12.0	13.7	0.1	0.7	1.4	2.0	7.7	7.0	6.8	7.8
Posen	12.8	14.2	15.9	17.0	0.1	1.6	2.6	3.9	5.7	5.2	6.2	4.6
Silesia	14.2	14.6	15.2	15.6	1.1	2.5	2.7	3.9	8.7	8.3	8.7	7.9
Saxony	11.1	12.3	13.1	14.1	5.1	7.7	7.6	8.3	3.5	3.4	3.5	3.2
Schleswig-Holstein	2.7	2.9	3.0	3.0	0.1	0.1	0.1	0.0	3.9	2.3	2.4	3.5
Hanover	8.6	9.5	10.2	11.7	1.1	2.7	3.0	3.2	3.8	3.6	3.4	3.9
Westphalia	8.9	10.0	10.9	11.7	0.0	0.4	0.4	0.3	6.7	6.1	6.1	6.2
Hesse-Nassau	12.4	13.3	13.7	14.6	0.1	0.8	0.9	0.9	7.0	6.6	6.9	7.1
Rhineland	13.0	13.7	14.1	14.7	0.6	1.3	1.6	1.8	9.0	8.4	8.0	8.1
Bavaria	9.2	10.4	11.0	12.6	0.1	0.1	0.2	0.3	8.2	8.6	8.8	8.8
Kingdom of Saxony	14.1	14.4	15.0	15.2	0.0	0.5	0.7	0.7	11.1	10.5	10.7	10.1
Württemberg	8.8	10.2	11.0	12.1	0.4	0.4	0.5	0.5	8.3	8.8	8.5	8.8
Mecklenburg-Schwerin	4.9	6.3	7.3	8.8	0.1	1.6	2.4	2.5	11.2	6.1	5.3	6.8
Alsace-Lorraine	12.7	12.4	13.3	13.8	0.0	0.0	0.1	0.2	6.7	5.3	5.4	5.7
Germany	10.6	11.6	12.4	13.3	0.7	1.5	1.8	2.1	7.2	6.7	6.9	7.0

Sources:

Monatshefte zur Statistik des Deutschen Reichs, February 1880, pp. 54 ff., Tables 9-11.

Vierteiljahrshefte zur Statistik des Deutschen Reichs, 1894, pp. IV. 172 ff., Table 6.

Vierteiljahrshefte zur Statistik des Deutschen Reichs, 1902, pp. III. 180 ff., Table 4.

Vierteiljahrshefte zur Statistik des Deutschen Reichs, 1915, pp. I. 48 ff., Table 6.

TABLE A.18 (cont.)

	Oats				Potatoes				Hay			
	1878-83	1887-96	1899-1902	1907-16	1878-83	1887-96	1899-1902	1907-16	1878-83	1887-96	1899-1902	1907-16
Prussia	1.05	1.10	1.71	1.95	7.23	8.44	13.22	14.19	2.37	2.13	3.49	4.04
East Prussia	0.83	0.84	1.53	1.63	5.52	6.66	11.28	13.07	1.74	1.52	3.38	4.04
West Prussia	0.93	0.93	1.50	1.83	6.21	7.56	11.67	13.47	2.52	1.95	3.26	4.41
Brandenburg	0.89	0.93	1.60	1.88	8.33	8.83	13.93	14.62	2.27	2.06	3.34	3.92
Pomerania	0.93	0.96	1.53	1.97	7.57	8.98	13.37	14.39	2.37	2.04	3.20	3.98
Posen	0.77	0.80	1.42	1.87	6.81	8.02	12.96	15.16	2.32	1.91	3.00	4.00
Silesia	1.09	1.11	1.69	1.96	7.01	8.49	13.16	14.00	2.35	2.25	3.24	3.78
Saxony	1.28	1.41	2.09	2.18	8.90	9.55	14.78	14.25	2.48	2.34	3.77	3.91
Schleswig-Holstein	1.33	1.32	1.92	2.22	6.61	7.39	11.32	12.67	2.37	2.42	3.39	3.83
Hanover	1.11	1.26	1.95	2.08	7.69	8.85	14.08	14.81	2.47	2.34	3.70	4.06
Westphalia	1.04	1.14	1.64	1.84	7.23	9.09	13.61	14.15	2.75	2.47	4.05	4.24
Hesse-Nassau	1.04	1.12	1.82	1.94	6.90	8.44	13.88	14.12	2.79	2.44	4.28	4.33
Rhineland	1.32	1.41	1.84	2.01	6.76	8.74	13.45	13.65	2.90	2.50	3.76	4.33
Bavaria	1.23	1.26	1.55	1.60	8.97	10.03	13.14	11.27	5.14	4.50	4.97	5.00
Kingdom of Saxony	1.50	1.57	2.05	2.15	10.00	10.79	14.36	13.44	3.23	3.04	3.96	4.09
Württemberg	1.24	1.18	1.42	1.54	7.06	9.14	11.99	10.45	4.45	4.05	4.70	5.27
Mecklenburg-Schwerin	1.49	1.56	1.88	2.26	11.42	11.59	14.06	14.23	3.02	3.19	3.94	4.31
Alsace-Lorraine	1.18	1.16	1.40	1.55	8.43	10.01	12.98	10.96	4.62	3.98	4.20	5.09
Germany	1.14	1.19	1.71	1.90	7.80	8.96	13.26	13.48	3.29	2.98	4.02	4.42

Sources: *Statistisches Jahrbuch für das Deutsche Reich*, 1886, p. 23, Table III.3c; 1899, p. 26, Table III.3f; 1904, p. 34, Table III.4b; 1919, p. 69, Table III.5b.

TABLE A.19
Asset yields and prices, 1871-1913

	Nominal rate on new mortgage debentures	Berlin bill rate	Average yield of securities	Market rate of return on shares ¹	Index of share prices
	(per cent.)				(1913 = 100)
1871	4.65	..	4.44	8.73	65.4
1872	4.60	..	4.26	7.69	88.0
1873	4.64	..	4.30	6.51	86.8
1874	4.67	..	4.24	6.20	66.8
1875	4.62	..	4.25	4.92	52.9
1876	4.65	3.04	4.22	4.83	43.1
1877	4.58	3.17	4.23	5.43	39.6
1878	4.57	3.07	4.25	5.22	41.7
1879	4.40	2.60	4.18	5.24	50.1
1880	4.28	3.04	4.05	5.00	64.5
1881	4.00	3.50	3.97	4.92	67.6
1882	4.00	3.89	3.95	4.98	67.6
1883	4.00	3.08	3.93	4.92	68.1
1884	4.00	2.90	3.88	4.83	65.5
1885	3.86	2.85	3.81	4.59	63.2
1886	3.50	2.16	3.73	4.36	63.8
1887	3.79	2.30	3.70	4.79	65.4
1888	3.68	2.11	3.64	5.47	74.8
1889	3.50	2.63	3.61	5.39	91.0
1890	3.73	3.78	3.67	5.90	88.4
1891	4.00	3.02	3.71	5.48	76.7
1892	3.99	1.80	3.67	4.90	73.2
1893	3.93	3.17	3.66	4.74	73.6
1894	3.63	1.74	3.55	4.98	79.1
1895	3.50	2.01	3.37	4.69	89.2
1896	3.50	3.04	3.34	5.40	91.8
1897	3.50	3.09	3.36	5.40	97.1
1898	3.58	3.55	3.41	5.54	100.2
1899	3.94	4.45	3.54	5.53	102.3
1900	4.00	4.41	3.68	5.54	94.2
1901	4.00	3.06	3.65	4.74	83.6
1902	3.98	2.19	3.52	4.45	84.9
1903	3.78	3.01	3.53	4.87	88.5
1904	3.87	3.14	3.57	4.98	94.5
1905	3.84	2.85	3.57	5.10	103.5
1906	3.94	4.04	3.63	5.49	102.3
1907	4.02	5.12	3.75	5.69	94.4
1908	4.02	3.52	3.80	5.01	91.7
1909	4.00	2.87	3.70	4.99	97.4
1910	4.00	3.54	3.76	5.02	103.4
1911	4.00	3.54	3.79	5.15	104.2
1912	4.03	4.22	3.91	5.51	104.0
1913	4.11	4.98	4.09	5.43	100.0

¹ Average dividend rate on nominal values of shares divided by the index of share prices.

Sources:

Average nominal yield on newly issued debentures and Berlin bill rate: K. Hunscha, *Die Dynamik des Baumarkts*, Berlin, 1930, p. 61.

Market yield on securities, market rate of return on shares and index of share prices: O. Donner, *Die Kursbildung am Aktienmarkt*, Berlin, 1934, pp. 97-99.

TABLE A.20
Real investment in building, 1871-1913
 (Million marks, constant 1913 prices)

	<i>Industrial</i>	<i>Agricultural</i>	<i>Non- agricultural residential</i>	<i>Public</i>	<i>Total</i>
1871	140	230	180	80	640
1872	210	260	310	100	870
1873	220	330	690	110	1350
1874	230	270	1010	120	1620
1875	320	270	1240	150	1980
1876	320	250	1130	150	1850
1877	230	190	860	140	1420
1878	200	170	890	130	1300
1879	200	170	770	170	1310
1880	220	130	500	180	1030
1881	220	160	510	180	1070
1882	220	170	570	130	1090
1883	260	120	620	120	1120
1884	300	130	760	80	1270
1885	300	220	700	110	1320
1886	320	320	570	120	1320
1887	330	270	810	130	1530
1888	370	250	910	140	1670
1889	410	170	1060	150	1790
1890	460	140	1350	150	2090
1891	440	130	1470	150	2190
1892	420	140	1530	150	2230
1893	470	150	1400	150	2180
1894	510	150	1300	140	2100
1895	580	150	1150	170	2060
1896	680	210	1080	140	2120
1897	780	200	1110	150	2250
1898	720	200	1310	180	2420
1899	640	200	1510	230	2580
1900	530	150	1680	250	2610
1901	470	180	1820	300	2770
1902	550	270	1700	330	2850
1903	620	380	1850	380	3200
1904	720	450	1800	350	3310
1905	820	300	1760	340	3220
1906	940	320	1890	270	3420
1907	830	250	2230	370	3680
1908	780	390	2050	350	3570
1909	680	530	1770	410	3390
1910	670	630	2040	360	3700
1911	780	580	2000	390	3740
1912	840	640	1840	350	3670
1913	900	500	1750	290	3440

Sources: Estimates of W. G. Hoffmann.

TABLE A.21. *Capital issues, 1883-1913*
(Million marks)

	State securities		Municipal loans		Mortgage debentures		Railway debentures		Industrial debentures		Railway shares		Bank shares		Insurance shares		Industrial shares		Total	
	N ¹	I ²	N	I	N	I	N	I	N	I	N	I	N	I	N	I	N	I		
1883	42.5	44.2	59.3	59.3	101.1	101.1	..	..	45.8	45.8	38.9	41.0	32.0	35.6	4.3	4.4	27.8	32.4	442.1	453.9
1884	46.2	47.1	47.5	47.5	188.2	188.2	6.0	5.8	48.0	48.0	6.9	7.1	..	..	..	..	27.5	31.0	370.1	374.8
1885	80.4	79.0	62.0	62.0	154.2	154.2	9.3	9.2	32.9	32.9	..	..	3.6	3.8	..	..	45.1	48.1	387.8	389.1
1886	78.0	77.7	104.7	104.7	251.9	251.9	4.6	4.9	12.8	12.8	5.0	4.9	18.4	19.6	3.9	3.7	49.4	53.0	525.3	930.2
1887	154.5	154.5	66.1	66.1	214.9	214.9	4.0	4.0	31.0	31.0	0.6	0.6	28.0	35.5	..	..	70.8	92.1	571.9	598.6
1888	670.8	671.2	30.3	30.4	324.7	324.7	3.0	3.0	28.0	28.0	0.1	0.1	51.9	61.2	0.7	1.3	140.3	194.5	1249.4	1317.4
1889	230.6	230.6	15.4	15.3	406.3	406.3	4.7	4.7	19.8	19.8	5.1	5.1	105.4	137.9	0.9	1.3	231.3	357.4	108.4	1157.7
1890	442.5	414.9	59.8	58.1	292.4	292.4	8.0	8.0	54.9	55.2	1.5	1.7	78.7	140.0	..	..	153.1	200.5	1090.7	1134.8
1891	512.0	440.7	89.8	84.8	341.7	341.7	..	..	29.3	29.4	4.7	5.9	33.1	40.9	..	..	24.8	29.7	1043.4	973.0
1892	369.5	313.9	56.1	55.1	437.9	437.9	3.7	3.7	13.3	13.3	4.8	4.3	2.0	2.5	..	..	12.9	14.8	900.0	845.5
1893	401.0	356.7	82.1	79.8	349.8	349.8	2.1	2.1	68.6	68.9	4.2	4.6	21.6	34.0	1.8	2.6	19.6	25.3	950.7	923.8
1894	226.0	202.5	94.8	92.9	559.6	559.6	7.8	8.0	48.4	50.3	1.4	1.8	31.6	36.2	2.0	5.1	60.3	79.0	1031.8	1035.3
1895	41.5	42.7	95.3	96.8	500.0	500.0	5.5	5.6	40.4	40.4	2.4	2.6	113.0	143.1	2.5	2.7	101.2	223.3	901.7	1056.7
1896	59.0	58.7	101.5	101.3	487.6	487.6	47.5	48.6	42.4	42.8	26.1	37.8	157.8	213.4	2.2	3.5	245.3	333.9	1169.2	1327.6
1897	20.0	19.2	148.3	147.9	483.3	483.3	9.7	9.8	56.9	58.0	6.2	9.7	173.1	265.7	..	..	100.9	318.2	1088.5	1311.8
1898	168.1	160.4	101.7	100.8	364.8	364.8	16.8	17.0	139.8	141.1	14.8	17.9	273.4	272.8	..	..	310.2	520.6	1389.6	1697.4
1899	430.5	399.2	269.0	261.1	447.1	447.1	49.5	49.6	73.2	77.0	6.5	8.8	211.6	276.5	..	..	535.9	861.4	2001.5	2377.5
1900	216.3	220.4	222.4	220.4	126.1	126.1	88.2	85.0	178.2	178.8	49.6	55.6	138.0	174.5	..	..	297.5	401.1	1316.3	1501.8
1901	554.0	505.6	204.4	203.6	210.5	210.5	15.0	14.8	189.3	193.3	2.9	3.0	30.6	36.3	..	..	116.0	164.3	1412.7	1421.3
1902	580.0	536.4	197.9	196.1	411.4	411.4	8.8	8.7	164.3	168.1	43.9	48.1	81.5	114.3	..	..	160.4	184.9	1647.7	1657.2
1903	340.0	317.6	214.1	208.6	564.7	564.7	2.0	1.9	65.2	65.0	3.9	3.4	46.6	67.6	..	..	157.3	192.3	1424.1	1424.1
1904	343.0	335.6	242.6	239.5	506.2	506.2	8.6	8.5	109.1	110.1	3.5	3.8	129.5	196.5	2.4	2.8	234.3	359.8	1579.2	1702.9
1905	428.8	429.7	258.9	257.4	509.5	509.5	12.0	11.8	114.1	115.2	..	..	116.8	146.5	..	..	309.2	552.1	1869.2	2082.2
1906	637.0	638.1	346.8	347.0	404.6	404.6	9.5	9.0	182.3	183.1	1.7	2.2	184.2	282.2	1.5	1.9	300.9	653.8	2158.5	2521.8
1907	551.0	546.2	430.9	425.4	326.3	326.3	1.0	1.0	170.9	172.8	0.6	0.6	108.9	152.5	3.1	3.1	284.1	431.3	1876.8	2059.3
1908	1259.0	536.3	511.7	756.3	756.3	3.2	3.2	317.4	314.7	16.2	18.9	50.2	68.8	11.0	11.6	262.3	599.8	322.3	3544.2	3544.2
1909	1665.0	1002.9	395.2	409.9	646.9	646.9	4.5	4.5	270.7	273.5	25.0	28.6	53.3	86.9	3.0	4.0	410.0	731.3	2873.7	3241.5
1910	613.3	624.9	245.4	247.5	680.5	680.5	1.0	1.0	134.8	135.9	4.9	4.7	190.1	273.5	4.0	4.2	284.1	504.4	2158.1	2476.7
1911	238.9	241.9	303.9	308.6	621.5	621.5	23.5	23.5	200.2	203.8	4.4	5.5	137.9	177.4	14.7	12.0	315.5	536.0	1950.5	2220.2
1912	635.0	642.6	363.1	360.4	204.2	204.2	9.0	9.0	388.0	387.8	..	..	105.4	139.6	8.8	15.4	457.0	905.8	2170.5	2664.4
1913	780.1	765.8	426.5	407.5	50.0	50.0	1.0	1.0	210.1	209.8	..	..	49.3	59.2	7.0	12.4	286.8	500.9	1862.7	2035.5

¹ Nominal value.

² Issue price.

Source: H. Kleiner, *Emissions-Statistik in Deutschland*, Stuttgart, 1914, pp. 129-30.

TABLE A.22
Series of output and income, 1871-1913

	Mining	Iron	Steel	Textiles	Leather	Bricks	Sugar	Brewing	Tobacco	Gas	Wheat	Rye	Personal
	(1913 = 100)										(M. marks at 1913 prices)		(1,000 m. marks)
1871	14.9	8.1	7.3	38.3	30.7	..	9.4	38.3	71.7	..	312	518	..
1872	17.3	10.3	8.7	38.6	34.2	28.5	6.9	46.0	104.1	..	361	568	..
1873	18.6	11.6	8.7	41.3	34.1	47.4	9.7	50.5	69.2	..	363	496	..
1874	18.0	9.9	9.6	41.1	35.3	53.8	10.8	52.1	66.2	..	421	661	..
1875	18.7	10.5	8.8	37.5	32.9	61.7	9.5	53.1	65.8	..	345	585	..
1876	19.3	9.7	8.2	39.8	30.9	61.2	13.2	53.0	67.0	..	319	511	..
1877	19.3	10.0	8.3	38.5	29.9	52.9	10.7	52.2	71.5	9.7	394	697	..
1878	20.3	11.1	9.2	38.8	33.7	55.8	14.0	51.8	73.9	..	467	792	15.9
1879	21.3	11.5	9.2	44.8	35.8	44.5	15.7	50.7	76.5	..	402	604	16.1
1880	23.9	14.1	10.9	40.1	36.2	37.3	15.1	52.6	76.9	..	411	521	16.4
1881	25.1	15.1	12.5	42.6	35.3	35.1	20.5	53.4	71.0	9.0	356	589	16.6
1882	26.9	17.5	14.1	44.4	36.4	33.4	22.2	53.6	52.4	9.6	456	666	16.8
1883	28.6	18.0	13.5	51.0	40.4	39.7	30.7	55.8	58.7	11.8	411	606	17.2
1884	29.1	18.6	13.7	52.8	42.3	40.6	34.7	57.8	67.5	..	435	588	17.5
1885	29.6	14.1	13.4	50.8	44.8	42.0	41.5	57.1	62.0	14.2	463	643	17.8
1886	29.2	18.3	13.6	52.9	43.9	38.6	29.9	61.5	67.9	..	477	677	18.3
1887	30.6	20.3	15.9	57.6	43.8	44.0	37.6	64.3	70.6	16.7	509	718	18.8
1888	32.8	22.5	16.6	59.5	46.5	49.0	35.4	65.1	64.7	17.4	449	600	19.4
1889	34.0	23.4	18.0	68.6	44.8	55.0	36.6	71.5	73.4	19.6	415	578	20.2
1890	35.4	24.1	18.0	65.0	42.6	60.8	46.6	72.1	78.4	20.8	505	648	20.9
1891	36.6	24.0	19.0	65.8	47.5	62.4	49.4	72.6	72.0	21.8	410	507	21.4
1892	36.3	25.6	19.0	66.7	46.8	64.0	44.3	74.7	70.2	22.9	541	784	21.6
1893	37.3	25.8	19.4	68.8	47.3	65.7	45.5	75.9	72.5	23.3	547	877	21.9
1894	38.5	27.9	21.4	72.6	49.2	68.5	..	..	..	24.5	537	807	22.4
1895	39.8	28.3	22.4	80.9	56.4	71.0	67.5	82.8	90.6	25.1	509	732	23.0
1896	43.2	33.0	26.6	74.8	54.3	72.6	60.5	84.1	90.8	27.2	554	831	23.8
1897	45.6	35.7	28.4	77.8	60.3	74.2	67.3	90.6	92.3	29.1	526	789	24.8
1898	48.1	38.3	31.8	85.3	64.5	75.7	68.2	92.7	82.6	31.5	587	890	25.9
1899	51.0	41.6	34.4	84.6	58.1	79.0	63.6	94.8	80.2	33.8	629	850	27.2
1900	55.1	43.6	33.4	72.8	65.5	82.2	66.3	96.7	85.4	35.2	627	833	28.3
1901	55.1	40.3	32.0	74.0	57.9	84.6	73.1	97.1	89.1	39.5	399	792	28.8
1902	54.8	43.5	38.4	79.7	57.8	87.0	85.1	92.4	88.0	42.1	642	938	29.3
1903	59.5	52.2	42.6	86.7	66.9	89.4	66.1	94.1	87.7	46.1	583	990	30.1
1904	61.6	52.3	42.2	84.1	72.5	81.6	71.0	95.8	89.5	48.8	625	1006	31.4
1905	63.1	56.9	47.0	88.0	75.5	94.1	59.3	99.1	97.3	52.1	605	951	32.8
1906	70.7	64.6	53.4	86.7	76.9	95.5	88.7	99.8	86.0	56.4	649	955	35.3
1907	74.0	67.4	55.3	97.3	76.9	97.0	82.8	100.5	94.2	60.4	572	972	37.4
1908	75.9	61.2	64.7	94.5	78.4	98.5	79.0	96.8	104.7	62.4	610	1084	38.6
1909	77.1	66.9	68.4	99.3	85.9	100.0	76.8	93.5	84.1	65.8	619	1155	40.2
1910	80.4	76.6	75.8	91.9	89.0	101.5	75.3	93.2	92.0	75.4	634	1055	41.8
1911	84.7	80.7	83.0	96.7	87.6	101.8	95.0	101.7	95.8	76.5	670	1099	43.6
1912	92.7	92.5	95.1	107.8	87.3	102.1	55.3	98.1	109.9	84.4	726	1174	45.6
1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	778	1249	47.9

Sources: Estimates of W. G. Hoffman.

TABLE A.23

*Average export prices by commodity groups, 1872-1913*¹

(1895 = 100)

	<i>Food</i>	<i>Raw materials</i>	<i>Chemicals</i>	<i>Metal goods</i>	<i>Textiles</i>	<i>Machines</i>	<i>Fuel</i>
1872	209.8	146.0	218.1	371.6	182.4	148.2	..
1873	226.0	118.0	189.4	369.5	160.8	148.2	..
1874	219.6	123.3	183.0	330.6	160.9	148.2	..
1875	216.9	117.4	177.8	285.3	160.8	115.7	..
1876	220.7	109.5	172.1	275.8	153.4	92.7	..
1877	227.8	108.2	159.2	247.4	147.3	105.2	..
1878	222.9	111.7	154.9	226.3	139.2	101.3	..
1879	227.5	103.9	158.0	226.3	131.1	88.3	..
1880	177.5	120.0	167.0	213.7	141.9	98.7	56.4
1881	162.8	117.7	154.1	179.0	180.4	104.0	58.9
1882	142.5	126.3	154.6	169.5	183.8	104.0	89.3
1883	141.4	128.9	126.3	168.4	177.7	97.5	83.6
1884	115.4	124.6	119.6	144.2	167.4	93.5	75.3
1885	118.1	120.2	121.0	121.1	124.3	91.0	82.3
1886	126.0	121.2	114.8	110.5	129.1	87.0	80.4
1887	116.9	118.2	110.8	115.8	134.5	90.9	89.3
1888	112.8	115.9	102.5	120.0	127.0	94.8	96.2
1889	134.2	116.6	98.6	143.2	132.4	110.5	110.8
1890	143.6	112.5	117.0	132.6	129.1	117.0	134.8
1891	109.0	100.8	93.7	123.2	118.3	113.8	128.5
1892	108.3	100.8	97.6	113.7	111.5	102.7	109.5
1893	113.2	93.9	99.8	106.3	103.4	100.0	99.4
1894	104.9	90.0	101.1	101.1	98.0	97.5	100.7
1895	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1896	101.1	101.5	92.0	109.5	106.1	106.5	103.2
1897	90.6	94.1	82.3	115.8	104.7	111.7	106.3
1898	114.7	92.1	74.2	113.7	106.8	114.3	115.9
1899	115.8	103.3	59.6	136.8	127.0	127.3	131.0
1900	106.0	105.1	55.4	143.5	131.1	136.0	148.1
1901	104.9	101.5	53.3	114.7	116.2	117.5	146.2
1902	100.0	99.2	46.1	106.3	122.3	113.7	130.4
1903	102.3	101.3	42.3	103.2	122.3	110.8	125.3
1904	109.0	100.5	39.5	102.1	123.0	110.8	126.6
1905	116.5	102.3	38.0	105.3	135.1	114.8	126.6
1906	109.0	105.4	39.9	134.7	143.9	141.3	143.1
1907	136.1	101.8	35.8	117.9	152.0	161.0	139.3
1908	138.7	91.1	38.5	114.7	146.0	162.4	139.3
1909	145.1	86.7	37.8	108.4	139.9	154.0	129.8
1910	154.9	93.9	38.7	109.5	139.9	154.0	129.8
1911	149.8	92.6	35.1	107.4	137.8	120.1	131.7
1912	158.7	102.1	33.7	124.2	135.8	122.9	143.1
1913	160.9	108.7	32.3	126.3	140.5	124.3	145.0

¹ For details of calculation, see Appendix C.

Sources: Calculated from statistics of foreign trade published in issues of *Statistik des Deutschen Reichs*, vols. 3-61 of the old series, 9-172 of the new series.

TABLE A.24
Average import prices by commodity groups, 1872-1913¹
 (1895 = 100)

	Food grains	Other food, drink, and tobacco	Fuels	Metals and ores	Raw materials for consumer goods	Metal goods, machinery, and transport equipment	Textiles	Other raw materials	Chemicals
1872	186.2	132.1	420.3	216.1	149.4	266.0	139.3	120.7	281.8
1873	203.3	140.8	393.5	216.1	158.8	300.8	134.8	152.3	270.6
1874	213.8	136.7	338.2	197.6	151.0	196.6	127.4	146.4	253.1
1875	186.9	139.4	315.5	195.1	154.2	156.8	127.4	162.0	251.7
1876	198.7	142.9	471.6	178.5	151.8	153.4	115.0	125.2	251.7
1877	194.8	142.1	387.0	155.1	145.6	135.3	111.1	115.8	242.6
1878	167.6	133.8	288.2	142.4	136.4	125.4	105.0	111.6	232.1
1879	169.9	130.5	235.8	132.2	135.9	125.4	109.5	110.9	231.8
1880	178.7	121.4	239.0	139.0	147.7	116.2	124.9	121.4	217.1
1881	180.7	114.4	209.8	130.2	138.3	119.1	130.8	120.2	233.6
1882	159.0	117.1	188.6	124.9	134.5	123.6	138.5	111.4	230.8
1883	158.0	112.6	195.1	115.6	129.1	99.7	137.4	120.2	183.8
1884	142.3	97.3	195.1	104.9	130.5	102.4	133.8	111.2	156.7
1885	129.5	91.1	190.2	101.0	117.3	115.2	123.7	106.6	155.8
1886	124.3	90.1	170.7	102.0	120.0	108.9	120.2	110.7	141.4
1887	112.1	99.4	159.4	99.0	124.8	109.4	122.1	106.1	139.0
1888	115.4	106.2	196.8	104.9	117.0	111.3	122.3	107.8	126.2
1889	136.7	112.0	170.7	114.6	125.9	125.4	127.1	113.6	123.5
1890	141.3	108.4	148.8	120.5	127.0	122.8	127.9	115.1	120.1
1891	161.0	107.0	126.8	110.2	108.9	116.0	120.7	110.2	125.3
1892	151.5	97.7	107.3	98.1	109.4	109.2	99.8	106.3	123.5
1893	126.2	105.3	81.3	95.1	114.3	106.5	103.3	110.7	121.1
1894	101.0	102.3	75.6	96.1	97.3	102.9	101.0	101.0	105.5
1895	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1896	106.9	94.8	91.9	103.4	100.3	100.3	102.9	109.7	99.4
1897	120.7	96.1	67.5	113.2	98.1	100.8	110.0	117.0	96.0
1898	134.1	88.0	89.4	117.1	93.8	101.6	95.9	123.1	94.5
1899	123.0	94.0	105.7	152.2	111.6	116.2	101.5	122.1	91.8
1900	123.0	101.4	109.8	169.3	125.6	124.6	113.7	112.9	96.0
1901	128.2	100.4	91.9	139.5	118.1	107.1	109.4	95.6	96.6
1902	127.2	91.1	92.7	136.1	122.9	100.5	111.7	96.4	92.4
1903	119.4	90.7	111.4	131.2	128.3	99.0	112.9	100.2	92.1
1904	120.3	90.7	97.6	129.8	136.1	99.5	116.3	110.7	93.3
1905	131.2	97.1	81.3	146.2	134.8	104.7	116.9	121.7	91.5
1906	135.8	98.8	109.8	163.9	150.1	105.2	118.1	123.6	91.8
1907	149.0	96.3	121.1	182.4	161.5	115.4	126.5	137.5	90.9
1908	147.9	96.1	114.6	139.5	146.4	108.1	112.5	130.9	88.7
1909	155.1	95.5	112.2	143.4	143.9	108.9	129.5	137.0	86.3
1910	131.8	101.4	95.9	125.7	150.1	103.4	115.7	147.7	83.8
1911	150.2	113.4	111.0	143.4	153.4	103.4	107.3	146.2	86.0
1912	171.5	115.3	105.1	155.1	162.0	122.8	106.1	155.2	101.5
1913	147.6	113.6	110.6	177.1	156.9	120.7	119.2	150.1	87.2

¹ The details of calculation are given in Appendix C.

Sources: As for Table A.23.

TABLE A.25

Average export and import prices and terms of trade, 1872-1913¹

(1895 = 100)

	Import prices	Export prices excluding fuels and machinery	Export prices including fuels and machinery	Terms of trade excluding fuels and machinery	Terms of trade including fuels and machinery
1872	169.1	214.1	..	126.6	..
1873	178.1	197.4	..	110.8	..
1874	167.7	192.0	..	114.5	..
1875	166.8	182.0	..	109.1	..
1876	172.5	176.3	..	102.2	..
1877	161.7	169.0	..	104.5	..
1878	145.6	161.7	..	111.1	..
1879	140.8	160.4	..	113.9	..
1880	143.4	158.2	151.2	109.2	104.4
1881	137.4	156.5	149.9	114.1	109.3
1882	133.0	154.7	149.8	116.0	112.3
1883	130.3	148.4	143.5	119.9	116.0
1884	121.7	135.7	131.1	111.8	108.0
1885	113.9	121.1	118.2	106.4	103.8
1886	112.3	121.0	117.9	107.6	104.8
1887	115.1	120.1	117.3	105.1	102.6
1888	117.7	116.2	114.5	98.5	97.1
1889	123.3	124.3	123.1	101.2	100.2
1890	121.4	125.7	125.8	103.9	104.0
1891	115.6	108.6	109.7	95.2	96.2
1892	107.9	106.0	106.1	98.8	98.9
1893	108.1	102.7	102.2	94.9	94.7
1894	98.7	98.2	98.3	99.0	99.1
1895	100.0	100.0	100.0	100.0	100.0
1896	100.0	102.1	102.3	102.9	103.1
1897	101.2	97.3	98.2	97.9	98.8
1898	100.4	99.5	100.8	100.7	102.0
1899	107.9	108.4	110.1	102.9	104.6
1900	113.8	108.0	113.8	96.7	101.9
1901	107.0	98.9	94.6	95.4	91.2
1902	104.9	96.3	98.5	94.8	97.0
1903	107.1	96.0	97.9	91.3	93.2
1904	109.7	96.4	98.4	89.3	91.1
1905	113.5	101.3	103.0	90.4	91.9
1906	119.5	107.9	110.7	91.3	93.7
1907	119.3	110.1	113.1	91.8	94.3
1908	120.7	106.4	109.9	88.8	91.7
1909	122.4	103.8	105.6	85.9	87.4
1910	122.7	107.6	109.1	86.4	87.6
1911	130.0	104.9	106.7	80.1	81.5
1912	136.2	110.7	112.7	81.2	82.6
1913	133.0	114.0	115.8	85.3	86.7

¹ Details of calculation are given in Appendix C. Average prices of exports excluding machinery and of exports excluding fuel lie generally between those of exports including and excluding both. The indices of export prices and terms of trade, therefore, represent the extreme limits of variation.

Sources: As for Table A.23.

Appendix B

MAIN STATISTICAL SOURCES

THIS is a brief survey of the principal sources of statistics of prices, employment, production, and foreign trade.

B.1. *Retail price statistics*

Price series are available from two kinds of sources: statistical offices of state governments and of local authorities. Of the statistical offices of the states, the following are known to have published retail price series.

STATE	PUBLICATIONS
Prussia	<i>Zeitschrift des königlichen preußischen statistischen Bureaus (later Landesamts); Statistisches Jahrbuch für den preußischen Staat.</i>
Bavaria	<i>Zeitschrift des königlichen bayerischen statistischen Bureaus; Statistisches Jahrbuch für das Königreich Bayern.</i>
Baden	<i>Statistische Mitteilungen über das Großherzogtum Baden.</i>
Württemberg	<i>Württembergische Jahrbücher für Statistik und Landeskunde.</i>
Hesse	<i>Mitteilungen der großherzoglichen hessischen Zentralstelle für Landesstatistik.</i>

This list may not be comprehensive. Owing to the disorganization and the loss of material during and after the last war, great labour and luck are required in tracking down sources; hence it is possible that other material can be discovered. But its significance will not be great since four of the five largest states—all except the Kingdom of Saxony—are included above.

It is also impossible to get a comprehensive view of the statistics of towns. Almost all accessible sources have been used in the construction of the cost-of-living index and listed in the sources of Table A.9.

The series refer almost without exception to basic foodstuffs. Very occasionally series for beer, coal, and oil are to be found.

The Prussian series are the longest; some start as far back as 1816. But most of them start in 1871 or 1873. Bavarian series start around 1876. Some series for particular towns are given in the state statistics.

A few statistical offices of cities (Berlin and Dresden for example) began publishing statistics in the 1870s; but most local series start in the 1890s, and quite a few after 1900. Rent statistics are available only from local sources; they become more abundant after 1900, when housing shortages led many cities to introduce registration of vacant dwellings.

Very useful collections of local statistics are to be found in the *Statistisches Jahrbuch deutscher Städte*, published by the Verband deutscher Städte-Statisti-

stiker from Breslau at irregular intervals from 1890; the earliest series in it begin in 1885. Another good source of retail price series is the volumes on the cost of living published by the Verein für Sozialpolitik (vols. 145.I-IV, *Kosten der Lebenshaltung in deutschen Großstädten*, 1914-15); most series in it run from 1890 to 1910 or 1912.

B.2. Wholesale prices

The most comprehensive set of wholesale price statistics is that collected by the Statistisches Reichsamt, starting in 1879. It was published in a number of places—annually in the *Monatshefte* (from 1892, *Vierteljahrshefte*) zur *Statistik des Deutschen Reichs*, in the annual issues of the *Statistisches Jahrbuch für das Deutsche Reich*, and up to 1905 in the *Statistisches Handbuch für das Deutsche Reich* published in 1907. Prices are given for agricultural commodities, cattle, pigs, basic raw materials, metals, and fuels; series for some cities are extended back to 1871.

Prussia also published wholesale prices of a number of foodstuffs. The sources are the same as for retail prices (Section B.1).

There probably existed a mass of local price material for market towns; much of it is available today from secondary sources. One of the most reliable among them is the statistical appendix to the new edition of Arthur Spiethoff's work on trade cycles, *Die wirtschaftlichen Wechsellagen, Aufschwung, Krise, Stockung* (Tübingen and Zürich, 1955). The series there begin in 1890. Another good source is Otto Schmitz, *Die Bewegung der Warenpreise in Deutschland von 1851 bis 1902* (Berlin, 1903); the prices are mostly for Hamburg.

Nothing is comparable for the number and length of wholesale price series to the study of Jacobs and Richter, *Die Großhandelspreise in Deutschland von 1792 bis 1932* (Berlin, 1935), which gives series for forty-five commodities, all reaching back to 1850 and most to 1792. Besides common foodstuffs and raw materials they give the prices of some manufactured goods, e.g. metals, building materials, and textiles.

Jacobs and Richter's price indices are based on market prices in one city at a time. Owing to the length of the period, the number of links is naturally large. Normally only price series of comparable quality are used, and series are compared over an overlapping period of six or eight years for similarity of movements. The bulk of the material comes from Hamburg and Berlin. Hence it is doubtful if the claim of the series to be nationally representative can be sustained in detail; nevertheless, their continuity and uniform quality make them preferable to most alternative series.

B.3. Employment statistics

Three sets of employment statistics of national significance are available—statistics from occupation and establishment censuses for benchmark years from 1875, accident insurance statistics available annually from 1886, and annual factory inspectors' statistics from 1896. They follow similar industrial classifications and are therefore mutually comparable.

Employment statistics can also be derived from information published by sickness insurance offices (*Krankenkassen* and *Knappschaftsvereine*), available

in irregular issues of *Statistik des Deutschen Reichs*, and from 1902 also in *Vierteljahrshefte zur Statistik des Deutschen Reichs*. The organization of the statistics is very haphazard however. Sickness insurance associations were organized partly on an industrial basis (for example for mining and building) and partly on a geographical basis, so that their details are of little use. As an indicator of employment in all industries and regions together, accident insurance or factory inspectors' statistics have a better coverage.

B.31. *Censuses of occupations and establishments*

The first census of occupations was held on 1 December 1875. Being held in winter it seriously underestimated employment. Oil was expensive in those days, and the use of gas for lighting was not yet widespread; further, labour was easy to obtain. So many establishments closed down in winter to save lighting expenses. Employment in outdoor occupations like building was also underestimated.

The censuses of 1882, 1895, and 1907 were held in June and thus give an estimate for peak employment in the year for most industries; however, they underestimated employment in the lumber industry which worked in winter. They also ignored seasonal migration of labour between industries. Such migration was common in the sugar industry and in Silesian coal-mining, whose workers went to the fields in summer to help in harvesting.¹ Some idea of seasonal changes in employment can be gained from figures of maximum employment in the year given in the report on the 1907 census.

The results were published in *Statistik des Deutschen Reichs* (old series, vols. 34-35, new series, vols. 2-7, 102-19 and 202-19). The characteristics chosen for classification were occupation, age, sex, marital status, and religion of occupied persons (including workers, employers, and self-employed persons) and industry, size, and energy consumption of establishments. Information was published for the empire, the states, and cities with a population of over 100,000. The information for states normally gave details for their provinces, and often for districts (*Kreise*).

A single census was held in 1882, but the information was organized into two sets of statistics for occupied persons and for establishments. In 1895 and 1907 independent censuses were held for persons and establishments. Statistics were published separately for agriculture and gave information on agricultural machinery; information about livestock, material inputs, yields, etc., was not simultaneously collected however.

The counting and the coverage of the censuses are probably fairly accurate; defects in classification are more serious. The original classification in twenty-two trades, drawn up for the Prussian occupation census in 1861, was essentially a classification by products.² Hence where people were doing a number of jobs

¹ F. Kuh describes the migration out of Silesian coal-mining ('Die Hüttenindustrie Oberschlesiens', *Schriften des Vereins für Sozialpolitik*, vol. 106, Leipzig, 1903, pp. 43-145). The migration out of the sugar industry can be inferred from the fact that census estimates of employment in the industry were much lower than the number insured against industrial accidents.

² See E. Engel, *Die deutsche Industrie 1875 und 1861*, Berlin, 1880.

or were engaged in firms producing a number of products, their classification was hazy. The difficulty was met by establishing lists of correspondence between jobs as they were commonly named and official industry classes, and by collecting much information about subsidiary occupations (*Nebengewerbe*).

The second device successfully dealt with the problem of persons (mainly farmers) who carried on other work in their leisure time; but it could not tackle the problem of people doing a number of jobs or people in multi-product firms. Firms branched out in fields with similar techniques; so there was much vagueness at the boundaries between mining, metal-working, and machine-making, as well as between chemicals, lighting materials, fats, and oils. In the middle of the century, 'fats and oils' was an industry that prepared vegetable oil, wax, resin, and tallow for lighting. Gas was included in the class when it became an important lighting material; soap also came to be included since it was made of oil. By 1907 the class was a ragbag of diverse trades. The class for wood and wickerwork (*Holz- und Schnittstoffe*) also consisted of entirely different industries like lumber and furniture-making.

In spite of these increasingly apparent inadequacies the basic industry classification was unchanged until after the First World War; the only new class that was introduced was that of music, theatres, and shows in 1907. The problem of new industries and products was met by increasing subdivisions in industry classes. The subdivision was done competently and amalgamation of classes was avoided, and a fair degree of continuity was maintained.

Employed persons were divided into self-employed persons, salaried personnel, and wage-earners. The self-employed were further divided into workers in cottage industries and others; salaried people into technical, supervisory, accounting, and administrative personnel, and workers into skilled and unskilled workers and helping dependents. The number of dependents that did not work was also given for each class.

This classification worked satisfactorily in industry, trade, and distribution, but it went awry in agriculture where the difference between different classes of occupied persons was not clear. Table B.1 illustrates this.

The table shows an increase in the number of persons occupied in agriculture of nearly 1.5 million between 1895 and 1907; along with this increase, there was a fall in the number of female dependents of farmers and managers of 1.3 million and a rise in the number of helping female family members of 2 million. The description of the methods and definitions followed in the two censuses shows no change whatever, but it is evident that while wives and daughters of farmers were generally recorded as dependents in 1895, many of them were listed as helping family members in 1907.

The number of wives included in the 1907 working population can be roughly estimated as follows. Few males remained dependents after their fourteenth year when they left school.¹ Hence we might suppose that all male dependents of farmers were minors who did not do much work on farms; and we would not be very wrong in assuming that the number of male and female minors was the same. Let us further assume that the number of wives equalled

¹ Cf. *Statistik des Deutschen Reichs*, vol. 2, pp. 96-98.

the number of farmers. Then none of the wives were recorded in the occupied population in 1882, 29,000 in 1895 and 1,013,000 in 1907. The effects of the facts that some farmers were unmarried and that the number of female minors somewhat exceeded that of male minors would tend to cancel each other. Thus, about a million wives were included in the occupied population in 1907 who would have been excluded in 1895: about a million of the increase of 1.5 million in the occupied population was illusory.

TABLE B.1
Persons occupied in agriculture and their dependents, 1882-1907¹

(Thousands: dependents italicized)

	1882			1895			1907		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Resident owners ²							1997	298	2295
Tenants	1977	276	2253	2178	345	2523	2021	3005	5027
Managers	2056	4157	6213	2141	4290	6431	112	25	137
Administrative personnel							15	2	17
Supervisory personnel				29	17	46	31	14	44
Accountants	42	6	47	6	15	21	6	13	20
	26	53	79	27	1	28	26	2	29
				26	48	73	25	42	68
				2	—	2	3	—	3
				—	1	2	1	2	3
Owners' family members	1011	923	1935	881	1017	1898	1051	2832	3883
	27	70	97	37	72	109	38	57	95
Bondsmen and bondswomen	974	615	1632	1068	651	1719	708	625	1333
	24	40	65	101	175	275	10	15	24
Day labourers with own land	748	118	866	315	67	383	214	46	259
	806	1571	2377	313	597	910	217	355	572
Day labourers with others' land							219	17	237
	786	588	1374	814	632	1445	276	414	691
	482	921	1403	563	1031	1594			
Landless day labourers							646	697	1343
							265	426	691
Total	5537	2527	8064	5315	2730	8045	5023	4558	9582
	3422	6812	10234	3187	6228	9415	2861	4331	7191

Further, the number of bondsmen's dependents went up by 210,000 between 1882 and 1895. Now, it was very rare for bondsmen to marry: the proportion of married bondsmen (and women) was below 4 per cent. as late as in 1907.³ Hence the increase in the number of their dependents must have consisted largely of parents and illegitimate children. This is possible but difficult to believe; it is also doubtful because the number of bondsmen's dependents fell to a mere 24,000 in 1907. What is more likely is that a number of landless labourers with families were counted as bondsmen in 1895. Similarly it is likely that some day labourers with land were counted as independent farmers in 1895. The census distinctions are by no means clear in agriculture.

¹ From *Statistik des Deutschen Reichs*, vol. 2, p. 8; vol. 102, p. 3; vol. 202, pp. 21-22.

² Figures for dependents include dependents of tenants and managers in 1907.

³ Statistisches Reichsamt, *Die deutsche Landwirtschaft*, Berlin, 1913.

B.32. *Accident insurance statistics*

The scheme of insurance against industrial accidents, outlined in section 2.1, also yields series of the number of insured persons by industry; they are given in Table A.6.

The coverage of the insurance scheme progressively increased; hence the number of insured persons rose faster than actual employment. Occupation censuses show an increase of about 25 per cent. in the number of people employed in the industries and trades covered by the insurance scheme between 1895 and 1907, while the number of insured persons rose by 65 per cent. The change in the coverage of the scheme cannot be worked out for individual industries since the insurance demarcation of industries is somewhat different from the census demarcation.

Grumbach and König have attempted to get round this problem by adding together figures for a number of industries and comparing the totals with corresponding census totals.¹ Their calculations show a rise in the coverage of insurance statistics in most industries between 1895 and 1907. It rose from 22.8 to 35.4 per cent. in clothing and laundering, from 52.9 to 61.2 per cent. in the leather industry, from 66.2 to 75.1 per cent. in foodstuffs and from 86.2 to 101.6 per cent. in chemicals, gas, and water. The increases in other industries were smaller, and there were declines from 113.9 to 89.4 per cent. in printing, 132.7 to 122.7 per cent. in building and 138.2 to 129.8 per cent. in shipping. It is impossible to say how the coverage changed from 1907 to the beginning of the First World War, but it was lower in 1925 than 1907.

As was noted in section 2.17, insurance statistics overestimated employment in industries with high labour turnover, presumably because firms submitted the number of workers employed at one time or another in the year rather than the average number employed. In such industries—building, stone quarries, bricks, and glass—the level of recorded employment was 20 to 35 per cent. above the average. Progressive increase in coverage was probably unimportant in these industries.

Statistics of insured persons were used to calculate changes in labour productivity in Table 5.3. Owing to the increase in coverage it is likely that the increase in employment between cycles III and IV was overestimated and the increase in productivity underestimated in all industries except bricks and building. This strengthens the contention in section 5.2 that the share of wages in value added declined in most industries between those two cycles. Estimates of changes in productivity between cycles IV and V are probably not far wrong, and the conclusion that the share of wages rose between them remains unaffected.

B.33. *Factory inspectors' statistics*

Statistics of employment in establishments subject to factory inspection are available from 1896 in *Amtliche Mitteilungen aus den Berichten der Gewerbe-Aufsichtsbeamten* (1896-8) and *Jahresberichte der Gewerbe-Aufsichtsbeamten*

¹ F. Grumbach and H. König, 'Beschäftigung und Löhne der deutschen Industrielwirtschaft', *Weltwirtschaftliches Archiv*, vol. 79, 1957, pp. 153-5.

(1900-24) published by the Reichs-Innenministerium.¹ They were also published in *Statistisches Jahrbuch für das Deutsche Reich*. There are gaps in the statistics in 1899 and 1914-17. The series are reproduced in Table A.7.

The criteria of coverage of establishments were somewhat chaotic. Factory inspection was a matter for individual states, and the criteria they laid down were not standardized till the end of 1908. Establishments subject to factory inspection—essentially those that employed women and children—were included; so were those using mechanical energy and those that employed a minimum number of workers. The minimum number varied between 5 and 20; in 1909 it was fixed at 10 in all states. In mining it was 5 throughout.

In spite of the heterogeneity in criteria the factory inspectors' figures show good correspondence with occupation census figures; their coverage is good and does not rise precipitately. This is illustrated in Table B.2.

Factory inspectors' figures begin in the year after the 1895 census and end in the year before the 1925 census; hence figures from those two censuses must be compared with factory inspectors' figures in adjacent years. Employment is likely to have risen between 1895 and 1896 and between 1924 and 1925; this must be borne in mind when looking at Table B.2.

TABLE B.2

Comparison of factory inspectors' and occupation census statistics of employment²

	Factory inspectors' figures as proportions of census figures (per cent.)		
	1895-6	1907	1924-5
Mining	—	118.6	148.5
Quarrying, pottery, glass, etc.	89.2	85.2	76.2
Metals	56.1	59.2	76.2
Machines	78.9	79.1	77.8
Chemicals	81.4	82.5	71.0
Soap, oils, fats, etc.	81.2	78.0	68.2
Textiles	71.9	79.7	77.0
Paper	59.1	60.3	73.8
Leather		45.6	36.7
Wood	40.8	48.9	63.3
Food, drinks, and tobacco	49.5	48.2	53.2
Clothing	11.3	23.4	51.8
Laundering	—	—	33.6
Building	—	8.7	46.9
Printing	77.0	82.2	16.4
			—

¹ Further details are given in the prefatory remarks to the tables of employment in the issues of *Jahresberichte der Gewerbe-Aufsichtsbeamten*; see also J. Müller, 'Die Erfahrung der Industrie durch die Statistik der Gewerbe-Aufsichtsbeamten', *Allgemeines Statistisches Archiv*, 1921-2, pp. 374-92.

² Calculated from the following sources: *Ämtliche Mitteilungen aus den Berichten der Gewerbe-Aufsichtsbeamten*, 1896, 1907, and 1924; *Statistisches Jahrbuch für das Deutsche Reich*, 1913, pp. 55-56, Table V.1: 1925, pp. 82-87, Table V.5.

The coverage of factory inspectors' statistics appears to have been about the same between 1895 and 1907 in non-metallic minerals, oils and fats, and food, drink and tobacco, and to have increased slightly in machines, chemicals, paper, and leather. The increase must have been somewhat larger—perhaps up to 10 per cent.—in metals and printing. The comparison between 1907 and 1924-5 is not very useful since the intervening years saw the disorganization of factory inspection by the war; but the coverage seems not to have changed much in metals, machines, textiles, wood and food, drink and tobacco.

B.4. *Production statistics*

The sources of production statistics are numerous and the picture they present untidy. Comment here is restricted to country-wide census-type data and to long series.

B.41. *Mining and metals*

Statistics in this field are comprehensive and reliable. They are based on annual census-type inquiries: non-response rates seem to have been negligible; and the products being fairly homogeneous, uninterrupted output estimates are available for long periods. The only exception is products of iron, whose number grew so rapidly that the classification tends to change frequently and to fall behind actual changes, especially after 1890.

The original statistics refer to Germany and Luxemburg (including Alsace-Lorraine from 1872) and are given in *Statistik des Deutschen Reichs* (O.S., 1871-82), *Monatshefte* (1883-90), and *Vierteljahrshefte* (from 1891 onwards) *zur Statistik des Deutschen Reichs*. They cover coal, lignite; mineral salt, sedimentary salt, potassium salts; ores of iron, zinc, lead, copper, silver, and gold; iron, steel, and their intermediate products; zinc, lead, copper, silver, gold, and sulphuric acid. The figures are also to be found in *Statistisches Jahrbuch* and *Statistisches Handbuch für das Deutsche Reich*, 1907.

An excellent source of the above and other data is M. Meisner's *Weltmontanstatistik* (Stuttgart, 1925-39). Besides giving statistics of annual production Meisner gives an able critique of them.

B.42. *Series as by-products of fiscal policy*

A few series—among them, production series of sugar, beer, brandy, champagne, and tobacco—are available as by-products of the excise administration. They were published in *Monatshefte* and *Vierteljahrshefte zur Statistik des Deutschen Reichs*, and reproduced in *Statistisches Handbuch für das Deutsche Reich*, 1907 and *Statistisches Jahrbuch*.

Three points are worth noting about these series. First, none of them refers to calendar years; and the years can be different where the commodity is subject to taxation by individual states. Second, the territory covered by the statistics is not always that of the empire. Third, different series begin in different years; for example, beer goes back to 1871, sugar to 1872, and brandy to 1887.

B.43. *Censuses of industrial production*

Censuses of industrial production were held in 1897 and 1913. The results were published in *Vierteljahrshefte zur Statistik des Deutschen Reichs* 1898 and a supplement to it in 1913.

The 1897 census covered only a few industries besides those included in annual inquiries (described in sections B.41 and B.42). The year of estimation was not the calendar year, and differed between industries. It is likely that as a pioneer attempt, this census is not very reliable.

The 1913 estimates are much better. The Statistisches Reichsamt began preparing for the census and collecting production statistics in 1907; so there were five years of preparation behind it. Besides mining and metal industries, various branches of chemicals and textiles, cars, cement, starch, etc., were covered. The annual production of some of the goods from 1907 to 1913 is also available. A comparison with the official statistics of mining and metal production suggests that the coverage of the census estimates was somewhat less complete.

B.44. *Wagenführ's estimates*

Rolf Wagenführ built up a comprehensive set of industrial production statistics for 1860-1932 (*Die Industriegewirtschaft*, Berlin, 1933). His description of his sources and methods is very inadequate, however. The probable sources of his series and an estimate of their reliability are given here.

For products mentioned in sections B.41 and B.42 Wagenführ probably used official sources; this would make them fairly reliable. For cotton textiles, rubber, and cocoa industries he probably used import statistics as indicators of raw material consumption and assumed that production was proportionate to material consumption; both assumptions are questionable.

For lime, cement, stones, clay and cement pipes, glass and glass manufactures, earthenware, iron and steel goods, machines, chemicals, wood and celluloid, paper and pulp, Wagenführ probably used series of railway traffic, which begin at about the same time. If so, very little confidence can be placed in them. Used in conjunction with industrial census estimates of employment, Wagenführ's output series for cement and machines show declines in productivity of 16 and 21 per cent. respectively in 1895-1907. In view of such implausible results this group of series must be considered extremely unreliable. For building and leather manufactures it is impossible to guess the sources.

The various aggregated series are very dubious. Wagenführ says that his weights are based on figures of employment and energy consumption in 1907. This description is highly inadequate, and it is hardly conceivable that he could have obtained good approximations to value added which should be the basis of weighting.

B.45. *Estimates of agricultural production*

Annual estimates of yields and harvests of field crops were made by the Statistisches Reichsamt from 1878 and published in the *Monatshefte* (later *Vierteljahrshefte*) zur Statistik des Deutschen Reichs.

Up to 1892 the estimates were based on reports from a number of people in

each district on the prospects of growing crops and by the heads of local authorities on actual results of crop-cutting operations; estimates from the two sources were averaged.¹ Yield estimates were used with the area under different crops as reported by local authorities to calculate total harvests. It is possible that large errors entered estimates of the quantities; but the variations and trends were probably well represented.

The number of reports on crop prospects was raised from one to eight in 1893; a report every month in the growing season (April to November) was asked for. The yields of barley and oats show substantial increases between 1893 and 1894, and the yields of wheat and rye a year earlier. The increases in yield are so large—some over 25 per cent.—as to suggest a change in methods. The weight given to crop reports was probably increased.

Crop-cutting experiments were stopped in 1898 and reliance was placed entirely on reports of crop prospects. This change coincided with further recorded increases of over 25 per cent. in yields of most crops and was doubtless their cause. It was officially estimated that the new method gave yield figures that were 15.5 per cent. over those given by the old method for wheat, 20 per cent. for rye, 24 per cent. for oats, and 16 per cent. for barley.² These figures probably offer a fair correction for the national series, but do not help in correcting production series for states. (The correction should be applied to figures after rather than before 1898; the latter, based as they were on actual yields, were more reliable.)³

Finck von Finckenstein used a more elaborate method of adjusting the levels of pre-1898 and post-1898 yields.⁴ He postulated a certain increase in yields between the periods preceding 1898 and following 1897 on the basis of five-year averages of yields in 1883-97 and 1898-1908. This was done for every province and state and the increases in national yields were derived as averages of provincial increases weighted by the area under each crop in each province. The results are probably an improvement on the raw figures; but they leave much room for scepticism since there is no reason to believe that five-year averages of yields should show linear trends. Besides, the problem of fictitious increases in 1891-3 is left untouched.

Censuses of livestock were held in 1873, 1883, 1892, 1897, 1900, 1904, 1907, and 1913. The results of the first census were published in *Statistik des Deutschen Reichs* (o.s., vol. 8). The rest were published in *Monatshefte* and *Vierteljahrshefte zur Statistik des Deutschen Reichs*.

¹ See H. W. Finck von Finckenstein, *Die Getreidewirtschaft Preußens von 1800 bis 1930*, Berlin, 1934, for a description of official methods.

² See C. Ballod, 'Die Produktivität der Landwirtschaft', *Schriften des Vereins für Sozialpolitik*, vol. 132.

³ This view is supported by N. Jasny and A. Hanau ('Die deutsche Getreide-Bilanz', *Blätter für landwirtschaftliche Marktforschung*, October, 1931, p. 201, and December, 1932, p. 315). H. W. Finck von Finckenstein differs, but his judgement rests not so much on the accuracy of statistics as on considerations of economy of computation: the methods used before 1878 and after 1897 were similar, and less work was involved in adjusting the estimates for 1878-97 to the earlier and later estimates than the other way round.

⁴ H. W. Finck von Finckenstein, op. cit.; also his *Die Entwicklung der Landwirtschaft in Preußen und in Deutschland 1900-1930*, Würzburg, 1960.

Many estimates of meat production are available;¹ the latest are those of E. Bittermann for benchmark years (*Die landwirtschaftliche Produktion in Deutschland, 1800-1950*, Halle dissertation, 1956) and A. Heese (*Die langfristige Entwicklung der deutschen Landwirtschaft*, Münster dissertation, 1956) for all years. Like earlier estimates, they involve considerable guesswork regarding the proportion of livestock annually slaughtered, deadweight of animals, etc., and differences in the quality of guesswork are small.

B.5. Foreign trade statistics

Annual foreign trade statistics were published in *Statistik des Deutschen Reichs* for 1872 and the following years. Here the discussion will be confined to statistics of imports and exports. Besides these, annual information is also available on stocks in bonded warehouses, goods re-exported after processing, transit of goods through the country, tariff revenue, etc., in *Statistik des Deutschen Reichs*, and monthly information on imports, exports, and tariff revenue was given in *Monatshefte zur Statistik des Deutschen Reichs* up to 1891 and in *Monatliche Nachweise über den auswärtigen Handel Deutschlands* thereafter. More frequent information on imports and exports of foodgrains and important raw materials was given in *Deutscher Reichsanzeiger*, fortnightly till 1 March 1906 and every ten days thereafter.

Import and export statistics are available in three forms; it will be convenient to discuss them in terms of the following classification.

Imports

1. Imports for consumption in the German Customs Area and free ports.
2. Imports to be processed and re-exported by natives of the country.
3. Imports out of bonded warehouses.
4. Imports to be processed and re-exported by foreigners.
5. Imports into bonded warehouses.
6. Direct transit through the country.

Exports

1. Exports out of the production of the Customs Area and free ports.
2. Re-exports of processed goods by natives.
3. Re-exports of processed goods by foreigners.
4. Re-exports out of bonded warehouses.
5. Direct transit.

Classes 1, 2, and 3 of imports and 1 and 2 of exports comprised special trade (*Spezialhandel*). Classes 1, 2, 4, and 5 of imports and 1 to 4 of exports comprised trade on home account (*Gesamteigenhandel*), and all classes together comprised general trade (*Generalhandel*).

The distinction between natives and foreigners arose out of the customs law, which allowed only natives to import goods free of duty if they were re-exported after processing. Bonded warehouses were generally used to avoid paying duty in entrepôt trade. They are treated as foreign territory for special trade and for trade on home account.

¹ Cf. J. B. Esslen, *Die Fleischversorgung des Deutschen Reichs*, Stuttgart, 1912, pp. 24 ff.

The area coverage underwent a number of changes. Essentially it comprised Germany and Luxemburg. The free ports of Hamburg, Bremen, Bremerhaven, Cuxhaven, and Heligoland were excluded from 1880 to 1888; figures for those years are not continuous with those for the rest of the period.

Imports and exports were cross-classified by the volume and value of commodities and by countries. The countries of origin of imports and of the final destination of exports were recorded; while there was much scope for inaccuracy here, there is no conspicuous misrecording even in the case of Britain and Holland which made a great deal of entrepôt exports to Germany.

Officially, the volume of commodities was recorded in terms of net weight in metric tons, except for liquids other than fats and oils whose gross weight was recorded (and for commodities like animals and cars for which weight was an inappropriate measure). However, tariff lists were generally given in terms of tare weight, and it is to be suspected that tare weights were in normal use—in other words, that the net weight was taken to be a certain proportion (depending on the commodity and the containers in which it was normally carried) of the gross weight.

A commission of trade statistics (*Handelsstatistischer Beirat*) met every year to fix unit values of imports and exports. They used the declared values of goods where they were available—for example in case of dutiable goods. All duties were specific, so they did not provide an incentive to understate declared values. The number of commodities whose value was declared was large in the case of imports because of the comprehensive tariff, but it was quite small in the case of exports. Where values were not declared the commission fixed unit values on the basis of prices in ports and market towns or of trade quotations.

Appendix C

SUPPLEMENTARY NOTES ON SOURCES AND METHODS

SOME output series are given in Tables A.20 and A.22, and series of terms of trade in Tables A.23 to A.25. A brief description is given here of their sources and methods of estimation.

C.1. *Output series*

Series of building investment in Table A.20 and indices of output in Table A.22 were prepared in the Institut für industriegewirtschaftliche Forschung, Münster, under the direction of Professor Walther G. Hoffman, and kindly made available by him.¹ Tables A.20 and A.22 give only the series that have been used in the text, and information on sources for the period 1871-1913 is given here so as to assist in evaluating the reliability of the series.

Building. Building excludes public amenities (streets, drainage, etc.) and building by railways, and represents the value of buildings excluding land. The series have been derived by taking first differences of the stock of buildings at original cost and dividing the resulting series by an index of building costs.

The stock series has four components: non-agricultural residential, agricultural, industrial and commercial, and official buildings. The last three components and the total stock were independently estimated and the remaining component was derived as a residual.

The total series, the series for public buildings and for industrial buildings were derived by inflating the series for a particular territory to obtain a series with a larger regional coverage; the method of inflation was to multiply the series by the ratio of the region's population to that of the territory. The territory was Berlin for municipal buildings in Berlin, Hamburg, and Bremen, the state of Baden for state buildings in the country and Prussia for the total stock of buildings and industrial buildings in the country. Prussia was fairly representative of the country; the error involved in the inflation of its data is probably small. The procedure gives less certain results for public buildings, but their proportion in the total stock was only about 10 per cent., so the error in the total would not be significant.

Estimates of industrial and commercial buildings were based on the statistics of their value assessed for a tax on buildings. The value was supposed to represent capitalized rent, but since industrial buildings, which were the chief component of the series, were seldom rented, the value was generally based on cost.

¹ The final version of the series has since been published in W. G. Hoffman, *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*, Berlin, Heidelberg, and New York, 1965.

The buildings tax also gave statistics of the value of other buildings, but they were biased: they did not include agricultural buildings, whose stock rose relatively slowly, and they were affected by the progressive increase in the rental value of residential buildings. Another series was available for all buildings from the statistics of the value of buildings insured with public fire insurance companies; but it underestimated the rise in the stock of buildings. Public companies were required by law to accept all business offered to them. Hence while they insured the bulk of buildings throughout the period, the less risky business was competed away from them by private insurance companies which could choose their clients and quote premium rates commensurate with the risk. Hence the share of public companies fell progressively; and the total could not be derived since statistics for private insurance companies were not available. Hence it was derived by taking an unweighted average of the fire insurance values and buildings tax values, whose mutual bias tended to cancel out.

The stock of agricultural buildings was derived by estimating series of the sale value of agricultural land per hectare and of the value of agricultural land including buildings, equipment, etc., and taking the difference between them to represent the value of buildings and equipment per hectare, which was then multiplied by the area of agricultural land in the country. The procedure is open to a number of doubts. First, the values include the value of equipment; and the sales were mostly of old buildings whose value did not stand in any necessary relation to the original cost. The inclusion of the value of equipment would offset the fall in the value of the building due to age, but it is uncertain to what extent this happened. Second, the sale values would depend on the prospects of agricultural profitability which improved considerably in the 1890s and after. While much of the effect of this improvement was to be seen in land values and correspondingly less was to be expected in the value of buildings and equipment, there is no guarantee that the latter were free from the effect.

The series for public buildings was based on information from public accounts. No deduction was made in respect of depreciation; but in view of the rapid growth in the stock of buildings this was probably inconsequential.

Mining, iron, and steel. The original series were taken out of official statistics described in section B.41. Heterogeneity in products was ignored. The mining series is an average of series for individual minerals weighted by employment; employment was taken from the occupation census for 1882 for the series up to 1895 and from the 1907 census for subsequent years. While the weighting is crude, the series is probably insensitive to it owing to the preponderance of coal.

Beer and sugar. Figures were taken from the fiscal statistics described in section B.42.

Bricks. The series is based on contemporary estimates for individual years. Figures for intervening years were interpolated by means of the index of investment in building.

Gas. The figures were taken from publications of Deutscher Verein von Gas- und Wasserfachmännern, and represent actual production.

Tobacco, leather, and textiles. The series are based on raw material consumption without adjustment for stock changes, and were estimated from statistics of home production and foreign trade. The figures of home output of the materials are commented on below.

Agricultural production. We have made direct use of estimates for two items of agricultural production, wheat and rye, and other products enter into the output series of textiles, tobacco, and leather. These estimates are from A. Heese's Münster dissertation, *Die langfristige Entwicklung der deutschen Landwirtschaft*.

It was noted in section B.45 that estimates of the yield per hectare of field crops rose twice between 1892 and 1899 owing to changes in methods. Heese raised the official yield of wheat from 1878 to 1898 by 12 per cent. and that of rye by 18 per cent. to make the series continuous. This probably still leaves a fictitious increase in yields between 1891 and 1893. Further, the level of production is likely to have been overestimated throughout since the estimates between 1878 and 1898 are nearer the actual figures. The figures from 1871 to 1878 were obtained by estimating the area under different crops in 1860, interpolating the area figures from 1861 to 1877, and estimating total yields on the basis of yields per hectare in Prussia, which were available.

The same method was used for flax between 1871 and 1877. Average yields of flax were not available, so it was assumed that they varied with the average of yields of other field crops. This is not a well-founded assumption, but it is probably inconsequential since most of the flax consumed was imported.

Estimates of domestic wool and hide production were made from the census figures of the number of sheep and cattle. They involve the same steps and the same elaborate guesswork as the estimates of meat production described in section B.45.

C.2. Terms of trade series

The import and export price and terms of trade indices in Tables A.23 to A.25 are weighted averages of price indices of selected commodities. It was impossible to work out the unit value series of all commodities listed in the foreign trade statistics, so commodities were chosen which were reasonably homogeneous and were the most important in the trade of 1872 and 1913, the terminal years. Series for forty-six commodities constituting about half of the visible imports and twenty-eight commodities covering nearly 40 per cent. of exports were finally used.

First, their unit values were calculated and normalized with 1895 as base year. Then the commodities were divided into groups, and group price indices were calculated as unweighted averages of the commodity indices. The indices for groups were weighted by their proportions in the value of imports and exports of 1895 to obtain average export and import prices.

Unit value indices for a number of commodities were rejected because the commodities were heterogeneous, or the series did not continue over the entire period, or there was implausible variation in the series. Fictitious unit values were to be suspected where they remained constant for a long period or showed a sudden large fluctuation without any apparent change in quality (for instance,

the unit value of ammonium sulphate rose from 24 marks per ton in 1895 to 72 marks in 1896; the unit value of calfskin fell from 71 marks per ton in 1884 to 34 marks in 1885). Heterogeneity was often apparent when the designation of the commodity was vague and unit values showed large, erratic fluctuations (for example, the unit value of clothes); in the case of some heterogeneous commodities the unit values were guesses of the commission of trade statistics and were unduly steady.

TABLE C.1

*Proportions of commodity groups in the value of imports and exports 1895, and weights used in the indices of import and export prices (per cent.)*¹

	Proportions		Weights	
	Imports	Exports	Imports	Exports
Foodgrains	8.9	0.7	8.9	..
Other food, drinks, and tobacco	20.3	11.0	24.8	12.5
Animals	4.5	0.8	..	..
Consumer goods raw materials	22.7	9.0	22.7	..
Other raw materials	16.1	7.4	16.1	16.4
Metals and ores	2.7	1.1	2.7	..
Fuels	4.5	4.3	4.5	4.3
Chemicals	1.7	4.4	1.7	4.4
Textiles	6.5	20.5	6.5	20.5
Metal goods	0.2	10.5	..	10.5
Machinery	1.6	2.7	1.8	..
Transport equipment	—	0.3	..	3.0
Other goods	10.3	27.3	10.3	28.4
	100.0	100.0	100.0	100.0

Discontinuities in the unit value series were numerous. The commodity classification was based on the tariff list and changed with almost every new tariff law. Successive tariffs made the classification finer in order to create more scope for tariff bargaining and to restrict the benefit of MFN treatment to third countries; by 1906 there were more than 900 commodity classes. Tariffs on manufactures were often revised with regard to the changing interests of home producers, and entailed the reclassification of the products of an industry. The classification of cotton yarn (classes of fineness as measured by the count), for example, underwent a number of changes. In this and other similar cases, we calculated continuous bits of unit value series for periods when the classification remained unchanged and spliced them by means of series for commodities of the nearest description for which continuous series were available. This method gives fairly reliable results in general, but this cannot be presumed in the case of machinery. There we have spliced the various bits by means of a series for pig iron. While this was probably the best expedient

¹ Calculated from *Statistik des Deutschen Reichs*, O.S., vol. 3 and N.S., vol. 271.

under the circumstances, the general correspondence between the series for iron and machinery is not so close as to remove all doubts.

The series for machinery were also unsatisfactory on account of heterogeneity. The classification of machinery was very broad. At first it was divided by the material of manufacture—wood, cast iron, and wrought iron. For this period we combined the series for the latter two with equal weights; wooden machines were unimportant. From 1900, machines came to be classified by their industrial use; here we used an unweighted average of series for agricultural machines, electrical machines, and machine tools. The classification became much finer in 1906; from that year we used unweighted averages of export series for metalworking machines, milling machines, cables, paper-making machines, electrical equipment and motor-cars for exports, and agricultural machines, textile machines, and machine tools for imports.

The unit value indices were first combined into unweighted averages for commodity groups; these were then combined into averages weighted by the proportions of the groups in the imports and exports in 1895 to give indices of import and export prices. The proportions are shown in Table C.1.

Indices for the following commodities were combined to form group averages. Commodities whose indices begin in 1880 are marked with asterisks.

Imports

Foodgrains	Wheat, rye, oats, barley.
Other food, drinks, and tobacco	Wine and cider, butter, herrings, coffee, tobacco, sugar.
Consumer goods raw materials	Cotton, silk, wool, flax, hides of sheep and goats.
Other raw materials	Jute, rubber, softwood, sawn softwood*, bran*.
Metals and ores	Lead, sulphur pyrites, iron ore, pig iron.
Fuels	Mineral oil.
Chemicals	Anilin and tar, saltpetre, calcined soda*.
Textiles	Single-thread cotton yarn count 17-45, ditto double-thread, ditto dyed and bleached, fine woollen goods, silk yarn*, coarse cotton cloth*, fine cotton cloth*, cotton tulle*, silk tulle*.
Metal goods	Rails, wire.
Machines	Locomotives, cast iron machines (1872-99), wrought iron machines (1872-99), agricultural machines (1900-13), textile machines (1900-13), machine tools (1900-13).

Exports

Food, drinks, and tobacco	Beer, ham, starch, sugar.
Raw materials	Tanned ox-hide, sole leather, combed wool, glazed packing paper.
Fuels	Coal*, coke*.
Chemicals	Anilin and tar, potassium chloride, indigo.
Textiles	Woollen yarn, miscellaneous woollen goods.

Metal goods	Iron girders, iron wire, rails.
Machinery and transport equipment	Locomotives, cast iron machines (1872-99), wrought iron machines (1872-99), metalworking machines (1900-13), milling machines (1900-13), cables (1900-13), papermaking machines (1900-13), cars (1900-13), electrical equipment (1900-13).

For the import groups in which commodity series running from 1880 to 1913 were included, group indices were separately calculated for 1872-80 and 1880-1913 and linked together. This was impossible for fuel exports since both component series began in 1880. Hence indices were calculated both including and excluding fuel.

The faults in the machinery index led to the question whether it should be included. The question was of importance only for exports since inclusion made little difference to the index for imports. Hence two indices for exports were calculated, one including and another excluding machinery. Finally, an export price index was calculated including both fuel and machinery. It was found that of the four indices—excluding fuel, excluding machinery, excluding both and including both—the first two generally lay between the last two. Hence export price indices are given in Tables A.23-A.25 only for the last two, which represented the limits of variation.

Current-weight indices were also worked out for 1872 and 1913. Exports of foodgrains could not be given any weight in the calculation of either: no foodgrains were exported for some years in the 1880s and 1890s and continuous export price series could not be obtained for them. The current-weighted terms of trade were 108.3 in 1872, and 92.7 excluding and 93.6 including exports of fuel and machinery in 1913 (1895 = 100). The comparable figure for 1913 from Soltau's current-weighted index is 92.¹

Some of the estimates in Kindleberger's detailed index for Germany (index of terms of trade for benchmark years) are comparable with ours; the corresponding figures are given in Table C.2.

The total figures are seen to be fairly similar, as well as those for textiles and materials; but any similarity of estimates elsewhere seems to be accidental.

Kindleberger's and our methods are very similar except in one respect: for commodity groups we use unweighted averages of a fixed number of commodity prices, while Kindleberger uses average unit values of a large number of commodities lumped together. His description is as follows:² 'Unit values were calculated through dividing values of special trade converted into dollars by quantities traded (generally converted to metric tons) for sizeable aggregates of fairly homogeneous commodities. The result is that the changes in unit values include some perhaps considerable element of change in commodity composition, in addition to change in unit value which can properly be called price change.'

¹ F. Soltau, 'Statistische Untersuchungen über die Entwicklung und die Konjunkturschwankungen des Aussenhandels', *Vierteljahrshefte zur Konjunkturforschung*, 1926 (supplementary issue).

² C. P. Kindleberger, *The terms of trade*, London and New York, 1956, p. 353.

Both Kindleberger's and our methods have their weaknesses. We have chosen commodities with the largest representation in trade in 1872 and 1913; so we should have, for each commodity group, a mixed sample of commodities whose trade grew fastest and those whose trade grew most slowly. If, therefore, the groups were large enough, we should have a mix of commodities the growth rate of whose trade is nearly equal to the overall average; and since price movements are closely related to the rate of growth of trade, a good mix would lead to an unbiased group price index. In view of the smallness of our

TABLE C.2
Comparison of Kindleberger's estimates with ours¹

(End-year weights; beginning year = 100)

	1900/1872		1913/1900	
	Kindleberger's estimates	Our estimates	Kindleberger's estimates	Our estimates
<i>Imports</i>				
Chemicals	50	34	105	91
Textiles	76	82	116	104
Total	71	67	117	118
<i>Exports</i>				
Food, drinks, and tobacco	70	51	101	152
Materials	84	72	113	104
Metal goods	81	39	119	88
Machinery	117	92	100	91
Chemicals	84	25	104	58
Textiles	59	72	115	108
Total	70	..	110	102
<i>Terms of trade</i>	99	..	94	86

group samples, however, the possibility of a bias in group indices is not excluded. The current-weighted indices for 1872 and 1913 give an idea of the possible bias in one direction; its magnitude in the other direction is unknown.

Kindleberger's method, on the other hand, mixes up price changes and weight changes inextricably. This would not matter much if price movements of different commodities in a group were similar; but this is precisely what they are not.

Terms of trade, being index numbers of relative prices, are capable of being measured in many different ways, none of which is ideal. The quality of the two indices cannot be judged by any absolute criteria: it must be judged in terms of the performance of the particular tasks for which they were designed.

Our index is a by-product of the export and import unit values of a number of commodities that we derived for comparison with internal prices. The unit values serve this purpose adequately; the group and total indices have not been

¹ Kindleberger's estimates from C. P. Kindleberger, op. cit., pp. 36-37; our estimates from Tables A.23-A.25.

called upon to perform any special task. Their comparison with Kindleberger's indices does, however, raise doubts whether the latter are sufficiently reliable to bear the burden of his conclusions, especially those that rest on his detailed indices.

Bibliography

THE following abbreviations are used for periodicals and series.

- Asa* *Allgemeines statistisches Archiv*. Tübingen.
Beww Beiträge zur Erforschung der Wirtschaftlichen Wechsellagen. General ed. A. Spiethoff. Jena.
Eca *Economica*. London.
Ej *Economic Journal*. Cambridge.
Hws Handwörterbuch der Staatswissenschaften. Ed. J. Conrad, W. Lexis, *et al.* 3rd edition. Jena, 1909-11.
Iks Vierteljahrshefte zur Konjunkturforschung, Sonderhefte. Institut für Konjunkturforschung, Berlin.
Mvs Münchener volkswirtschaftliche Studien. Stuttgart.
Nber National Bureau of Economic Research. Princeton.
Sj *Jahrbuch für Gesetzgebung, Verwaltung und Volkswirtschaft im Deutschen Reich*; after 1913, *Schmollers Jahrbuch*. Munich.
Snsa Sammlung nationalökonomischer und statistischer Abhandlungen. General ed. J. Conrad. Jena.
Ssf Staats- und sozialwissenschaftliche Forschungen. Leipzig.
Svs Schriften des Vereins für Sozialpolitik. Munich and Leipzig.
Wa *Weltwirtschaftliches Archiv*. Kiel.
Zkpb *Zeitschrift des königlichen preussischen statistischen Bureaus* (later *Landesamts*). Berlin.

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