

The occupational structure of Germany, 1846-1907

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This represents a very preliminary discussion of German occupational structure in the period 1846-1907. Although I hope to produce new estimates of occupational structure the period 1820s-1907, and the linkage of these series with twentieth century occupational data, this has not yet proven possible in the time available. Much of this paper thus utilises estimates produced by Walther Hoffmann in the 1860s, and discusses the limitations of this material. There is also some recourse to material drawn directly from contemporary occupational statistics for the analysis of particular issues.

The context of Germany

German industrialisation was one of the most striking economic phenomena of the second half of the nineteenth century. From a position of relative backwardness, a combination of political and institutional unification beginning with the customs union of 1834, and adoption of new industrial technology in a coal- and iron-rich country from the 1840s, promoted the transition from a largely agrarian to an industrial nation at the same time that the nation itself was forged. By the end of the nineteenth century the country had reached international prominence in iron and steel production and the chemical industry, facts often thought to be linked to the willingness of country's financial sector to invest in the secondary sector. Nevertheless a large proportion of the population still worked in agriculture, and especially in the western part of the country landholding remained widespread and fragmented. The agrarian lobby was strong and supported by protectionist tariffs after unification in the 1870s.

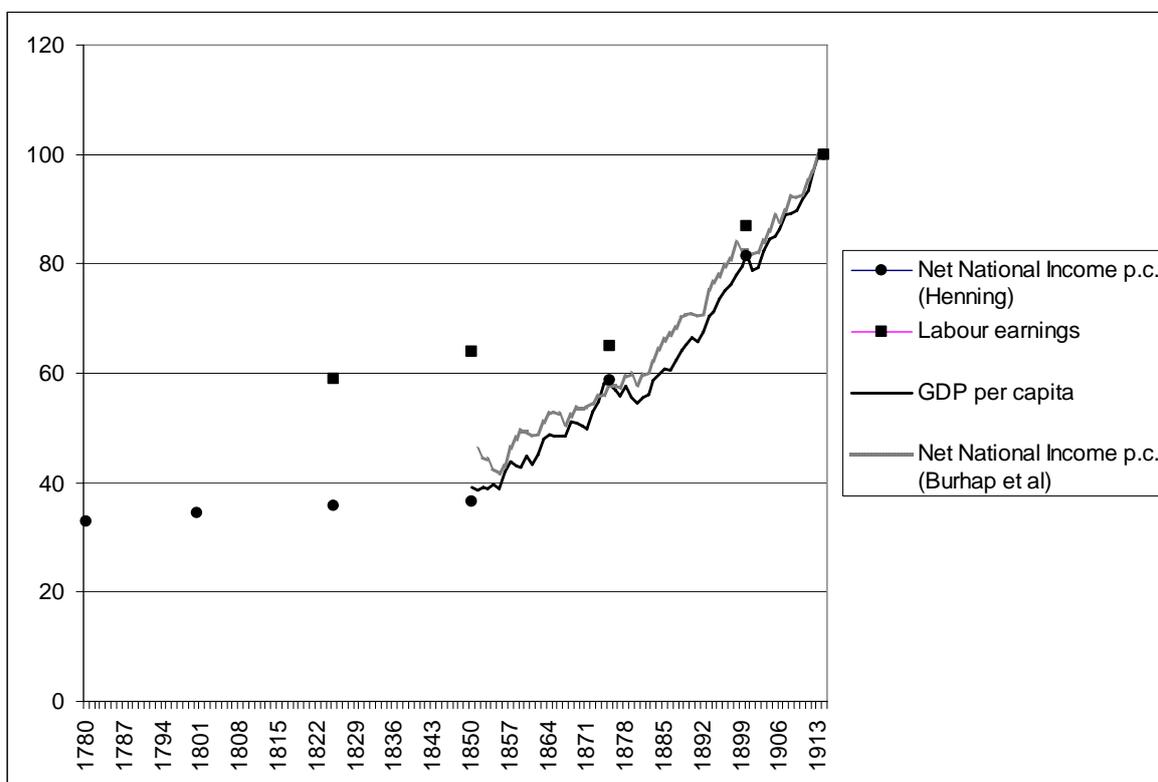
Analysis of German national income remains largely based upon figures produced by Walter Hoffmann in 1965, although there are widely recognised to be flaws in his estimates.¹ The traditional picture of German per capita income development is of relative stasis prior to the 1850s, followed by a rapid take-off and development in a mature industrial economy after about 1870.² Note that Figure 1 shows labour

¹ See Hoffmann (1965); Fremdling (1988); Holtferich (1983); Ritschl (2004); Burhop and Wolff (2005); Burhop (2008).

² Tilly (1996)

earnings did not increase until a much later date, after the mid-1870s. This suggests that early growth largely brought increased returns to capital, but possibly also that labour force participation rates were low before the late nineteenth century.

Figure 1. Estimates of per capita and labour income, (1913/4 = 100)



Sources: GDP per capita from Maddison (2003); net national income per capita from Henning, and Labour earnings from Gömmel, cited in Tilly (1996); net national income per capita calculated from Burhap and Wolff (2005).

The German experience was marked by strong geographical diversity, and prior to the creation of the German Empire in 1871, political diversity too. The dominant state was the Kingdom of Prussia, covering much of the north of the country. A second tier of states included Bavaria, Hanover, The Kingdom of Saxony, Hessen, Württemberg, and Baden. Next to these were a number of micro-states, some with a population of only a few thousand. After unification these retained some autonomy as administrative units and formed a basis for the enumeration of population and occupational data. This fortuitously allows us to track changes across the great political divide of the creation of the Empire, although there are boundary changes. However, prior to 1871 coverage for individual states is highly variable and surveys were undertaken using different criteria. This compounds the usual problems of

boundary changes and shifting occupational categorization. In addition, the boundaries of the German states as a whole changed over time, most notably in the acquisition of Alsace-Lorraine in the war of 1870, that was relinquished at the end of World War One.

Census data

Many German states provide relatively rich statistical data on population and occupation back to the Napoleonic period, that has been used widely for studies of industrial structure and productivity. In addition, there have been some studies on a more regionalized level, and that have sought to push the study of occupational structure back in time, notably that of Kaufhold for Prussia for the start of the nineteenth century.³ The standard work on Germany's economic structure remains Walter Hoffmann's *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts*. This provides series on a branch level going back to 1846. Most subsequent works have drawn on this volume, if they do not directly utilise data from censuses.⁴ While Hoffmann's data on national income has come under severe critical scrutiny in the past two decades, his data on occupational structure has received rather less comment. There are certainly problems both with his method and the clarity of its presentation, but with the current state of research it remains the most comprehensive study and forms the primary basis of discussion here.

The first national German census of occupations was taken in 1875. This is sometimes, somewhat misleadingly, called an 'Industrial Census' (translated from *Gewerbezahlungen*). In fact, coverage was wider than this term suggests, although those who worked solely in agriculture were not included. The groups explicitly excluded from this survey were military, navy, railway, post and telegraph workers (but workshops under the management of these branches were included); insurance; medical professions; musicians and actors and entertainers; carers and prison guards; and production for autoconsumption.⁵ It would be more accurate to call this an occupational census that excluded certain categories, most importantly the agricultural sector. Further and more complete occupational censuses were taken in 1882, 1895, and 1907. These may be compared with frequent population censuses,

³ Kaufhold (1978)

⁴ Hoffmann (1965); see for example Broadberry (2007)

⁵ *Statistisches Jahrbuch für das deutsche Reich* (hereafter SJDR) 1 (1880), p.38.

sometimes taken in the same year. In these, the earliest of which was in 1871, householders were asked to self-identify an occupation, as opposed to the occupational censuses, that recorded people actually at work on a given day.⁶ The census of 1871 aggregated the data to give the proportion of the population assigned to each sector, rather than the individual numbers of workers.⁷ Data from 1882 has been gathered at a relatively high degree of aggregation in a major research project involving a range of German economic historians that was active during the 1980s, with an initial project at the University of Mannheim, and late contributions by Rüdiger Hohls and Hartmut Kaelble.⁸ Reinhard Stockmann utilised this material for methodological essays on the aggregation of data into consistent sectors over time, and to investigate structural change with a particular interest in the organisation of firms between 1875 and 1970.⁹ For the most part these studies concentrated on providing consistent sectoral categorizations of the data that could be applied in specific geographical regions. The reliability of the basic data itself was not subject to so much scrutiny. Because these projects were orientated towards providing data consistently comparable over the whole 1875 to 1970 period using a different schema to Hoffmann's, the two sets of results are only very roughly comparable. Indeed the reporting of results at the branch level can give very wide divergences. The totals and categorizations provided by Hoffmann correspond much more closely to the printed censuses themselves in the nineteenth century. As we will see, an important service that Hoffmann provided was to correct obvious inadequacies in the pre-1907 censuses. Later works have not done this and are unreliable guides to sectoral division, primarily because of undercounting in agriculture. Hoffmann's estimates for early twentieth century labour force have also come under scrutiny in Carsten Burhop's recent reassessment of labour productivity in 1913.¹⁰

Before 1871, coverage of German occupations is mixed. The much- and rightly-vaunted Prussian statistics provide occupational data stretching back to the eighteenth century. These were set on a new standard with the founding of the a central statistical bureau in 1810 and the first broad census of the kingdom was taken in 1816. From 1822 data is easily available on a provincial level within Prussia, with surveys occurring as frequently as every two to three years. However much of the

⁶ Stockmann (1984), p.60.

⁷ SJDR 1 (1880), p.15.

⁸ The Mannheim project provided machine-readable data that provided the basis for late studies. Unfortunately this precocious project seems to have made the material readable by machines that we no longer use. Stockmann (1987), p.94; Hohls & Kaelble (1989).

⁹ Stockmann & Willms-Herget (1984); Stockmann (1984); Stockmann (1987).

¹⁰ Burhop (2008), p.215.

early census data was collected because of official interest in the consequences of the liberalisation of trade and production from corporate controls, and thus occupations where this was not of interest were poorly recorded.¹¹ Most of this early work was not officially published, but was utilised in articles and books produced by officials working at the Prussian statistical bureau, and hence they have a quasi-official character.¹² In the case of most other German states coverage is less frequent and the data tends to be less consistent than those available from Prussia. However, in many cases there is still data stretching back to the 1820s. In 1861 a census was taken for the entire Customs Union (*Zollverein*) but without there being a consistent approach across all of the states. In some cases occupational census data can be compared with far less fine-grained data on 'souls', that is, population numbers, that also sometimes provided details of occupation. The table below provides details of coverage for most of the major German states. Censuses taken up until 1861 have been provided in summary form and to some degree within a set pattern of categorization, in a series of volumes on *Quellen zur Berufs- und Gewerbestatistik Deutschlands 1816-1875* between 1980 and 1995. Although the intention was to provide material for further research little use has been made of them.¹³ All of the data discussed here from the period 1816-1861 is drawn from these volumes.

Table 1. Availability of Occupational Census Material, 1807-1861

Date	Prussia	Württemberg	Duchy of Hessen	Principality of Hessen	Kingdom of Saxony	Bavaria	Baden
1807		X					
1816	X						
1819	X						
1820		X					
1822	X						
1824						X	
1825	X						
1828	X						

¹¹ Kraus (1989), p.4.

¹² Kraus (1989), p.11.

¹³ Köhlmann, W., (ed), *Quellen zur Berufs- und Gewerbestatistik Deutschlands 1816-1875*. 5 vols (1980-1995). Hereafter *QBGD*. Much of the work was done by Antje Kraus.

1829							X
1830						X	
1831	X						
1832		X				X	
1834	X						
1835		X					
1836					X		
1837	X						
1840	X					X	
1843	X						
1846	X				X		
1847			X	X		X	X
1849	X				X		
1852		X				X	
1855	X						
1858	X						
1861	X						

Source: QBGD, Bs.II-V.

The national surveys from 1875 were conducted by providing a series of direct questions to the owners or leasees of all businesses on how many people were employed by them. This is likely to have resulted in some under-counting of small enterprise and home-workers. Indeed, it is explicitly stated that especially in the case of Alsace-Lorraine, small businesses that were only intermittently running were not included. The survey of 1875 was taken on 1st December, and is likely to have under-counted employment in seasonal industries such as construction, shipbuilding, and brick-making. December 1875 fell into a cold snap and under-reporting was likely to have been high in the construction industry, which indeed shows a large leap in numbers by 1882.¹⁴ The census of 1882 and subsequent years was carried out in June.¹⁵

Although some pre-unification censuses provided data on the unemployed, rentiers, and those on poor relief or resident in institutions, this was done inconsistently and it is doubtful that the surveys provide reliable data on the extent of un- or under-

¹⁴ SJDR, 1, (1880), p.38; Hoffmann (1965), p.183.

¹⁵ Stockmann & Willms-Herget (1984), p.15;

employment. It is likely that these figures on the non-working sections of the population also include those who were infirm or not of working age. The censuses do not therefore provide full data on the labour force.

Close examination of the pre-1875 data also makes it clear that there was frequent re-categorization of workers, that there were major problems with under-counting, and highly inconsistent methods in regard to recording the female labour force. Such problems are relatively easy to spot, especially in the case of Prussia, because of the frequent taking of censuses on a provincial level. The most challenging analytical issues relate to determining the size of the agricultural population and allocating those described simply as 'labourers' or 'servants'; accounting for by-employment; and accounting for male and female labour force participation.

Census coverage and Hoffmann's methods

We can examine the reliability of the data through labour force participation rates. As the censuses only record those with actual occupations, rather than those who are part of the work-seeking labour force, these will be underestimates according to usual statistical conventions. Nevertheless, the data from national surveys conducted from 1882 onwards suggests that coverage is reasonably good, with participation rates starting at around 70% and rising to 78% by 1914.¹⁶ This is in the same range as Belgian and British data and gives some confidence in the results.¹⁷ The lower earlier total was to a large degree caused by an under-counting of the female workforce in agriculture, as we will see.

The same technique can be applied to pre-1882 data, although in itself this tells us nothing about the quality of enumeration *within* the censuses (there is also a very small amount of inclusion of those aged 14 or under in earlier census material). Some early population censuses provided information on the number of those between the ages of 15 and 60. Those recorded as having occupations can be compared against both this cohort, and the total population. From this it is clear that Prussian occupational censuses give good coverage from 1852 onwards; Saxon

¹⁶ The occupational data categorised people according people between the ages of 15 and 60, when the international convention is to treat the potential labour force as lying between the ages of 15 and 65. I have consequently calculated the proportion of the population between the age of 15 and 65 from the populations censuses, which remains very stable at around 60%, and used these to make the participation rate calculation.

¹⁷ Buyst (2009).

censuses back to 1846. Those in the south are far less comprehensive, although the Württemberger and Prussian occupational censuses of 1815-6 were rather better than some successors. In the Prussian case this is because it included a 'labourer' category that was left out of subsequent censuses until 1846.¹⁸

These differences also partly reflect simple differences in occupational structure, because industrial and artisanal trades were far more likely to be recorded. Saxony was one of Germany's most industrialised regions and coverage was commensurately better. However, it is clear that the 1846/7 and 1861 censuses covering most or all of the *Zollverein* were very incomplete. This is an issue barely addressed by Hoffmann. Nevertheless, his starting point of 1846 is a sensible one, as difficulties are further compounded by the lower quality of enumeration before this date.

Table 2. Recorded Occupations as Proportion of Adult and Total Population

	<i>Prussia</i>		<i>Württemberg</i>		<i>Saxony</i>		<i>Bavaria</i>	
	<i>15-60</i>	<i>Total</i>	<i>15-60</i>	<i>Total</i>	<i>15-60</i>	<i>Total</i>	<i>15-60</i>	<i>Total</i>
1807/16	44.3	25.7		21.9				4.7
c.1821	28.6	16.4	13.3	8.5				5.1
1835/7	26.7	15.8	18.5	12.8	13.5	6.9		
1846/7	52.5	31			66.5	40.4	42.8	30
1861	67	39	21.8	15.5	70.3	47.5	22.9	16

Source: QBGD, Bds.II, III, V.

The major gap in occupational censuses before 1882 is labour in the agricultural sector was generally not recorded, or only very inadequately. For example, a leap in Prussian coverage that then took place between 1846 and 1852 was because prior to the later date owner-occupiers and tenants of land were not included in the agricultural labour force.¹⁹ The 1846 and 1849 censuses also clearly under-counted on-farm labour across the Prussian provinces. In Bavaria the enumerated workforce in 1846/7 was far too low, while in 1861 agricultural workers were not included at all. Saxony recorded labourers and farmhands but not occupiers and their families in

¹⁸ QBGD, *passim*; and Kraus (1989), p.11.

¹⁹ Although a figure was recorded in 1849 this appears to be the entire family or household of the owners and tenants, and is certainly far too high to be the workforce of farm-owner or leasees and their working family members.

1846. Such patterns are replicated across Germany. To determine the agricultural workforce Hoffmann thus chose to look at the relationships between the total size of the working population, the total population of all ages, numbers of occupiers, and figures for labourers and servants, to come to 'a rough approximation to reality'. He does not explain how he actually used these ratios to come to his final figures.²⁰

Hoffmann also failed to comment at all on the large number of 'free labourers' not allocated to any branch or sector. There were 1.5 million of these men and women in Prussia in 1852, and over 100 000 in the Kingdom of Saxony in 1846; and around 200 000 in Bavaria in 1847. They made up over 10% of the entire workforce (if we can believe Hoffmann's totals). Presumably some of these labourers worked predominately in agriculture and were accounted for in some form by the estimates made for that sector. But most were probably involved in activities such as construction, and the clothing industry and laundering.²¹ By 1882 over 200 000 were still listed as labourers who undertook variable and seasonal labour, a group almost entirely made up of men when large numbers in this category in earlier surveys were women.²²

From 1846 to 1871 Hoffmann created time series for each branch by using the trends found in Prussian data, with its dense return of triannual censuses. The Kingdom of Prussia accounted for some 55-60% of the German population in this period. After 1875 he provides annual series to link the census data, although it is not entirely clear what the benefits of doing so are. For the period 1875-1884 he used records of birth, marriage and death where occupation was listed, converting these into actual workforce totals using vital rates statistics, to create interpolated trends. He gives no indication of how this information was weighted, or indeed how well the numbers thus generated matched those recorded in the censuses. After 1885 he used insurance records, but again the extent of coverage is not indicated.²³

More promisingly Hoffmann made corrections for important absences in earlier censuses, that especially affected the recording of female employment. These included numbers of women sewing, or family members providing labour in hotels

²⁰ Hoffmann (1965), p.187.

²¹ Kraus's discussion of the practice of the statistical office suggests that the labour and servants working in agriculture were properly separated out in 1858 and the residual was employed in industry and commerce. However examination of the raw data suggests that the re-categorisation was probably not complete until 1861. Kraus (1989), p.536.

²² SJDR 5 (1884), p.19.

²³ Hoffmann (1965), 186, 189, 204-5. See also Burhop (2008), p.215.

and inns. The largest group affected by these changes were family members (mostly women) working in agriculture. Between the census of 1895 and that of 1907 the number of 'dependent family members' indicated as actual members of the labour force on farms leapt from 43% to 76%. If this correction is made for earlier data the agricultural labour force would be 1.4 million larger in 1882 and nearly 1.5 million larger in 1895.²⁴ This has the affect of raising the total labour force by nearly 8%, and in facts the apparently lower participation rates in the earlier censuses.

It is beyond the scope of a short paper to go further into anomalies to be found in the data for the industrial and commercial sectors, on which Hoffmann provides no comment. As it stands Hoffmann has provided the only comprehensive estimates of sectoral employment before 1882 and provided some important corrections to later data that has not been incorporated into the German national statistics and labour force estimates provided by later studies, especially for the period 1882-1907. However his methods are frequently opaque, and thus there is no way of following his procedures to assess the plausibility of his assumptions. New work in the field will have to work from the ground up on pre-1882 censuses at a relatively disaggregated level to provide new estimates and assess the accuracy of Hoffmann's work. For the 1882 census itself, as published in the *Statistisches Jahrbuch für das deutsche Reich*, and after making the additions and corrections listed by Hoffmann himself, I find that Hoffmann's total of occupations falls 632 000 short of the newly calculated total of 20.6 million; shortfalls are spread across the three sectors. A reader of the following discussion must bear the limitations of the data in mind.

Sectoral Breakdown

Table 3 provides the results of allocating Hoffmann's figures to the PST schema. Separating out mining from the primary would not make that much difference; mining, quarrying and salt production took up 2.6% of total employment in 1907, which would be deducted from the 'Primary share'. We can see that the primary sector remains the largest throughout this period of German history, but that more rapid structural change begins after 1882, when both secondary and tertiary sectors are growing in size. Two-thirds of this late structural shift is taken up in the shift from primary sector to secondary sector employment, and about a third moved into the tertiary sector. Employment in mining and extraction rose from 1.6% to 2.6%, and doubtless a

²⁴ Hoffmann (1965), pp.183-4.

greater proportion of agricultural production went into raw material for industry. Indeed food production became more industrialised itself as employment in food processing rose from 0.75 to 1.2 million over this period, a faster rate than the growth of the total workforce.

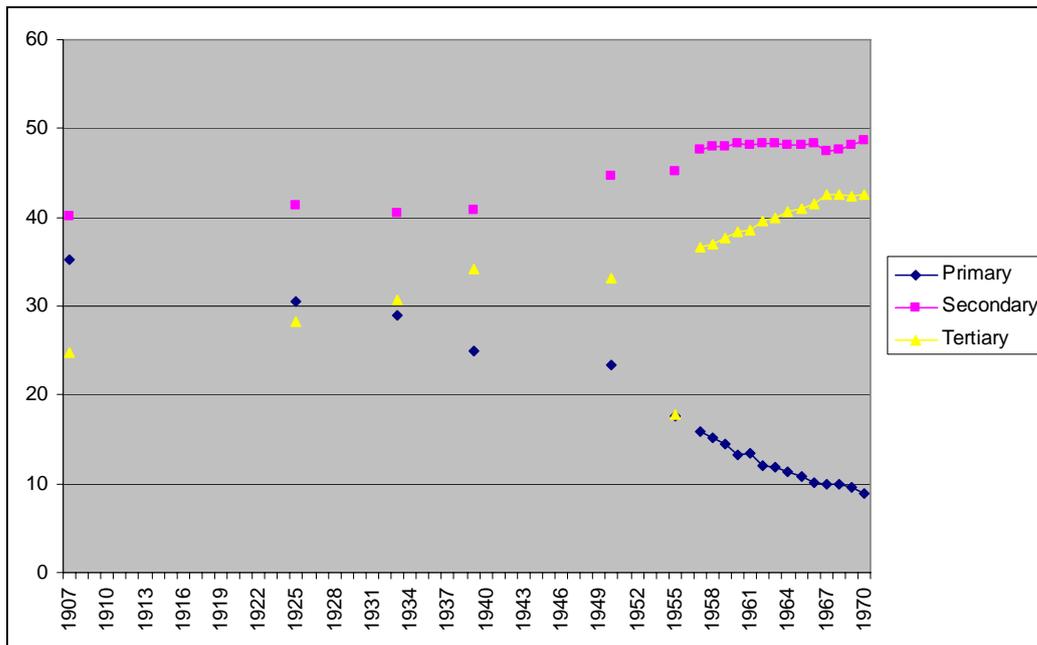
Table 3. Sectoral shares of employment in Germany

	Primary	Secondary	Tertiary
1849	56.7	22.9	20.4
1861	52.8	26.2	21.0
1875	51.0	27.6	21.3
1882	50.0	28.0	22.0
1895	43.7	32.1	24.2
1907	37.8	35.8	26.5

Source: calculated from Hoffmann (1965), pp.194-205.

Figure 2 takes the story up to 1970 using data from the German Federal Statistical Office. This data is not completely comparable with Hoffmann's, but from 1907 discrepancies are relatively small. The chief issue to remember is that mining is included in the secondary, not the primary sector. It can be seen that the share of the industrial workforce in the total remained very stable in Germany until the 1950s. The relative decline of the agricultural workforce is balanced by the rise of tertiary employment, which has expanded continuously in every decade except for the 1940s.

Figure 2. Sectoral (PST) shares of employment in Germany, 1907-1970



Source: Statistisches Bundesamt Wiesbaden, (ed.) *Bevölkerung und Wirtschaft 1872 – 1972* (Stuttgart/Mainz, 1972). p.142.

Note: This data refers to the boundaries of the post-war Federal Republic.

Agriculture and by-employment

It is worth examining a little more closely the agricultural share of the workforce. As we have seen this was the least likely to be accurately enumerated from the earliest censuses, if it was included at all. It has also been subject to the greatest correction by Hoffmann, who added 1.4 million people to the 1882 census figures to account for on-farm dependents who were part of the labour force. This raised them from 24% to over 35% of the agricultural labour force. The global effect of this change is to push the Primary sector share to 50% from 46%. Thus Hoffmann's correction, being more prepared to include the family on-farm labour than the census takers prior to 1907, has the effect of making structural change appear more concentrated after 1882. The structure of the agricultural labour force in 1882 is presented in Table 4.

Table 4. The Structure of the German Agricultural Labour Force, 1882

	Number (million)	%
Occupier / Farmer (<i>Landwirt</i>)	3.14	33.1
Servants in husbandry /	1.64	17.2

stewards		
Family and other dependents	3.34	35.2
Waged labour	1.37	14.5

Source: calculated from SJDR 5 (1884), p.10; Hoffmann (1965), p.183.

Family labour thus made up around two-thirds of the entire agricultural workforce, and waged labour only a small proportion. Indeed, of the occupiers, no less than 72% did not employ any waged labour. This has important implications for our understanding of where 'unallocated' labourers recorded in earlier census actually worked. Unless there had been a very major structural shift in German agriculture in previous decades, only a relatively small minority of this unattributed labour could have worked in agriculture.

The relative size of the agricultural sector in occupational terms is complicated by the presence of by-employment: people who primarily work farms but also do additional labouring, spinning, weaving or the like on the side; or those predominately active in secondary and tertiary occupations who nevertheless retain land which they work themselves. In some cases German statisticians of the nineteenth century lamented it was hard to tell which was the 'main' and which the 'by' employment; in some regions of highly fragmented landholding such practices were very widespread indeed. If the economic activity of the household implied a division of labour *within it*, for example with the male head working in industry and his wife working as a dairymaid at home, this would not present a problem in occupational categorization, or in understanding the structure of the economy. It was far from clear however that this was the case.

Alongside the basic figure for the number of persons in each occupation, the census takers of 1882 also recorded the number included in that total who were women; the number of other dependents in the household, some of whom performed work; and a total for each occupation combining those for whom it was their main occupation, *plus those by-employed*. As this last figure was very nearly always larger than the basic total given for that occupation, it is clear that the 'main figure' did generally not incorporate people who were by-employed. By-employed agriculturalists, for example, presumably were counted elsewhere in the census under their main occupation, although a proportion of them may not have appeared elsewhere in the occupational census at all. The procedure seems to have mostly avoided double-

counting in the column for main occupation, although the statisticians reported that in their *aggregation to sectors* of this final tally including the by-employed there was, inevitably, double-counting.²⁵

16% of Germany's work positions were by-employments. At least that it is the total we get by subtracting those counted with a main occupation from the total of by-employed and main occupations, and comparing the remainder, presumably the by-employed, against the total. Doubtless some by-employed had *multiple occupations*, while some by-employed might be better described as part-time workers. We cannot thus give by-employment as a percentage of the labour force, as we cannot eradicate double-counting. We can note that virtually every single occupational category (of 147) had some by-employment, but the proportion was usually small. A wide variety of occupations ranging from civil servants, actors and musicians, to fisherfolk, shop workers, gravediggers, and turfcutters had more than a fifth of their number by-employed. In the case of those selling insurance, a full 71% were by-employed. This was not something by any means limited to landholding and agricultural labour. However, by far the largest groups of by-employed *did* work in agriculture, either occupiers of land and their families, or servants in husbandry, totalling over 3 million persons. Far behind are shopworkers (180 000) and those providing accommodation (143000). These numbers can be aggregated on a sectoral basis, as in Table 5. We can see there is a skew towards by-employment in the primary sector, and thus the 'main occupations' used to provide the sectoral shares above are likely to underestimate actual activity in the primary sector.

Table 5. By-employment in Germany in 1882

	Number (1000s)	%
Primary	3168	75
Secondary	489	12
Tertiary	533	13

Source: SJDR 5 (1884), pp.10-20.

How can we compute this into the total occupational statistics? A very simple model can illustrate the potential impact of by-employment. We can set the time a by-

²⁵ SJDR 5 (1884), pp.10-20.

employed person works at a task as being 25% of a full-timer. This is an entirely arbitrary figure for the purposes of the model. We then assume that all those by-employed were in fact included in the main occupational census elsewhere. If we assume that by-employment in the secondary and tertiary sectors effectively cancelled each other out, for the sake of simplicity, we then have to add labour to the primary sector, and deduct it from the other two sectors, to find the modelled distribution of activity. Thus we add $0.25 * 3.168\ 000$ workers to agriculture, and for the sake of convenience, deduct that labour time equally from the other two sectors ($0.25 * 1.584\ 000$ each) Table 6 reports the impact of this exercise on the sector shares. Alternatively, as another extreme, we could assume that all the by-employed were *additional* to those recorded in main occupations, that is, they were really part-time workers and did not have multiple occupations (whether ‘main’ or by-employments.) In fact this assumption gives exactly the same sectoral shares as the model just outlined.

Table 6. Modelling the impact of by-employment on sector shares

	Real % 1882	Model % 1882
Primary	50	54
Secondary	28	26
Tertiary	22	20

Although at first glance the difference seem relatively small, the model produces an occupational structure that would fit Germany around 1860 – a considerable period of time in an age of supposedly rapid change. These simple calculations can only suggest that the role of by-employment suggests that structural transformation came later in Germany than even Hoffmann’s figures suggest. However this is clearly only suggestive of what the effect might have been. If the by-employed worked only 10% the hours of full-timers, this impact would be halved: the approach is easy to adjust.

Female and male employment

In 1882, 1895 and 1907 women made up around 35% of the labour force. In fact, this proportion had altered little by 1970.²⁶ Occupations such as laundering and sewing and embroidery were almost exclusively female. In the provision of accommodation,

²⁶ Calculated from Hoffmann (1965); and Hohls & Kaelble (1989), p.102.

factory spinning and health services the workforce was 59-65% female. The military was the only occupational group that contained no women at all, but generally construction, and mining had very few women (1% or less), as did some branches of manufacturing that involved a rather less obviously gendered activity by traditional standards, such as shoemaking, where only 2% of the workers were female. Table 7 provides the breakdown on a sectoral basis.

Table 7. Female share of workforce within each sector, 1882

Primary	39
Secondary	19
Tertiary	47

Source: calculated from SJDR 4 (1885), pp.10-20.

It is likely that Hoffmann's figures (or the 1882 census figures adjusted as by Hoffmann) slightly overstate the female share of the workforce. Hoffmann assumed that nearly all of the residential household servants, who numbered nearly 1.5 million, were female.²⁷ But among non-residential domestic servants the proportion was only 71%. It may be that residential servants were much more likely to be female, but nevertheless this is probably an overstatement. Prussian statistics give the share of men and women among domestic servants in censuses stretching right back to 1816, and the proportion is always around or a little more than 70%.²⁸ As domestic servants were a large part of the tertiary sector, the share of female employment may have been several percentage points lower..

By disaggregating male and female workers we can examine how each gender was distributed across the sectors (that is, what proportion of each gender worked in each sector), as shown in Table 8. Unsurprisingly we find that women cluster in the primary (agricultural) and service sectors, while the male workforce was more industrial than the total workforce.

²⁷ Hoffmann (1965), pp.205, 210.

²⁸ SJDR 5 (1884), p.19; QBGD, *passim*.

Table 8. Distribution of Male and Female Workforces, 1882

	Total	Male	Female
Primary	50	46	57
Secondary	28	35	16
Tertiary	22	21	27

Over time to 1907 the share of women in each sector held steady or actually rose, but because the period was most marked by the rise of the industrial sector, where the proportion of female employment was static, the female share of the overall workforce also altered little. A similar phenomenon kept the female share of the labour force stable for much of the twentieth century. The structural shift towards secondary and tertiary employment had a depressive effect of female labour force participation, even though female participation *within* every sector rose.

Leading Sectors and Regions

We have seen that structural change in Germany favoured the secondary sector, but that the shift was more marked after 1882, especially in fact in the tertiary sector that had retained a rather static share of employment before that date. Within the secondary sector, the most salient changes are the rise of the metallurgical branches and the slide from dominance of the textile and clothing industries. Industrialisation of the total workforce thus involved the declining relative importance of textiles within the secondary sector. The persistence of 'traditional' industries such as wood products and food processing left Germany with a diversified secondary sector by 1907.

Table 9. Shares of Secondary Sector Employment in Major Industries (%)

	Ceramics, bricks, stone, glass	Metals	Chemical	Textiles	Clothing	Wood	Food processing	Construction
1846	4.4	10.3	0.5	22.2	24.7	10.9	13.8	10.2
1861	5.8	10.9	0.9	19.4	23.1	10.3	14	11.3
1875	6.5	14.6	1.3	18	20.9	10.1	13.1	10.3
1882	6.8	14.4	1.5	16.3	22.9	9.7	13.4	9.2
1895	7.9	15.8	1.8	13.2	18.5	9	13.7	13.6
1907	8.2	19.8	2.3	10.8	15.2	8.9	12.3	15.3

Source: Hoffmann (1965)

In the tertiary sector, the dominant story is the rise of the retail and financial sector and the relative decline in domestic service. Other changes are relative sideshows compared with this shift. In the transport sector the rise of the railways was counterbalanced by the decline in both maritime and riverine navigation. The share of transport and communications only leapt forward in the late 1890s as the combined result of the growth of the postal service, trams and rail. Public services such as education and administration registered modest increases. The structural transformation within the tertiary sector was already underway in the 1850s and the rise of the overall importance of the sector after 1882 was not marked by any change in internal trends.

Table 10. Shares of Tertiary Sector Employment (%)

	Finance	Transport & Communications	Public Services	Domestic Service	Other
1846	13.2	8.2	12.4	50.9	15.3
1861	14.5	11.0	13.3	46.4	14.8
1871	19.8	10.0	13.0	42.8	14.4
1882	22.9	11.0	13.3	37.4	15.4
1895	28.0	9.8	14.1	30.6	14.9
1907	32.3	15.0	14.6	23.0	15.2

Note: 'Public Services' includes education, clergy, public administration and health. 'Other' includes chemists, personal services, artists, and journalists.

Source; Hoffmann (1965).

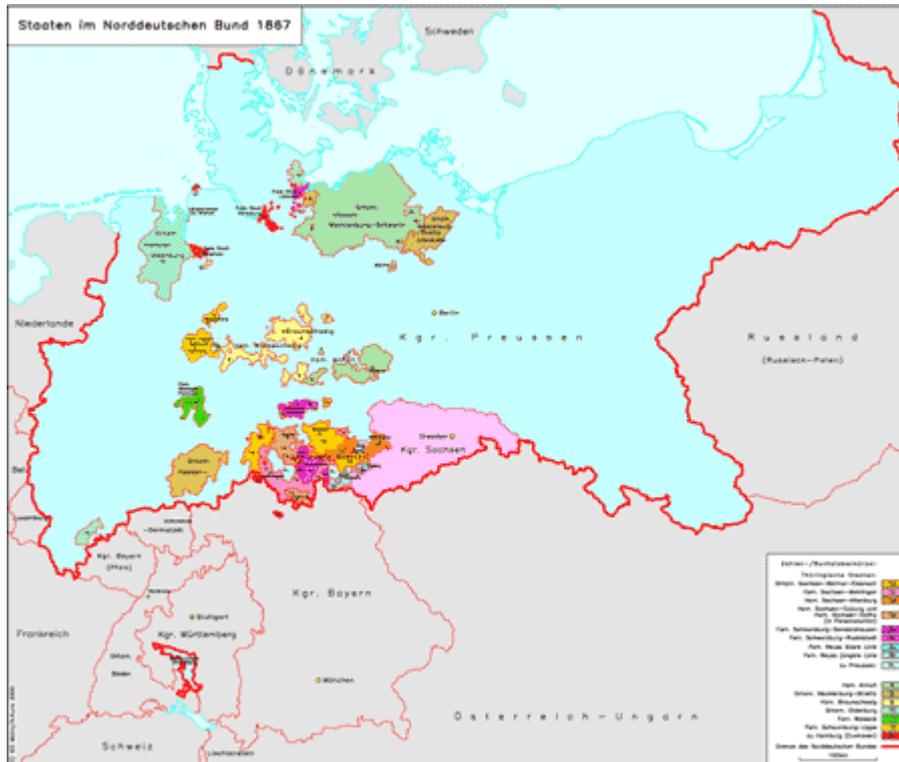
Although we cling to national statistics, as much from convenience as the degree of unity provided by increasingly unitary tariff, taxation and legal regimes, European industrialization is well-known to have been a highly regionalized phenomenon.²⁹ This was especially true of the energy-intensive industries that comprised an increasing share of German industry: metals, engineering, and chemicals, that depended on supplies of cheap coal – most famously in the case of the spectacular expansion of the Ruhr from the 1850s. We can see however that while the 1850s was indeed an era of rapid advance for industry, over the period c.1850-1914 no one branch and by implication no one region was able exercise a dominant influence on structural change, at least in employment terms. Industrialisation was indeed a spatially very uneven process with great concentrations of activity. Nevertheless if we examine the data on the scale of the provinces that made up the Kingdom of Prussia, and the principalities that pre-dated unification, we do not find structural change in occupations being strongly driven by any one, or indeed handful, of regions.

1882 is the first year where we can obtain aggregate data across the whole of Germany for occupations in all sectors. However, as we have seen, this data must be corrected, as has been done by Hoffmann. However Hoffmann conducted his revisions on the national level and it is not yet possible to ascertain how these should be distributed on a regional scale. At earlier dates these difficulties are further compounded because of the unreliability of data collected, especially for the primary sector.

Given this I have examined regional change using only the secondary sector, looking at changes in secondary sector employment as a share of the total adult population of working age. The baseline is 1882.

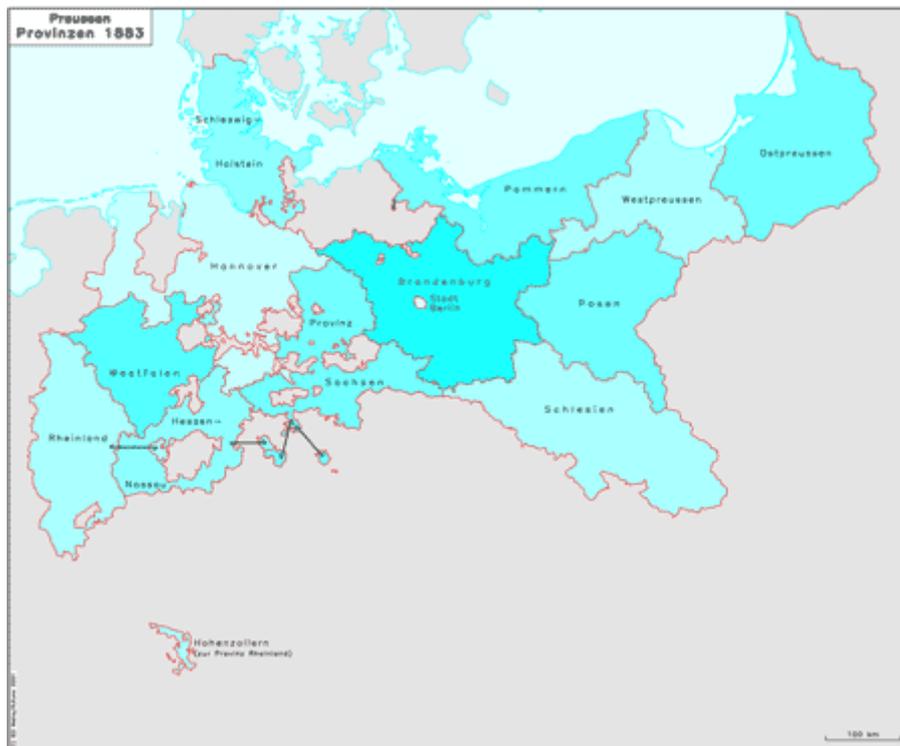
²⁹ Pollard (1981)

Map 1. The German states in 1867



Source: A.Kunz, IEG-Maps, Staaten im Norddeutschen Bund 1867.

Map 2. Provinces of Prussia, 1883



Source: A.Kunz, IEG-Maps, Provinzen im Königreich Preussen 1883.

Table 11. Regional Levels of Secondary Sector Employment in Germany, 1882

<i>Province / State</i>	<i>Secondary Sector Employment</i>	<i>Share of adults (15-69) employed in secondary sector</i>
Ostpreussen	101625	0.11
Westpreussen	72728	0.12
Berlin	185332	0.35
Brandenburg	224969	0.20
Pommern	105261	0.14
Posen	78750	0.11
Schlesien	420033	0.20
Sachsen	271234	0.22
Schleswig-Holsten	109677	0.19
Hannover	196214	0.17
Westfalen	220704	0.20
Hessen-Nassau	162893	0.20
Rheinland	511683	0.25
Hohenzollern	8644	0.16
Prussia	2668797	0.19
Franken	212562	0.19
Oberbayern	290448	0.17
Pfalz	72405	0.21
Bayern	574415	0.18
K.Sachsen	513665	0.36
Wuerttemberg	243552	0.21
Baden	200454	0.21
Hessen	101588	0.22
Mecklenburg-Schwerin	48914	0.15
Sachsen-Weimar	36570	0.23
Mecklenburg-Strelitz	8276	0.15
Oldenburg	29611	0.17
Braunschweig	46504	0.25
Sachsen-Meiningen	34683	0.28
Sachsen-Altenburg	21822	0.27
Sachsen-Coburg-Gotha	27888	0.28
Anhalt	35930	0.24
Schwarzburg-Sonder	11221	0.24
Schwarzburg-Rudolstadt	9192	0.27
Waldeck	4785	0.16
Rauss aelterer	10813	0.42
Rauss juengerer	14697	0.34
Schaumberg-Lippe	3980	0.20
Lippe	12876	0.18
Luebeck	8692	0.23
Bremen	24143	0.28
Hamburg	67106	0.26
Elsass-Lorraine	196348	0.24
Reich	4961811	0.21

Source: SJDR 5 (1884). Note: see note to table 12.

Table 11 shows how the Kingdom of Saxony³⁰ (*K. Sachsen*), centred on Leipzig and Dresden, was the most industrialised region of Germany with some 36% of its adult population working in the secondary sector (although some very small administrative units also had large secondary sector shares, indicating that many of the pre-unification micro-states were relatively highly industrialised). This large share was predominately a result of the textile industry, both in cloth production and finished clothing, which had a much higher share of secondary employment than the national average (50% against 36%). The rising metallurgical industry was more heavily concentrated in the western provinces, especially the Rhineland. As one would expect urban centres such as Berlin, Hamburg and Bremen also have high shares of secondary sector employment, especially in finished clothing and food processing. What is perhaps striking is that most regions of Germany do not deviate that far from the national average, with the exception of the eastern provinces of Prussia, where secondary sector employment was very low.

Tracing these patterns back is more difficult, and is attempted here only for a selection of Prussian provinces between 1852 and 1882. This is a short time period but one often considered to be the 'take-off' of German industrialization. As can be seen in Table 12, there is little sign of faster or slower rates of industrial development in different provinces (Brandenburg's industrial growth is largely accounted for by Berlin). Industrial leaders in the 1850s were industrial leaders in the 1880s, despite the structural shifts within the secondary sector over those years.

Table 12. Secondary Sector Employment as Share of Adults, Prussian Provinces, 1852-1882

	1852	1861	1875	1882
Brandenburg (inc. Berlin)	0.18	0.20	0.20	0.25
Posen	0.09	0.12	0.08	0.11
Pommerania	0.11	0.09	0.12	0.14
Silesia	0.18	0.17	0.18	0.20
Saxony	0.19	0.21	0.19	0.20
Westphalia	0.22	0.21	0.19	0.20
Rhineland	0.25	0.23	0.22	0.25

³⁰ This should not be confused with the province of Saxony within the Kingdom of Prussia.

Source: SJDR 1 (1880), 5 (1884); *Statistik des deutschen Reichs* Bds. XXXIV & XXV (Juliheft 1877); QBGD, Bd.II.

Note: This table was not quite compare like with like. The first two columns relate to the population aged 15-64. The second two relate to the population aged 15-69. As data on this latter cohort are currently not available to me for 1882, the proportion of the population of this age in each region is assumed to be the same as in 1875. There was some variation, with urban populations having a much smaller proportion of children in the total. Given this, the proportion of adults in the secondary sector was probably rather stable from 1861 to 1882.

These remain preliminary and limited results. However, they suggest that German economic development was not marked by strong trend breaks on a regional or national level between the 1840s and early twentieth century. The more marked decline in the primary sector from the 1880s was accompanied by relative expansion of the industrial, and for the first time the tertiary sector, but there is little sign of changing trends occupational structure *within* these growing sectors at that point in time. Internal sectoral patterns of change were already established in the 1850s.

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