Primary Sector Output and Mortality Changes in Early XIXth Century Bavaria

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The overall significance of the fall in mortality, as the prime causal factor behind the overall growth in population in the late XVIIIth and early XIXth centuries has been generally recognised.[1] The debate as to why death rates fell, however, continues unabated. On balance the theory put forward by Mckeown and his colleagues would seem to be winning by a clear head,[2] and the theory itself has recently been characterised as possessing a « rocklike unshakeability ».[3] In essence the overriding emphasis is laid on the primary importance of an increase in food supplies, associated with a distinctive change from exploitive to productive agriculture. This transition laid the basis for the long-term growth in total population not only in England but on the basis of data from four other countries (Sweden, France, Ireland and Hungary) for Europe as a whole. Alternative explanations have been cast aside. It has been shown conclusively that much-vaunted public hygiene improvements invariably post-dated the onset of the long-term fall in general mortality. Equally the cycle of medical innovation has been proved to have been too weak to have provided effective remedies, particularly in view of

[1] D. V. Glass, *Introduction to Population in History*, D. V. Glass and D. E. C. Eversley (eds.), London, 1965, p. 15.

[2] T. McKeown and R. G. Record, *Reasons for the decline of mortality in England and Wales during the XIXth century*, « Population Studies (P.S.) », Vol. 16, 1962, pp. 94-122. T. McKeown, R. G. Brown and R. G. Record, *An Interpretation of the Modern Rise of Population in Europe*, « P.S. », Vol 26, 1972, pp. 345-382. T. McKeown, *The Modern Rise of Population*, London, 1976, p. 142.

[3] M. W. Flinn, *The Stabilisation of Mortality in Pre-industrial Western Europe*, « The Journal of European Economic History », Vol. 3, No. 2, 1974, p. 316.

the continued widespread ignorance until the mid XIXth century of the real nature of infectious disease. Finally the strenuous claims for the radical effect of smallpox innoculation on death rates have been revealed as largely misplaced.

The purpose of this paper is not to criticise the specific examples cited by McKeown and his colleagues in the context of the demographic experience of continental Europe, but to take a further case study in order to examine the general applicability of the theory for European experience as a whole. Despite, or perhaps because of the relative neglect of Germany in present discussions on the causative factors lying behind the general long-term fall in mortality during this period, it is hoped that this further example will cast some light on whether the « rock-like unshakeability » of the thesis has in fact been fully deserved. Can the relative fluctuations in mortality in the course of the early XIXth century be explained primarily in the context of increased per capita output from the primary sector and the inferred improvement in general standards of nutrition and diet? How close was the degree of correlation between the two prime indices of increased agricultural output and dependent reductions in age-specific mortality figures? Or is it conceivable that the changes in mortality were essentially more complicated and the beneficial spin-offs of higher output and productivity in agriculture more differentiated than the protagonists of the thesis have made out?

Most German states were still primarily agricultural at the end of the XVIIIth century. Indeed the agrarian sector continued to predominate generally until well after 1850. But as in the other cases cited by McKeown similar evidence of a marked rise in total agricultural productivity and output can be found during this period. The process of development evinced a marked duality. If certain Prussian provinces, such as Brandenburg, Pomerania and Posen were able to raise output by an extension in the total cultivable area,[4] other areas, such as Mecklenburg, Schleswig-Holstein and Saxony were noted for a general improvement in yields from existing land, facilitated either by the adoption of new crops, or by the application of modernised means of production. Significantly the last decade of the XVIIIth century has been taken as marking the onset of the "agricultural revolution" in Germany as a whole.[5] The details of this important development are already too widely known to require any further extensive discussion at this particular juncture. The net effect, however, was to

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[4] W. Köllmann, *Grundzüge der Bevölkerungsgeschichte Deutschlands im 19, und 20. Jahrhundert*, « Studium Generale », Jhg. 12, 1959, p. 384. The cultivable area in the North-East provinces, including East-Prussia, Brandenburg, Pommerania and Posen was increased from 3.2 to 7.4 million hectares in the period 1815-1849.

[5] P. Bairoch, *Agriculture and the Industrial Revolution, 1700-1914*, in C. M. Cipolla (Ed.), « The Fontana Economic History of Europe », Vol. 3, London, 1973, p. 466.

raise agricultural output considerably. Production from the primary sector rose by 135% in the period 1816-1865, or at an annual average rate of 1.3% between 1800 and 1883, considerably in excess of the comparative figure of 0.7% p.a. for the overall growth rate of population. The lessons provided by the "masters of agriculture", as the English in the late XVIIIth century had been known, had been well learnt.[7]

Despite the fact that differential rates of increased primary sector output were reported, almost every single German state underwent this general pattern of development. But significantly Bavaria was to prove no exception to this general pattern. Indeed, economic societies designed to stimulate innovation in the primary sector, such as the "Churbaierische Landesökonomie - Gesellschaft", the "Kurpfälzische ökonomie Sozietät" in Kaiserslautern and the "Sittlich-oekonomische Gesellschaft", had been founded from the 1760's onwards.[8] More concentrated impulses in this direction had been provided in the early XIXth century by both the Agricultural Union" and the "Polytechnische Verein".[9] Achievements in both major sectors of agricultural production were considerable.

(a) The proportional increase in the production of major grain crops in Bavaria was substantial and compared favourably with the relative production levels achieved in other German states (Table I). Indeed it could be argued that the rate of growth in output of basic grains was more rapid in Bavaria, particularly after 1833. Whereas in Saxony, Württemberg and Baden, the incremental rate of growth tended to slacken off in the 1830's and 1840's, and even went through a period of relative stagnation in the 1860's, the overall trend in Bavaria was continuous. During the period 1800-1851/5 total grain production rose by 210% in Bavaria, in comparison with a rise of 108% in Saxony, 62% in Württemberg and only 70.3% in Prussia (1804-1851/5). Furthermore although a high rate of increased output was common to all the basic grain crops (Table 2), wheat, which was the most valuable, both in monetary and nutritional terms, registered the highest overall rise of 383.96% in the period 1810-1863. Despite the occasional agricultural crisis, as in the years 1815/16, the 1820's, the late

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6 W. G. HOFFMANN, *The Take-off in Germany*, in W. W. Rostow (Ed.), « The Economics of Take-off into sustained Growth », London, 1963, p. 103.

7 J. C. WÖLLNER, *Unterricht zu einer kleinen aber auserlesenen Bibliothek bestehend in einer Anzeige der best ökonomischen Bücher und derer vornehmsten in grösseren Werken zerstreut befindlichen Abhandlungen über alle Teile der Landwirtschaft*, Berlin, 1764, p. 5. Cited by H.-H. Müller. *Christopher Brown — an English Farmer in Brandenburg-Prussia in the XVIIIth century*, « Agricultural History Review », Vol. 17, 1969, p. 121.

8 A. SCHLÖGL (Ed.), *Bayerische Agrargeschichte*, Munich, 1954, p. 52.

9 *Ibid.*, pp. 556-8. H. PFISTERER, *Der Polytechnische Verein und sein Wirken im vorindustriellen Bayern (1815-1830)*, « Miscellanea Bavarica Monacenesia », Heft 45, Munich, 1973.

TABLE 1

GRAIN AND POTATO PRODUCTION IN 4 GERMAN STATES
(in 1,000 Ton grain-equivalent) (index 1800/10 = 100)

	Prussia	(I)	Saxony	(I)	Bavaria	(I)	Württemberg	(I)
1800	4800	102	410	98	720	100	378	101
1804	4700	100	400	95	720	100	360	96
1810	4600	98	448	107	714	99	384	102
1816	4640	100	430	103	760	106	350	94
1821/5	5992	127	560	136	1143	159	511	136
1826/30	6177	131	606	144	1327	185	495	132
1831/5	6894	146	678	162	1726	240	536	143
1836/40	7443	158	793	188	1809	250	582	156
1841/5	7953	169	932	222	1931	268	633	169
1846/50	8589	182	977	233	2244	311	694	185
1851/55	7512	159	856	204	2234	310	616	164

(G. Helling. Berechnung eines Index der Agrarproduktion in Deutschland im 19 Jahrhundert. Jahrbuch für Wirtschaftsgeschichte. 1965, No. IV, p. 128).

TABLE 2

TOTAL PRODUCTION OF GRAINS IN BAVARIA (1810-1863)

	1810	1833	1830	1863
Wheat	396,120	1,259,367	1,343,622	1,917,090
Rye	1,327,561	2,962,520	3,260,971	3,898,413
Spelt	674,871	1,378,800	1,665,398	2,001,183
Barley	798,490	1,927,363	1,851,301	2,763,159
Oats	1,333,636	2,750,818	3,644,105	4,104,399
Total (Scheffel)	4,530,678	10,278,868	11,765,397	14,774,244

(F.B.W.v. Hermann. Die Ernten im Königreich Bayern und in einigen Ländern. Beiträge zur Statistik des Königreichs Bayern. Heft XV. Munich, 1866, pp. 50-52).

1840's and the middle years of the 1860's [10] the Bavarian achievement in this context was clearly considerable.

(b) A similar picture emerges, however, in the context of developments in the livestock/dairy sector.[11] Between 1810 and 1840 there was an increase in all the major categories of livestock listed in the official survey returns: horses (under 3 years) by 58.3%, calves by 87.3%, lambs by 139.7%, pigs by 129.3% and goats by 44.2%. Even to certain contem-

10 A. KALCHGRUBER, *Untersuchungen über landwirtschaftliche speziell bäuerliche Verhältnisse in Altbaiern*, Munich, 1885, p. 8.

11 Systematic calculations of livestock were implemented nationally for Bavaria on a fairly regular basis during this period, namely in 1794, 1810, 1833, 1840, 1854 and 1863, and provide an accurate basis for estimating overall trends in this sector.

poraries the increase in livestock numbers had appeared "extraordinary",[12] and this general process of numerical growth was reinforced from a nutritional point of view by distinct qualitative improvements. Average slaughter weights in Munich rose substantially and meat production as a whole is estimated as having risen over two-fold in the first half of the XIXth century.[13] The comparison with the late-XVIIIth century could not have been more pointed. According to a priest in Fürholzen the quality of local cattle had been invariably "poor".[14] Hazzi had pointed to a complete unawareness of the significance of breeding and highlighted the general lack of any attempts to improve the quality of livestock.[15] The practice of mixing cattle of different ages on general pasture had invariably had an adverse effect on overall milk production.[16] Nevertheless by the mid-XIXth century the livestock/dairy sector in Bavaria compared very favourably with achievements in other areas of Germany, which are often viewed as having been more advanced in this respect.

It is clear, therefore, from this brief survey that by the mid-XIXth century output of both basic grains and livestock had undergone a most pronounced development. Indeed in terms of an adjusted unit of rye equivalent output (net of seed allocations), the total availability of all bread grains per 1,000 inhabitants in Bavaria was noticeably higher than in any other of the major German states (Table 3). Given the fact that the annual rate of population growth in the period 1816-1864 in Bavaria only stood at 0.63%,[17] it is clear that the comparative annual increase in the output of basic grains of 4.26% (1810-1863) should theoretically have produced a very significant improvement in the overall quantity of food available to the indigenous population. Equally in the livestock/dairy sector, by the mid-XIXth century the distribution of livestock per 1000 population in Bavaria exceeded comparative distribution figures for most of the other major German states (Table 4).

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12 F. B. W. von Hermann, *Ueber den Anbau und Ertrag des Bodens im Königreich Bayern*, Munich, 1857, p. 20.

13 G. Helling, *Berechnung eines Index der Agrarproduktion in Deutschland im 19. Jahrhundert*, « Jahrbuch für Wirtschaftsgeschichte », 1965, No. IV, p. 137. A. Schlög, *op. cit.*, p. 522. Milk production per cow, for example, rose from c. 1,000 litres p.a. in 1800 to 1,500 litres by the mid XIXth century.

14 Pfarr-Archiv Fürholzen. Saalbuch, fol. 603 r.

15 J. von Hazzi, *Ueber Güterarondierung sammt der Geschichte der Kultur und Landwirtschaft von Deutschland und einer statistischen Uebersicht der Landwirtschaft von jedem Kreise des Königreichs Bayern*, Munich, 1818. Cited by A. Dimpfl, *Der Einfluss der Bauernbefreiung in Bayern auf den landwirtschaftlichen Betrieb*, Inaug. Diss., Munich, 1916, pp. 69-70.

16 J. R. Tschiffeli, *Von der Stallfütterung und vom Kleebau in der Schweiz*, Bern, 1789, pp. 10-15.

17 *Statistisches Jahrbuch für das Deutsche Reich*, Jhg. 33, 1931, p. 26. Cf. Table 6.

TABLE 3

TOTAL OUTPUT OF ALL BREAD GRAINS
(in rye equivalent units and net of seed allocation)

		Scheffel per 1,000 inhabitants
Austria	(1858)	1,222
Prussia	(1844-57)	1,097
Saxony	(1860)	1,291
Württemberg	(1852)	1,082
	(1863)	1,188
Hessen	(1864)	1,213
Belgium	(1856)	1,421
Bavaria	(1839)	1,120
	(1863)	1,383 (*Ibid*., pp. 68/9)

TABLE 4

DISTRIBUTION OF LIVESTOCK PER 1,000 INHABITANTS
IN INDIVIDUAL STATES

Country and year		horses	cows	sheep	pigs
Austria (1858 - average)		107	192	501	250
Prussia (1844-57)		96	183	1,019	148
Saxony	1846	48	207	289	110
	1860	43	185	167	121
Württemberg	1852	46	196	228	116
	1862	55	228	265	83
	1863	56	271	397	126
Hessen	1863	48	212	278	194
	1864	50	219	257	249
Belgium	1846	65	146	153	114
	1856	61	146	128	101
Bavaria	1839	80	283	435	193
	1863	81	326	439	148

(F.B.W. von Hermann. Die Ernten im Königreich Bayern und in einigen andern Ländern. Beiträge zur Statistik des Königreichs Bayern. Bd. XV. Munich, 1866, pp. 68/9).

The factors which contributed to this remarkable transformation of the primary sector during the early decades of the XIXth century were numerous, but structural reform was clearly important. The Hoffuss system was effectively abolished in February 1805, and with its demise a significant barrier to further land reform and an optimal distribution of land (as a factor of production), which had been criticised by many contemporaries in the late XVIIIthe century for its inherent rigidity,[18] was effectively removed.

[18] M. J. GÖHL VON POTHORSTEIN, *Gedanken über Bevölkerung und Landeskultur in Bayern*, Munich, 1800, pp. 14-16. As a result the process of land redistribution on the basis of more economically viable production units was visibly speeded up. Cf. R. SCHREIBER, *Güterzertrümmerung und Abnahme der Höfe in Oberbayern*, Munich, 1888, p. 65.

Equally legislation linked with the process of peasant emancipation undoubtedly reinforced the existing cash nexus of the primary sector and removed, to some extent, traditional restrictions on attempts to maximise potential output in this sector.[19] Indeed it is significant in this particular context that the mechanism of improved productivity and total output in the primary sector conformed fairly closely with the process of transition to be found in most European states during the first half of the XIXth century. Indeed the pattern of change in Bavaria followed to a large extent the structural changes outlined by McKeown,[20] including the introduction of new crops, particularly root crops, improved crop rotation, winter feeding for livestock, improvements in farm implements [21] and improved manuring practices. Perhaps it was not purely accidental that the first German factory for the manufacture of superphosphates was founded in Heufeld (Bavaria) in 1858. To this extent Bavaria fits nicely into the pattern of primary sector development, which constitutes a major underpinning of the existing hypothesis.

It is perhaps worthwhile to examine one or two specific aspects of this significant increase in primary sector output, before moving on to assessing the impact of this development on the demographic variable.

(i) In the first instance it is important to note that a major component in the increased grain output was a noticeable rise in average yields during the period under consideration (Table 5). Average yields, by the mid XIXth century compared well with equivalent figures for Prussia (including the primarily agrarian Eastern provinces). The highest yields for bread grains in Bavaria in 1863 amounted to 4.78 Scheffel per Tagwerk, although a figure of 7.24 Scheffel per Tagwerk was returned for all major grains in Lower Bavaria.

(ii) Secondly it is important to emphasise that the early decades of the XIXth century were marked by a significant transition within the major crops cultivated from rye to wheat, which enjoyed a c. 50% higher nutritional value. From every 1,000 cultivated Tagwerke, the area sown

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19 Legislation of 21.6.1803; 8.2.1815; 13.2.1826. K. Haff, *Die Bauernbefreiung und der Stand des Bodenzinsrechts in Bayern*, Leipzig, 1910, *passim*.

20 T. McKeown, « P. S. », Vol. 26, 1972, pp. 353-54.

20 T. McKeown, « Population Studies », Vol. 26, 1972, pp. 353-54.

A questionnaire distributed by the Central Committee of the Agricultural Union in 1811 revealed that the leading protagonists of intensive agricultural production in Bavaria, Schönleutner in Weihenstephan and Professor Wallner in Landshut, had already used modern machines, including the moulding plough, sowing machines and the"Exstirpator" « Wochenblatt des landwirtschaftlichen Vereins », Munich, 1811, Bd. I, p. 97.

22 A. Schlögl, *op. cit.*, p. 62. Interest in the increased use of manure to raise output can be traced in contemporary literature back to the latter decades of the XVIIIth century. « Müncher Intelligenzblatt », No. 21, 11.6.1788, Art. VII. « Von der Art zu düngen, dessen sich ein guter Wirth mit Nutzen bedienen kann ».

TABLE 5

AVERAGE YIELD OF MAJOR GRAIN CROPS IN BAVARIA
(Scheffel per Tagwerk)

	Wheat	Rye	Spelt	Barley	Oats
1810	1.85	1.75	4.33	2.16	2.60
1812	1.64	1.59	3.30	2.09	2.51
1833	2.20	2.18	4.34	2.63	2.94
1839	2.06	1.99	4.68	2.31	2.86
1863	2.24	2.24	5.40	2.77	3.08

(F.B.W. von Hermann, Die Ersten im Königreich Bayern und in einigen andern Ländern. Beiträge zur Statistik des Königreichs Bayern. Heft XV., Munich, 1866, p. XV).

with wheat was raised from 106 Tagwerke (1810) to 162 Tagwerke (1863). The less valuable rye had its area reduced proportionally from 378 to 327 Tagwerke.

(iii) Finally, particularly within the period 1833-1853, there was a marked increase in the cultivation of high-value, commercial crops, such as hops, flax, tobacco and oil seed.[23] Between 1839 and 1863, for example, the extent of tobacco cultivation had risen from 14,579 to 15,992 Tagwerke, at a time when the average yield had also increased markedly from 6.9 to 9.3 Zentner per Tagwerk.[24]

The outlook by the mid-century ought, therefore, to have been fairly promising. Production of basic bread grains by the early 1860's would have comfortably exceeded contemporary estimates of average consumption requirements.[25] Regional production figures for 1863 would seem to confirm the assumption behind the general trend in output figures that most areas of Bavaria, at least in typical years unaffected by adverse climatic conditions, would have enjoyed substantial surplusses in the quantities of grain harvested. In 1863 estimated requirement levels would have been exceeded by 473,000 Scheffel in Lower Bavaria, 42,000 Scheffel in Upper Bavaria and by 8,000 Scheffel in Lower Franconia.[26] On this basis, therefore, Bavaria on the whole can be taken as a good example of the way in which improvements in primary sector output, both on the arable and on the livestock/dairy side should have served to produce a distinct improvement

23 F. B. VON HERMANN, *op. cit.*, p. 16.

24 A. DIMPFL, *op. cit.*, p. 67.

25 F. B. W. VON HERMANN, *Die Ernten im Königreich Bayern und in einigen andern Ländern*, « Beiträge zur Statistik des Königreichs Bayern », Heft XV, Munich, 1866, p. 60. The required level of 1.38 Scheffel of bread grains per inhabitant was exceeded due to the availability of an average of 1.43 Scheffel (1863/4), excluding other sources of nutrition.

26 *Ibid.*, p. XXVIII.

in the overall nutrition base of the indigenous population throughout the early part of the 19th century.

To this extent Bavaria fits all the requirements posited in the initial hypothesis. If primary importance in accounting for the significant fall in mortality in the late XVIIIth and early XIXth century in continental Europe is to be attributed to the qualitative and quantitative improvements in the overall performance of the primary sector, then Bavaria with its marked and above-average performance in both main sectors of agricultural production should theoretically provide effective confirmation of the hypothesis.

It is at this point, however, that a crucial weakness would seem to appear, which may well place in question certain assumptions which have tacitly been accepted as useful explanatory models for accounting for the marked fall in mortality during this period. Despite adequate levels of per capital supply from the primary sector, and the outstanding performance of agriculture as a whole in Bavaria, at least in comparison with output figures and average yields in other major German states, the rate of population

Table 6

RATES OF POPULATION GROWTH IN GERMAN STATES: 1816-64
(in thousands)

Area	Additional Population	% increase	% annual rate
East Prussia	875	98.7	2.05
West Prussia	682	11.94	2.48
Brandenburg	894	82.6	1.72
Pommerania	755	110.5	2.30
Posen	704	85.8	1.88
Silesia	1,509	79.3	1.65
Saxony	848	70.8	1.48
Schleswig-Holstein	302	43.3	0.90
Hannover	316	19.6	0.40
Rheinland	1,462	76.5	1.58
Westphalia	601	56.3	1.17
Hessen-Nassau	430	44.8	0.93
Hohenzollern	10	18.1	0.37
Prussia	9,873	72.0	1.50
Saxony	1,143	95.7	1.99
Württemberg	337	23.8	0.49
Baden	426	42.3	0.87
Hessen	255	45.3	0.94
Mecklenburg-Schwerin	245	79.5	1.65
Gross-Sachsen	87	45.0	0.93
Mecklenburg-Schwerin	27	37.5	0.84
Bavaria	973	30.6	0.63
Pfalz	195	45.3	0.94
Oldenburg	80	34.2	0.71
Braunschweig	67	29.6	0.61
Sachsen-Meiningen	57	47.3	0.98

(Statistisches Jahrbuch für das Deutsche Reich. Jhg. 33, 1932, p. 26).

growth in Bavaria during the first half of the XIXth century compares very poorly with the gains of rival states (Table 6). If the primary mechanism of population growth was indeed a falling rate of mortality, which was itself dependent on the level of food supplies and basic nutrition, why, it can be asked, did this mechanism apparently fail to operate in this particular case?

In actual fact the process of population growth tended to run in a diametrically opposite direction to evidence provided by the continuous expansion of the nutrition base. The population growth rate fell almost uniformly from a registered peak of 1.0% p.a. (1818-1820) to 0.11% between 1852 and 1855. Indeed the slowing down in the overall rate of growth came as a surprise even to government officials. On the basis of previous trends in the population variable an estimate had been made in 1834 of a projected net increase of 1 million inhabitants for the forthcoming 30 years. In reality the actual growth in population of c. 560,000 was only slightly above half of the original projection.[27]

The dichotomy between the established increase in agricultural output and the relative movements in population becomes even more pronounced in the context of the general evolution of death rates during this period. In many areas in Germany, often of a distinctly diverse economic structure, the late XVIIIth and early XIXth centuries were indeed marked by a pronounced reduction in mortality. In the Kur and Neumark (Prussia) the death rate had declined from 29.4 to 26.3 per 1000 in the period 1748-93 to 1816-49.[28] In Hannover a death rate of 29.4 in the late XVIIIth century had given way by the 1830's to one of 26.3 per 1000. Similar trends throughout Germany can be found in such diverse locations as the city of Winsen, the Elbe Island of Finkenwärder and 3 Gemeinde in the Black Forest.[29] Indeed even in urban areas, where mortality levels were historically higher than in surrounding rural districts, a clear improvement was registered in many cases within the course of this general period.[30] Bavaria once again,

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27 *Kammer Verhandlung der Kammer der Abgeordneten*, Munich, 1834, Bd. XI, p. 287.

28 K. Biedermann, *Deutschlands politische, materielle und soziale Zustände im 18. Jahrhundert*, Leipzig, 1880, p. 340.

29 L. Wülker, *Zur Bevölkerung von Winsen*, « Archiv für Bevölkerungswissenschaft und Bevölkerungspolitik (ABB) », Vol. II, 1941, p. 257. W. Scheidt, *Bevölkerungsbiologie der Elbinsel Finkenwärder vom Dreissigjährigen Krieg bis zur Gegenwart*, « Deutsche Rassenkunde », Bd. 10, Jena, 1932, p. 37. I. Müller, *Bevölkerungsgeschichtliche Untersuchungen in drei Gemeinden des Württembergischen Schwarzwaldes*, « ABB », Vol. 9, 1939, p. 107.

30 In Königsberg the death rate fell from 35.2 to 30.4 per 1,000 in the period 1770/9-1800/3 and in Berlin the rate also fell from 35.7 in the period 1780-90 to 32.2 between 1820 and 1836. K. Kisskalt, *Die Sterblichkeit im 18. Jahrhundert*, « Zeitschrift für Hygiene und Infektionskrankheiten », 1921, p. 136. K. Biedermann, *op. cit.*, p. 341.

however, remained an exception in this important respect. Although there was a slight reduction in the death rate in the Isarkreis, for example, in the late 1820's and early 1830's, by the mid-XIXth century rates of over 30 per 1000 were once again predominant. Indeed throughout the central decades of the XIXth century the death rate in Oberbayern (as in Bavaria as a whole) lay well above the average for those territories later incorporated in the German Empire. If the overall death rates for the German territories as a whole in the period 1841-50 stood at 26.8 per 1,000, the corresponding rate for Bavaria between 1844 and 1851 was 28.4. Only in the final decade of the XIXth century did an element of equivalence finally appear.[31] On a more local level death rates of 43.5 and 43.4 (per 1000) for the Landgericht Freising in 1833 and 1840 respectively reinforce the impression of a pronounced continuation of late- XVIIIth century early-modern mortality conditions. The general seriousness of the situation is made explicit on the basis of results from more localised studies. From a small group of 6 parishes (located between Munich and Freising) a significant pattern of adult mortality emerges between the late XVIIIth and early XIXth centuries. The life expectancy of individuals marrying in the early decades of the XIXth century was noticeably lower than for their XVIIIth century predecessors. Furthermore there is tentative evidence for a continuous deterioration in life expectancy until the marriage cohort of 1840-49.[32] At the same time the trend in the other major component of mortality, namely infant mortality, is equally at variance with the expected hypothesis. Despite the fact that generally a high proportion of the overall gains in mortality in the early XIXth century were concentrated in this particular category, in individual dependent parishes, decennial rates of infant mortality could still reach such levels as 49.05 (Pfarrei Gremertschausen, 1840-49) and even 50.0 (Pfarrei Allershausen, 1830-39). Figures such as these in the mid-XIXth century leave precious little room for any claims of a noticeable improvement in this important variable during the critical period under examination. Given the fact that the increase in primary sector output was evident throughout the whole kingdom of Bavaria and no less the case in the Landgericht Freising from where the data for this analysis have been primarily taken, how can the effective disparity in the trends of the 2 basic indices, primary sector production and general mortality be accounted for? What light does the case of Bavaria possibly cast on the general hypothesis of the essential interdependence of a fall in mortality rates and the transition as far as agriculture was concerned from an extensive to an intensive system of production? Even if death rates for certain years in the first half of the

[31] E. KEYSER, *Die Bevölkerungsgeschichte Deutschlands*, Leipzig, 1943, p. 514.

[32] W. R. LEE, *Some Economic and Demographic Aspects of Peasant Society in Oberbayern from 1752 to 1855 with special reference to certain Estates in the former Landgericht Kranzberg*, « D. Phil. », Oxon, 1972, pp. 102-6.

XIXth century were indeed marginally lower than earlier rates in the XVIIIth century and even if they were no longer subject to such a great degree of annual fluctuation, why, in view of substantial registered improvements both in total output and in the level of relative yields both in the arable and the livestock/dairy sectors of agriculture, did death rates in Bavaria remain relatively sticky at a time when other states within Germany with lower rates of growth in the primary sector were benefitting from far more marked falls in general rates of mortality?

Of crucial importance in any discussion of the interrelationship between mortality levels and the nutrition base is an analysis of the precise causes of death. It is, however, in this context that the deficiencies of extant data which is often a constant problem in the sphere of historical demography makes itself fully felt. Data essential for an effective interpretation of the causal factors behind relative movements in overall mortality, which provide wide-ranging and comprehensive information on the specific causes of death in individual age groups is only available for the United Kingdom, for example, from the mid-XIXth century onwards. The situation as far as national statistics are concerned is not much better on the continent of Europe, and only Sweden possesses material relating to causes of death from an earlier period (1749-1773).[33] As far as the German source base is concerned relevant information for most of the XVIIIth century is, at best, meagre and intermittent. Despite the early attempts of civic authorities in such urban centres as Berlin, Halle and Breslau to compile comprehensive bills of mortality,[34] the consistent listing of the cause of death in parish registers is something that only becomes increasingly frequent in the latter decades of the century.[35] The Prussian Cabinet Order of 1737, which stipulated that all deaths should be distinguished according to the cause of fatality, was generally disregarded and comprehensive returns are not available until after 1777.[36] In Baden-Durlach, however, effective listings occur from

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33 A. E. Imhof and B. I. Lindskog, *Les causes de mortalité en Suède et en Finlande entre 1749 et 1773*, « Annales E.S.C. », Vol. 29, 1974, pp. 915-933.

34 A. Gottstein, *Zur Statistik der Todgeburten seit 200 Jahren*, « Zeitschrift für Soziale Medizin », Bd. I, Leipzig, 1906, *passim*. C. J. Sprengell, *Bills of Mortality of several cnosiderable towns in Europe. Beginning with the year 1717, i.e. from Christmas 1716, to Christmas 1717*. Extracted from the Acta Bleslaviensia, « Philosophical Transactions of the Royal Society », 32, 380. Nov-Dec 1723, pp. 454-69. Ibid., *The Bills of Mortality for the Town of Dresden, for a whole Century viz. from the year 1617 to 1717, ibid.*, 38, 428. April-May-June, 1733, pp. 89-93.

35 A. E. Imhof (Ed.), *Historische Demographie als Sozialgeschichte. Giessen und Umgebung vom 17. zum 19. Jahrhundert*, « Quellen und Forschungen zur hessischen Geschichte », Bd. 31, Darmstadt and Marburg, 1975, p. 560.

36 A. Fischer, *Geschichte des deutschen Gesundheitswesen*, Bd. 2, Berlin, 1933, pp. 104-12.

1767 onwards,[37] and other parishes in other parts of Germany, such as Mulsum in Lower Saxony, tended to follow suit in the 1780's and 1790's.[38] Until the end of the XVIIIth century, therefore, the information provided on the assessed causes of death is fairly irregular, at best limited to a recording of serious epidemic outbreaks, as in the case of Zittow (Mecklenburg), where references to epidemics occur in individual parish register entries for 1735-6, 1746, 1757, 1766 and 1773-7.[39] Indeed the process of effective categorisation was further retarded by the continued propensity to list the causes of death in terms of terminal symptoms (such as vomiting, diarrhoea etc.), rather than as specific illnesses. At the same time, however, it would be premature to dismiss this evidence as unsuitable for modern analysis. Certain descriptions do contain a common base with the categories of modern diagnosis, as in the case of smallpox, puerperal fever and various forms of accidental death. A further group of pre-modern diagnoses can also be accepted as generally accurate because of the overall similarity in the nature of contemporary descriptions, which would apply, for example, to cases of malaria, dysentry etc.[40] Furthermore, despite the continued controversies over the classification of certain illnesses, the general quality of late XVIIIth century evidence was improved by distinct ameliorations in the precision of diagnostic assessments, illustrated by Hildebrand's differentiation between ordinary, contagious typhus and abdominal typhus.[41] The general awareness of the need for accuracy in the listing of causes of death was also reinforced by the growing interest in surveys of medical topography to be found in a number of German states towards the end of the XVIIIth century. Formey, in his survey of Berlin, for example, listed 134 separate causes of death.[42]

The situation in Bavaria was not substantially different from the general trend. Despite occasional references to the causes of death in mid-XVIIIth century registers (in the case of Weiden over 1/3 of all deaths are attributed to a specific cause),[43] it was not until the early XIXth century that concrete

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[37] O. K. Roller, *Die Einwohnerschaft der Stadt Durlach im 18. Jahrhundert in ihren wirtschaftlichen und kulturgeschichtlichen Verhältnissen dargestellt aus ihren Stammtafeln*, Karlsruhe, 1907, p. 129.

[38] W. Klenck, *Das Dorfbuch von Mulsum*, Kreis Wesermünde, Niedersachsen, 1959, p. 281.

[39] E. Albrecht, *Die Bevölkerungsbewegung einer mecklenburgischen Landgemeinde (Zittow bei Schwerin) vom 17. bis zum 20. Jahrhundert*, « ABB », Vol. 10, 1940, p. 37.

[40] G. Rath, *Moderne Diagnosen historischer Seuchen*, « Deutsche Medicinische Wochenschrift », Jhg. 81, No. 50, 1956, pp. 2066-67.

[41] J. V. von Hildebrand, *Ueber den ansteckenden Typhus*, Vienna, 1810.

[42] J. L. Formey, *Versuch einer medizinischen Topographie von Berlin*, Berlin, 1796.

[43] K. Kisskalt, *Epidemiologisch-statistische Untersuchungen über die Sterblichkeit von 1600-1800*, « Archiv für Hygiene und Bakteriologie », Vol. CXXXVII, 1953, p. 31.

steps were taken to improve the quality of the data. The first decade of the new century was marked by a fresh approach to demographic matters and regulations designed to extend the scope of parish records to provide concrete information for the whole of Bavaria on the relative causes of death. These improvements were implemented by a series of legislative acts between 1803 and 1806.[44] The adoption of these changes in individual parishes was fairly immediate. By the end of the first decade of the XIXth century the cause of death was invariably recorded in local parish registers. During the first half of the XIXth century 289 specific causes of death are listed in the 6 specific parishes which have so far been examined, a figure which compares relatively well with the c. 400 causes of fatality listed in the French survey carried out by the Royal Society of Medicine (1774-1794) and 309 calculated by Imhof in his analysis of the city parish of Giessen and its surrounding area.[46] Indeed as far as the major categories of cause of death were concerned, the early XIXth century was marked by a constant attempt to improve the accuracy of registration. By the end of the 1830's an increasing degree of sophistication was obvious, with c. 38 major categories for the cause of death widely adopted throughout the kingdom. Finally in the 1850's, after some consideration of the problem of how best to distinguish between endemic and epidemic diseases, aggravated perhaps by the increase in the number of basic categories to over 50, the system of diagnostic registration was restructured on the basis of 12 key groups of diseases, which included a total of 77 individual causes of fatality, a system which significantly was closely modelled on the Prussian model with 11 basic categories.[47] The comprehensiveness of the overall returns both at the local and central level, combined with the increasing refinements in the general system of classification, therefore provide a manageable basis for isolating trends in disease-specific mortality in Bavaria during the early decades of the XIXth century. It is upon this basis that the exact interrelationship between improvements in primary sector output and the overall nutrition base, and trends in general mortality can best be examined.

In the case of the U.K. it has been established with a well-argued case that the fall in the death rate in England and Wales in the post-registration

[44] J. VON KERSCHENSTEINER, *Zur Geschichte der Mortalitätsstatistik in Bayern*, « Münchern Medicinische Wochenschrift », No. 31, 1886, p. 541. These improvements were implemented on the basis of the following legislation of 31.1.1803 (« Die Einrichtung der Pfarrmatrikeln betr. »); 15.10.1806 (« Die Organisation der General-Landes-Commissariate betr. »).

[45] J. P. PETER, *Une enquête de la société royale de médecine (1774-94): malades et maladies à la fin du XVII.e siècle*, « Annales E.S.C. », 22, 1967, pp. 711-751.

[46] A. E. IMHOF (Ed.), *op. cit.*, p. 566.

[47] H. OETTINGER, *Entwurf zu einen Schema der Todesursachen*, « Aerztliches Intelligenz-Blatt », Bd. II, Munich, 1855, p. 13.

period (from 1838 onwards) was largely, if not entirely, due to a decline in mortality from a group of diseases which can be broadly defined as "infectious diseases". These in turn can be divided into three distinct categories: [48]

(a) A broad group known generally as "infectious fevers", including measles, scarlet fever, whooping cough, smallpox and diphtheria.

(b) Tuberculosis, typhoid, paratyphoid, dysentery, influenza and syphilis.

(c) A sub-group consisting of diseases caused mainly by pathogenic micro-organisms communicable from one person to another and including such diseases as diarrhoea, enteritis, infant convulsions and respiratory infections. It is further argued that the primary causal factor behind a decline in mortality from this broad group of diseases was the long-term rise in general living standards, associated above all with an improvement in general nutrition levels.

In the context of Bavaria, however, the overall proportion of deaths arising from these three basic categories of diseases does not appear to have altered significantly during the early decades of the XIXth century (Table 7), at least on the basis of mortality calculations conducted on the 6 local parishes in Oberbayern. Furthermore the relative incidence of mortality from the first 2 sub-groups, during a period when general levels of mortality within Bavaria were either static or tending to rise, does not appear to have changed radically, if data from a number of regional sources are brought together (Table 7). If in the first two sub-groups a slight fall in the proportional incidence of disease is accepted for the period 1812/13 - 1856/7, the continuous series obtainable from the individual parishes tends to emphasise how marginal any gains in these two sub-groups in fact were. Similarly the apparent decline in proportional mortality from the final sub-group, which would seem to be common to all areas, may not signify any major change at all, but simply a more precise categorisation of the major disease in this group (infant convulsions) and the transference of mortality cases to other headings instead of the pattern of aggregation that was common in the early years of the XIXth century which attributed a large proportion of total infant deaths to this general category.

If these figures are examined in detail the failure of the expected trend to materialise becomes even more apparent. It may be true that the compulsory introduction of smallpox innoculation had a marked effect on overall

48 T. McKeown, « P. S. », Vol. 26, 1972, pp. 347-48.

TABLE 7

COMPARATIVE DISTRIBUTION OF DISEASE-SPECIFIC MORTALITY AS A PROPORTION OF TOTAL RECORDED

		McKeown category		
		1	2	3
6 parishes	1801-9	11.7	13.0	31.13
	1810-9	10.4	17.7	30.50
	1820-9	7.0	16.1	27.6
	1830-9	11.2	13.2	24.54
	1840-9	10.2	15.5	26.7
Isarkreis	1810-1	3.4	19.9	34.9
	1812-3	6.3	22.0	26.2
Landgericht Freising	1912-3	3.0	21.7	32.2
	1814-5	6.1	18.9	37.7
	1815-6	5.7	13.2	43.7
	1819-20	14.8	18.8	—
Oberbayern	1811	3.2	19.0	32.1
	1812-3	5.9	21.7	31.2
	1817-8	2.9	23.5	27.8
	1818-9	4.8	19.8	30.1
Königreich Bayern	1939-40	6.0	13.1	15.4
	1856-7	6.4	16.6	16.9

mortality from this disease,[49] but it is equally likely that if any lives were saved by innoculation, despite continuing deficiencies in the administrative system, this was probably more than counter-balanced by deaths from other causes, probably from digestive disorders or other infectious diseases. Certainly if all diseases which can be generally listed as "infectious fevers" are aggregated together, mortality per 1000 inhabitants did not change substantially at all during this period, falling only imperceptibly in the case of the 6 individual parishes from 6.02 (1810-9) to 5.24 (1840-9). Similarly although specific statistics on the incidence of syphilis are difficult to collate, it can be safely assumed that the striking increase in illegitimacy during the early decades of the XIXth century would not have conspired to reduce its overall incidence.[50] It must be remembered in this context that the rate of

49 P. E. RAZZELL, *Population change in eighteenth-century England: a reinterpretation*, « Economic History Review », (2nd series), 18, 1965, p. 312. Within Europe Bavaria was one of the first countries to legally enforce smallpox innoculation in 1807, closely following the example set by the Swiss Canton of Aargau (1806) and the principality of Piombino and Lucca (1806). O. LENTZ, *Die gesetzliche Regelung der Pockenbekämpfung*, in O. Lentz and H. Gins (Eds.), « Handbuch der Pocken-bekampfung », Berlin, 1927, p. 497.

50 F. M. PHAYER, *Religion und das Gewöhnliche Volk in Bayern in der Zeit von 1750-1850*, « Miscellanea Bavarica Monacensia », Heft 21, Munich, 1970, p. 114.

illegitimacy on the Hofmark Thalhausen had risen from 3.94 (per 100 live births) to 55.29 (1750/9 - 1840/9). As far as whooping cough was concerned there is effectively little difference between a rate of 1.23 per 1000 recorded for the Landgericht Freising (1824-5) and one of 1.01 registered for Oberbayern at the end of this period (1844-5).

However two specific causes of death stand out as being particularly significant in the light of the general discussion, primarily because of their overall importance as components in total mortality. In the first instance the proportion of deaths attributable to tuberculosis did not undergo any drastic fall in the course of the first half of the XIXth century. In the case of the Landgericht Freising mortality per 1000 rose from 6.14 to 9.23 between 1811 and 1831-2. Similarly in the 6 parishes examined aggregate mortality from this cause merely declined fractionally from 6.62 to 5.84 per 1000 in the period 1810-9 to 1840-9. Tuberculosis continued to be a major cause of death throughout the first half of the XIXth century. This disease in particular, however, can normally be taken as a fairly sensitive indicator of relative living standards. It tends to thrive where living conditions and nutrition are inadequate, or where continued physical strain is present.[51] Significantly deaths from all lung diseases in the 6 parishes revealed a particular rise in general incidence during the years 1816-17, 1824-25, 1843 and 1845-46, which in each case can be positively correlated with either a poor harvest or a general economic recession. It is therefore of crucial importance to note that for the kingdom of Bavaria as a whole tuberculosis mortality continued to rise throughout most of the XIXth century, finally reaching a peak in the period 1881-90, when 317 deaths per 100,000 inahibtants were registered.[52] Certainly there is no room for any fall in mortality from this disease which would normally be expected on the basis of the traditional model.

Secondly, as has already been intimated, the relative decline in deaths from the third sub-group is entirely dependent on changes in the incidence of infant convulsions. Indeed most of the specific causes of death listed under this heading were primarily diseases of infancy. Although it is true that the specific incidence of convulsions (or "Frais") did decline in the case of the 6 parishes examined from 11.18 to 6.55 per 1000 (1810/9 - 1840/9) this cannot be taken as confirmation of the original hypothesis. On the one hand it is clear that mortality from infant convulsions was not explicitly dependent on the activity of specific micro-organisms operating in a vacuum, but was closely linked in the first instance with the methods of feeding

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[51] H. Assmann, *Entwicklung und Bekämpfung der Lungentuberkulose*, « Schriften der Königsberger Gelehrten Gesellschaft », Jhg. II, Heft 3, 1934, p. 4.

[52] F. Prinzing, *Handbuch der medizinischen Statistik*, Jena, 1930, p. 509.

infants.[53] To the extent that these methods were themselves strongly linked with traditional social customs, the significance of a fall in mortality from this specific cause cannot be necessarily related to changes in the level of primary sector output. On the other hand although mortality from this specific cause did tend to decline within the period under consideration, infant mortality as a whole in Bavaria, which had always been an important constituent of total deaths, tended to move in the opposite direction. During the early decades of the century infant mortality rose continuously from 28.4 (per 100 live births) in the period 1825/6 - 1829/30 to 32.7 (per 100 live births) between 1862/3 and 1868/9. This fact in itself would seem to confirm the initial supposition that the process of diagnostic refinement in the course of this period had led to the reclassification of certain causes of infant deaths which would previously have been entered in parish registers as "convulsions" according to more accurate criteria.

It is clear, therefore, from this analysis that the established movements in mortality rates in the kingdom of Bavaria during the first half of the XIXth century do not fit into the traditional explanatory model for Continental Europe as a whole. Despite the remarkable increase in total output from the primary sector, the general death rate tended to remain extremely sticky or even to deteriorate throughout the period under consideration. If there was a slight improvement in the 1820's and 1830's, by the mid-century the higher death rates associated with earlier periods had returned once again to determine the overall growth rate of population. Furthermore in connection with those categories of disease which can be closely related to general nutrition levels and which are normally regarded as accounting for a large proportion of the net gains in mortality in other European countries during this period, the increments to total output from the primary sector in Bavaria do not seem to have produced any signs of effective improvement or a higher resistance to disease and fatality.

The question remains, therefore, as to why in this specific case the mechanism of a distinct fall in general rates of mortality, occasioned by a net improvement in overall food supplies, did not in fact materialise during the first half of the XIXth century. In the first instance a number of possible explanatory factors can perhaps be eliminated. Bavaria, because of its geographical position, was not readily a large-scale exporter of agricultural produce, either in the late XVIIIth or early XIXth century. Although grain exports, largely of wheat and barley, averaged 177,000 Scheffel p.a. in the period 1774-86, a high proportion of these exports went to areas which

[53] A. Vogl, *Die Sterblichkeit der Säuglinge in ihrem territorialen Verhalten in Württemberg, Bayern und Oesterreich*, Munich, 1909, *passim*.

after the territorial realignment of the early XIXth century were to be incorporated into the new Kingdom of Bavaria.[54] Even by the late XVIIIth century Munich traders had failed to develop effective foreign connections and this adversely affected the overall level of exports.[55] Later evidence confirms the disappointing performance in the grain trade for Germany as a whole particularly in the periods 1821-25 and 1832-34.[56] The continuing problems of cost-effective transportation would certainly have reduced the extent of the possible marketing area for these commodities and limited Bavaria's competitiveness in relation to other low-cost producers with better access to cheap forms of transportation. Equally the evidence already available concerning the nature of the peasant diet in Bavaria in the XVIIIth century provides no substantive ground for arguing that the nutritional base line at the beginning of this period was so low, that any incremental additions registered in the course of the first half of the XIXth century would simply have been used in bringing the diet up to a reasonable level.[57] Indeed a rough comparability in nutritional content would appear to have existed between many different areas of Germany in the late XVIIIth and early XIXth centuries. If anything the rural diet remained relatively rough, although annual meat allowances for parents in the 6 parishes granted as part of the legal devolution of holdings did rise slightly from 8lb to 10lb per head between 1790 and 1849.[58] The remaining part of this paper will be spent analysing the possible reasons as to why the experience of Bavaria during this period tended to diverge so markedly from the traditional pattern. These reasons, in turn, will hopefully provide a basis for a more comprehensive understanding of the general process of falling mortality rates in Continental Europe in the early XIXth century.

It is possible to explore the basic dichotomy inherent in this problem from two quite specific directions. Firstly an examination of the component factors contributing to the increase in primary sector output is necessary. The reliance on gross output figures, or the simple enumeration of the introduction of different aspects of intensified cultivation, fails to mirror the actual impact of the changes in production in the primary sector on the

[54] E. Schremmer, *Die Wirtschaft Bayerns vom hohen Mittelalter bis zum Beginn der Industrialisierung*, Munich, 1970, pp. 646-47.

[55] M. Edlin-Thieme, *Studien zur Geschichte des Münchner Handelstandes im 18. Jahrhundert*, Stuttgart, 1969, pp. 82-3.

[56] M. Kutz, *Deutschlands Aussenhandel von der Französischen Revolution bis zur Gründung des Zollvereins.* Eine statistische Struktur-Untersuchung zur vorindustriellen Zeit, « Vierteljahrschrift für Sozial-und Wirtschaftsgeschichte », Beiheft, No. 61, Wiesbaden, 1974, pp. 41-5.

[57] J. Schlicht, *Altbayern und Altbayernvolk*, Augsburg, 1886, p. 168.

[58] W. R. Lee, *op. cit.*, p. 178.

producers themselves. Nor does it provide any insight into the cost side of the equation. Secondly the failure of nutrition-sensitive causes of death to fall during a period of rapid, or even spectacular, increments to primary sector output places in question the overall hypothesis of a positive inter-relationship between the standard of living and mortality. It may indeed be the case in a far wider geographic context that the registered falls in mortality during this period were dependent on other factors other than the adoption of an intensified system of agricultural production.

If mid-XIXth century figures can be taken as indicative of conditions in earlier decades of the century (for which comprehensive data on the levels of capital investment in the primary sector are still unfortunately lacking), then the significant shift from a "traditional" pattern of cultivation to an intensive system of production would have been accompanied by a disproportionate incremental input of capital. Certainly by 1850 German agriculture as a whole was more capital-intensive than the main industries in the expanding secondary sector, employing approximately 52% of total national capital.[59] Indeed many of the "innovations" associated with the move towards intensive production in the primary sector required substantial additions to the capital stock invested. Improved manuring was an integral part of the "agricultural revolution", but guano, which was one of the substances closely linked with improvements in this field, despite attempts by the Agricultural Union to reduce its retail price through a system of bulk purchases, remained a high cost innovation.[60] Equally although the initial introduction of new types of agricultural machines in Bavaria coincided with similar developments in most other continental European states, the adoption of labour-saving technologies in this context further reinforced the capital-intensive nature of the new system of primary sector production. The construction of new farm buildings necessary for the introduction of stall-feeding for livestock was further complicated by a contemporary escalation in raw material costs, particularly for wood and other building materials, in the latter years of the XVIIIth century.[61] On balance it would be true to say that a high proportion of specific reform measures associated with the transition to intensive agricultural production would have necessitated additional inputs of capital into the primary sector. Furthermore these changes often involved substantial short-term transition costs, which could only be bridged in some cases by resort to outside finance. Even Knott, one of the foremost protagonists of stall-feeding was forced to admit that a

59 D. André, *Indikatoren des technischen Fortschritts*. Eine Analyse der Wirtschaftsentwicklung in Deutschland von 1850 bis 1913, Göttingen, 1970. Table 3, p. 80.

60 « Wochenblatt des Landwirtschaftlichen Vereins », Munich, 1815, p. 74.

61 « Kurfürstliches Intelligenz-Blatt », Munich, 1782, No. 35, Art. V.

lack of traditional pasture, which was fairly endemic as a problem in late XVIIIth century Bavaria, would almost certainly require an initial, short-term reduction in livestock and an adjustment in the extent of existing arable to make room for strips designed for the cultivation of supplementary fodder crops.[62] Such a short-term readjustment of the existing system of cultivation would also have implied higher capital burdens for the innovator. In some cases it is clear that this short-term burden was excessive.[63]

Certainly as far as relative capital flows were concerned, the general trend of the early XIX th century would seem to have been strongly in favour of the primary sector. Indeed the easing of mortgage restrictions and the establishment of rural savings banks undoubtedly contributed to the general trend towards channelling available capital funds into primary sector investment. The level of rural mortgages ("Pfandbriefe") in Prussia, for example, rose from 224 million Mark (1820) to 346 million Mark (1852).[64] A similar development can be posited for Bavaria, although it would be fair to assume that the higher levels of increased output achieved during this particular period would probably have required a larger volume of total capital flows into the primary sector, at least in relation to total capital supply. The first few decades of the XIXth century were marked by a rigorous attempt to establish a chain of local credit institutions primarily for the benefit of primary sector producers.[65] Lending institutions were set up in Munich (1808), Landshut (1808), Regenstauf and Riedenburg (1824), Amberg (1825), Dachau (1825/6), Freising (1828) and in most other Landgerichte. In addition the lending remit of the few public banks established in South Germany was increasingly re-structured to provide sufficient credit for the indigenous peasant producers.[66]

The effect of these developments in extending credit facilities to producers in the primary sector is difficult to assess for Bavaria as a whole. If the Massenhausen estate (Landgericht Freising) can be taken as symptomatic of the general trend, then it is clear that by the late 1820's there had been a substantial growth in the supply and availability of capital, which in certain

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62 J. N. Knott, *Grundsätze des Acker-und Wiesenbaues*, Munich, 1792, *passim*.

63 The case of the village of Kirchdorf (Landgericht Moosburg) is instructive in this context. Permission for the cultivation of the fallow and the introduction of winter-feeding was granted by the relevant authorities in 1804. By 1806, however, the traditional pattern of cultivation had been re-adopted due to the high initial transition costs. G. Völkl, *Kirchdorf - eine Pfarreigeschichte aus dem Ampertal*, Frisinga, Bd. 17, 1931, p. 73.

65 A. Cohen, *Die Geschichte und organisatorische Entwicklung des landwirtschaftlichen Kreditwesens in Bayern*, Diss., Heidelberg, 1919, p. 715.

66 F. Steffan, *Die Bayerische Staatsbank*, 1780-1955, Geschäfte und Geschichte einer öffentlichen Bank, Munich, 1955.

cases had already assumed alarming proportions. Total loans to producers on the estate had risen from a mere 4,622 Gulden (1800-9) to a substantial sum of over 144,000 Gulden by the 1840's. In the case of a further estate, Thalhausen (Landgericht Freising), a similar development is discernible, with the value of external capital loans rising from 790 to 7,530 Gulden (1820/9 - 1840/9). Indeed in certain cases the ability of peasant producers to absorb increasing volumes of capital was heightened, as in Württemberg, by the tendency of valuers and officials to over-assess the real value of peasant holdings.[67] Total capital investment in agriculture was also further raised by the fact that the extensive cash payments which landlords received during the first half of the XIXth century from the implementation of peasant emancipation legislation was largely channelled into "traditional" investment categories, such as the purchase of additional land and for the improvement of yields from existing estates.[68] Although further statistics are necessary to supplement existing material, the general impression would seem to be confirmed. Substantial increments of capital had been required in Bavaria in the course of the first half of the XIXth century to finance the important transition to a more intensive system of agricultural production.

Equally, it could be argued, many of the reforms in the primary sector also tended to require additional inputs of labour. It is significant that despite improvements in labour productivity facilitated primarily by the replacement of the sickle by the scythe (which produced, on average, a net labour saving of c. 30%),[69] the census material for the XIXth century reveals that almost all of the increase in total population registered in the early part of the period was absorbed by the primary sector. If in 1833 68.5% of the population of the Isarkreis were dependent on employment in agriculture,[70] as late as 1890 only 23% of the kingdom's population lived and worked in towns and urban areas, whereas the remaining 77% (or 4,307,000 individuals) continued to find a living in agriculture.[71] Significantly many rural villages and settlements tended to reach a peak in the overall level of population in the latter decades of the XIXth century.

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67 E. C. Dinkel, *Ueber die bäuerliche Credit-Verhältnisse in Württemberg*, « Zeitschrift für die gesamte Staatswissenschaft », Vol. XII, 1856, p. 567.

68 H. Winkel, *Die Ablösungskapitalien aus der Bauernbefreiung in West-und Süddeutschland*, Stuttgart ,1968.

69 E. J. T. Collins, *Labour Supply and demand in European agriculture*, 1800-1880, in E. L. Jones and S. J. Woolf (Eds.), *Agrarian change and Economic development*, The Historical Problem, London, 1969, pp. 61-94.

70 H. R. Giebel, *Strukturanalyse der Gesellschaft des Königreichs Bayern im Vormärz, 1818-1848*, Diss., Munich, 1971, p. 165.

71 W. Götz, *Geographisch-historisches Handbuch von Bayern*, Munich, 1898, p. 22.

Further evidence of the labour-intensive nature of many of the traditional innovations associated with intensive production in the primary sector, can be found by an examination of the general trend in wage rates during this period. Despite the fact that population did grow, complaints of labour shortages which can be found in the late XVIIIth century became almost endemic in the early decades of the XIXth century. Significantly this disturbing phenomenon was attributed by contemporaries either to a whirlpool that sucked away the working class, or to the fact that there had been an actual increase in the absolute amount of work required.[72] Dachau suffered from a drastic shortage of servants in 1809 and regulations governing employment in Erding could not be enforced due to the level of acute labour shortages.[73] As a direct corollary to the increasing disparity in the relative demand and supply of agricultural labour, directly dependent on the labour-intensive nature of many of the agricultural improvements being undertaken, wage rates tended to rise during the early decades of the XIXth century. In Dachau, for example, complaints could be heard of excessive wage demands and general disobedience on the part of agricultural workers. In Tölz (in 1813) a further wage rise had been successfully extracted from the employers. The real value of wages in the primary sector undoubtedly rose during this period. The wage index for the rates paid to a "Mittelknecht" (1654 = 100) had risen dramatically from 150 (1790) to 600 (1859). A similar trend was observed in relation to other categories of employment in the primary sector.[74] Similarly the wage index for day-labourers (1700 = 100) also rose during the same period from 100 (1776) to 350 (1853). Furthermore the land redistribution of the early XIXth century had accentuated this trend by providing small-holders with the possibility of extending their land endowment and encouraging a higher proportion to remove their services from the vagaries of the agricultural labour market. It is perhaps by no means an accident in view of these established wage trends, that two major writers, H. von Benckendorf and L. von Westenrieder, who were generally strong protagonists of agricultural reform, in principle, opposed the increased cultivation of fallow, on the grounds that the necessary additional labour input made such an undertaking in many cases economically unviable.[75]

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72 « Intelligenz-Blatt », Munich, 1797, Stück 21.

73 Staats-Archiv Oberbayern (St. A.ObB.), Regierungs-Akten 1103/15677-8.

74 H. Platzer, *Geschichte der ländlichen Arbeiterverhältnisse in Bayern*, Munich, 1904, p. 205.

75 L. von Westenrieder, *Beyträge zur vaterländischen Historie, Geographie, Statistik und Landwirtschaft*, Munich, 1788, pp. 199-204.

Given then the fact that the substantially increased rates of output from the primary sector required significant additional inputs of both capital and labour, the overall effect of higher output figures can be placed into a more objective context. Clearly if the level of increased output from agriculture exceeded the recorded growth rate in total population (as was the case in the early XIXth century), the net benefits accruing from this transition in the pattern of cultivation would have been related both to the occupational structure of the country (in terms of the division between producers and consumers) and to the relative movement in the general price level for agricultural commodities.

(A) Price movements during the early XIXth century would have been instrumental in determining the net returns on investment which producers in the primary sector could, with reason, have expected. Available price series, however, would seem to indicate that apart from continued short-term fluctuations, prices in the period 1811-1840 tended to remain relatively static. The index for wheat (1750/0 = 100) for the whole of Bavaria stood at only 106 in the 1830's, and the price of barley during the same period had only risen from 5¾ Gulden per Scheffel to just over 6 Gulden.[76] Furthermore the 1820's and 1830's were periods when it could be claimed that Bavaria suffered from relative over-production.[77] This had a particularly harsh effect on the small-scale producer, who had invariably incurred substantial debts during the traditional crisis years (1812, 1815, 1824 etc.) and was now prevented, due to rapidly falling prices, from repaying the original loans.[78] Output, positively influenced by the continuing pattern of agricultural reform, was still rising, although the slowing down in the growth rate in population had adversely affected the buoyancy of indigenous demand.

(B). An analysis of occupational structure in Bavaria, based primarily on central data from 1833, underlines the over-riding importance of primary sector producers within the community. In the Isarkreis, for example, if holdings with a dual occupational role (embracing both agriculture and craft production) are also included, c. 45% of the total number of listed families would have been dependent to a varying extent on the sale of agricultural goods. In the Untermainkreis the proportional representation of this group was even higher at 63.4%. Indeed from a total population of 3,643,413 individuals, the designated "Gutsbesitzer" (and their immediate dependents) numbered 1,265,264 or 34.7% of the total population.[79] It is equally

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[76] W. R. Lee, *op. cit.*, p. 461.

[77] W. R. Lee, *Zur Bevölkerungsgeschichte Bayern 1750-1850: Britische Forschungs ergebnisse*, « Viertejahrschrift für Sozial-und Wirtschaftsgeschichte », Bd. 62, Heft 3, 1975, p. 333.

[78] K. Fraas, *Die Ackerbaukrisen und ihre Heilmittel*, Leipzig, 1866, pp. 45-46.

[79] H. R. Giebel, *op. cit.*, pp. 165-66.

significant in this context to note that the majority of holdings in this general category were not very substantial in size. The average size of holdings in the early 1850's fluctuated between 11 Tgw. (Mittelfranken) and 24 Tgw. (Oberbayern).[80] On this basis, therefore, it could be argued that Bavarian agriculture was largely dominated by fairly medium to small-scale units of production, which would nevertheless have been dependent on a certain level of sales to the general market.[81]

The combined effect of the structural form of the primary sector and the established trend in price movements for agricultural commodities clearly played a major role in determining the overall effect of incremental improvements to primary sector output on general levels of mortality. The high cost element in the financing of agricultural improvements, coupled with the probable deterioration in labour productivity determined by the tendency for additional labour inputs to yield a decreasing return,[82] would have tended to limit the positive, or at least implied, nutritional spin-offs from a rapidly expanding output base. The evidence for this having been the case in Bavaria in the early decades of the XIXth century seems to be conclusive. Indebtedness in the primary sector rose considerably. The level of outstanding taxes also followed the same pattern (Table 8). Furthermore the general deterioration of the economic position of primary sector producers at a time of rising costs (both capital and labour) and static or falling prices for agricultural goods, is reflected in the reduction in marriage dowries in the 1820's and 1830's, particularly in the case of the larger peasant production units (1, ½ and ¼ holdings), which were considerably dependent on the overall level of market demand (Table 9). The abundance of contemporary pamphlets, many issued by the Agricultural Union, testifies to the severity of the situation.[83] It can therefore be posited that a substantial increase in output from the primary sector need not necessarily produce an immediate fall in general mortality rates, nor act as a predetermined stimulant to the overall rise in population. If an improvement in the supply position of agricululral goods would have undoubtedly benefited agricultural labourers, servants and

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82 E. Boserup, *The conditions of Agricultural Growth*, London, 1965, p. 40.

83 Anon., *Was ist die Ursache von der ausserordentlichen Wohlfeilheit des Gretreides. Von einem Patrioten*, Landshut, 1824. F. J. H. von Soden, *Die annonarische Gesetzgebung. Versuch eines Systems über den Getraidhandel und die Gesetze nach welchen die Staatsverwaltung in Absicht des Getraides zu handeln hat*, Nürnberg, 1828.

80 I Tagwerk = 3,407 qm.

81 For a general discussion of the significance of holding size in relation to income levels - F.W. Henning, *Die Betriebsgrössenstruktur der Mitteleuropäischen Landwirtschaft im 18. ahrhundert und ihr Einfluss auf die ländlichen Einkommensverhältnisse*, « Zeitschrift für Agrargeschichte und Agrarsoziologie », Vol. XVII, 1969, pp. 171-193.

TABLE 8

OUTSTANDING TAXES: HOFMARK MASSENHAUSEN (in Gulden)

Period	Amount outstanding.		
1810-9	620.	23	
1820-9	1,835.	6.	4.
1830-9	3.251.	15.	3.
1840-9	1,907.	5.	

TABLE 9

MARRIAGE DOWRIES BY DECADE AND SIZE OF HOLDING: HOFMARK MASSENHAUSEN (in Gulden)

Size of holding	1790-9	1800-9	1810-9	1820-9	1830-9
1	551	823	1,091.40	691.52	550
1/2	537	420	512.30	532.30	470
1/4	438	725	570	600	433.20
1/8	212	450	200	350	450
1/16	97	141	145	218.45	362.30

the working class in general, the coincidence of increasingly high costs of additional capital and labour with static or falling prices would have radically upset the economic viability of primary sector producers. The actual structure of producing units in the primary sector in Bavaria and their overall importance within the economy as a whole could have seriously militated or even directly negated any positive effects accruing from the improved output performance of agriculture.

Finally a word needs to be said concerning the general applicability of the basic assumption that the over-riding determinant of mortality in the period under consideration was the effective level of the nutritional base. The Bavarian evidence would seem to cast some doubt on the alleged primacy of this particular variable.

(a) In the first instance it must remain doubtful whether chronic malnutrition even in the XVIIIth century had ever been very widespread, except during periods of short-term harvest failures (as in 1771/72).[84] Certainly a comparison with XXth century conditions, where it has been claimed that some 50% of mortality in under-developed countries can be directly or indirectly attributed to chronic malnutrition would seem to be inappropriate.[85] Indeed irrespective of the frequency of traditional sub-

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[84] G. A. WILL, *Theuerung zu Nürnberg im Jahr 1770, 1771 und 1772*, « Hist.-Dipl. Magazin für das Vaterland und die angrenzenden Gegenden », 2, 1783, p. 357 et seq.

[85] J. DE CASTRO, *Geography of Hunger*, London, 1949, p. 34.

sistence crises after the early years of the XVIIIth century, crisis mortality (specifically from bubonic plague and typhus) did decline as a direct result of effective quarantine measures adopted by individual continental states.[86]

(b) Secondly it is generally accepted that one of the major elements in total mortality was the overall incidence of infant deaths within the first year of life. Certainly in the United Kingdom and in most areas of continental Europe infant mortality began to decline in the late XVIIIth century and this trend was continued into the XIXth century.[87] Although it could be argued that this reflected a distinct improvement in the nutritional base, as this affected both the mother and child, this trend did not materialise at all in the case of Bavaria. The average annual rate for the period 1835-1869 stood at 38.5 (per 100 live births), with a maximum of 39.8 in the period 1855/6 - 1861/2. Furthermore in the case of Oberbayern and Schwaben there is no evidence of an improvement in the rate of infant mortality until the 1870's. Indeed as a proportion of total listed deaths, the overall significance of infant mortality tended to be magnified during the course of the first half of the XIXth century. The proportion rose steadily from 40.59% (1819/20), to 43.45% (1820/21), to 45.40% (1844/5) and 51.23% (1856/57). As such infant mortality would have exercised a crucial role in determining the downward/upward flexibility of general death rates during the period under consideration. It is doubtful, however, whether the actual nutrition base was the over-riding factor in determining relative infant mortality levels. Areas in northern Germany, where the known increases in primary sector output were well below the figures achieved in Bavaria, invariably had lower rates of infant mortality. In Oldenburg, for example, a rate of 12.3 (per 100) was listed for the period 1855-1864, and in Schleswig-Holstein and the Duchy of Lauenburg the comparative rate for the period 1855/59 was 13.3.[88] The key explanation behind the high rates of infant mortality in Bavaria was totally unconnected with problems of food supply. Infant mortality was determined almost entirely by the actual method of feeding adopted. The 1905 survey revealed that over 70% of all infants in Bavaria were artifically fed, often with a thick indigestible meal pap.[89] Various hypotheses have been advanced to explain this phenomenon,

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[86] J. D. Post, *Famine, Mortality and Epidemic disease in the process of Modernisation*, « Economic History Review », XXXIX, n. 81, 1976, p. 37.

[87] T. S. Ashton, *The Industrial Revolution, 1760-1830*, Oxford, 1948, p. 4.

[88] C. Becker, *Statistische Nachrichten über das Grossherzogtum Oldenburg*, Heft XI, Oldenburg, 1870, p. 131.

[89] A. Groth and M. Hahn, *Die Säuglings-verhältnisse in Bayern*, « Zeitschrift der Bayerischen Statistischen Landesamt », Munich, 1910. J. Knodel, *Infant mortality and fertility in three Bavarian villages*, « P. S. », No. 22, 3, 1968, p. 301 et seq.

ranging from deficient milk secretion to excessive alchoholism,[90] but it would be fair to state that the causal factors behind this practice have been linked essentially to social constraints and established behavioural patterns, rather than the relative extent of the available nutrition base. Indeed the general pattern of infant feeding habits in XIXth century Germany would repay further attention. In general there was a tendency for the length of breast-feeding to decline on a north-south axis, with one extreme represented significantly by Krumbach-Hürben in Bavaria, with 92.3% of all infants artifically fed.[91] To this extent, therefore, a major determinant of mortality in Bavaria throughout the first half of the XIXth century was totally unrelated to the general level of output in the primary sector, or the overall availability of food supplies as a whole.

(c) Finally even in relation to adult mortality, evidence available in Bavaria would seem to question the close interrelationship posited between levels of mortality and general living standards. Despite inevitable inaccuracies inherent in the traditional classification of holdings on the basis of the "Fixierung" of 1445, it can be generally assumed in the context of early XIXth century conditions that the sub-division of peasant holdings from 1/16 to an integral unit, as far as tenements which were exclusively or largely involved in agricultural production were concerned, did represent an actual disparity in effective economic standing.[92] The available evidence, however, (Table 10) indicates that both in the period 1750-99 and 1800-49 the lowest rate of adult mortality was to be found among small-holders. Although the mortality rates of other socio-economic groups fluctuated considerably, a reverse correlation with land endowment and implied income level would seem to have been the case in the late XVIIIth century. The larger tenements (integral and half holdings) had the higher mortality rates, although the degree of differentiation was not excessive. Significantly in the first half of the XIXth century, although mortality rates in each individual group rose, tenants of small-holdings continued to enjoy the highest life-expectancy. At the same time, as far as the other groupings are concerned, mortality now tended to increase with the progressive diminution in the size of holding. Although

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[90] G. Lange, *Die Ernährungsweise der im Grossherzogtum Baden geborenen Kinder während des ersten Lebensjahres*, « Sozialhistorische Mitteilungen für Baden », 1917. G. von Bunge, *Die zunhmende Unfähigkeit der Frauen ihre Kinder zu stillen*, Munich, 1907, p. 311.

[91] C. Röse, *Die Wichtigkeit der Mutterbrust für die körperliche und geistige Entwicklung der Menschen*, « Monatsschrift für Zahnheilkunde », XXIII, 1905.

[92] P. Fried, *Zur Geschichte des Steuer in Bayern*, « Zeitschrift für Bayerische Landesgeschichte », Bd. 27, 1964, pp. 594.

TABLE 10

ADULT MORTALITY (COMBINED SEXES) ACCORDING TO SOCIO-ECONOMIC POSITION: HOFMARK MASSENHAUSEN (by date of marriage cohort)

Holding Size	1800-49			1750-99		
	High	Low	Medium	High	Low	Medium
1	58.4	66.1	61.8	53.8	62.8	58.0
1/2	58.7	63.1	60.8	50.7	62.6	56.4
1/4	57.7	65.5	61.9	52.9	59.3	56.3
1/8	59.6	64.2	62.6	51.6	62.2	54.4
1/16	60.7	65.0	63.5	52.1	65.3	61.7

it would be premature to draw any general conclusions from this evidence, the continuing favourable levels of adult mortality for occupants of small-holdings would seem to place in question once again the primary role of general standards of nutrition as the basic determinant of mortality.

German data relating to problems of historical demography are seldom exploited effectively within the context of general hypotheses. Despite pioneering work in this field, both in the XVIIth century and in the more modern period, and despite the fact that archival sources are more than abundant, historical factors both of a political and institutional nature have conspired to limit the further development of this school. The purpose of this paper has been to illustrate the potential applicability of German material to general problem areas and specifically to the conceptual understanding of the mechanism of mortality decline in the late XVIIIth and early XIXth centuries. The paradox that emerges in the case of Bavaria is that a significantly rapid rise in primary sector output in the course of the first half of the XIXth century had no noticeable impact at all on relative mortality levels. The basic causal factor behind the general decline in European mortality, as envisaged in the traditional model failed to operate in an area of Europe where the transition to an intensive form of agricultural production had clearly achieved substantial improvements in the overall supply of agricultural goods, both in the arable and livestock/dairy sector. Indeed only by a careful examination of the nature of this improvement has it proved possible to indicate that such an increment to total output in the primary sector may not necessarily insure immediate benefits for the producers. The relative effect of such a development will be closely dependent on the overall structure of the primary sector and the need to secure producers a viable return on their investment. On this basis, therefore, a distinctly different pattern emerges, with over-production relative to indigenous demand restricting the posited positive effects of the transition to an intensive system of production. It may well be the case that the traditional model is only applicable to certain countries or producing regions under certain definable conditions, which in the case of Bavaria in the first half of the XIXth century were clearly not met. Furthermore a more detailed assessment of general mortality levels (both infant and adult) has indicated that some basic assumptions of the original model are not perhaps as "unshakeable" as many people have believed. It can only be hoped that an increasing utilisation of German data may provide a more comprehensive insight into the general causative factors behind the established trends in mortality in Continental Europe as a whole, both in the XVIIIth and XIXth centuries.