ARTICLES

Why Wheat? Choice of Food Grains in Europe in the Nineteenth and Twentieth Centuries [1]

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The world food grain economy is now dominated by just three grains — rice, wheat and maize, together accounting for over 90 per cent of the total consumption [2]. Other grains, barley, rye, millet and sorghum are regionally significant but, on a world scale, of minor and diminishing importance. The choice is progressively narrowing as wheat continues to displace maize over much of south and central America, and rice consolidates its already strong position in the wet tropics and gains further ground in the Middle East. Looking to the future, should food habits continue to converge and to conform to the European and North American norm, then just possibly wheat may become the universal food grain and the wheaten loaf the universal grain-food.

[1] This paper is an extended version of a paper on broadly this same theme read at Session 32, Cereals in World History, at the XVIIth International Congress of Historical Sciences, Madrid, 1990, and is part of a larger, ongoing study of grain production and consumption. My grateful thanks to Mr. J Bruinsma and Mr. F. Paraboni of FAO, Rome, for making available contemporary statistical data from the FAO database. For grain consumption since the 1930s see *Food Balance Sheets,* FAO, 1949; and OECD food consumption data. For production, see, FAO *Production Yearbooks* and B.R. Mitchell, *European Historical Statistics, 1750-1970, 1975.*

[2] The three grains are of approximately equal output, but while rice is used almost entirely as a human food grain, a large proportion of maize and a smaller but significant proportion of wheat are used as animal feeds or for industrial purposes.

I

A feature of post-war Europe is that the relative importance of wheat has been, and in some countries still is, increasing. Today, wheat is everywhere the leading food grain accounting overall for over 80 per cent of total consumption. Otherwise rye, a minor but still essential item of diet in central and eastern Europe and Scandinavia, amounts to 6-8 per cent; maize, a secondary staple in parts of south-east Europe and the Biscay region, 4-5 per cent; rice about 3 per cent; and other grains — barley, oats, millet and buckwheat (not a true cereal but a *polygonaceae* producing small triangular shaped seeds yielding a white flour) — about 1 per cent.

The primacy of wheat, though, is a recent phenomenon that could not have been predicted as recently even as the eighteenth century, when the prospects of so dramatic an expansion in the wheat supply seemed remote. In 1920, the American geographer, A. O. Baker, estimated that 200 million people, some 40 per cent of the total European population, consumed other grains, whereas, in the 1880s, probably less than 50 per cent and in 1800 at the most 40 per cent used wheat.[3] The claim by the eminent economist, Dupré de Saint Maur, that in the early eighteenth century not more than two million men in all the households of France, Spain and England, or about 15-20 per cent of the combined population, consumed wheaten bread, although an underestimate, is an expression of the contemporary view that wheat was the preserve of the upper and middle classes.[4]

Clearly, even in wheat-growing regions a large proportion of households subsisted on other grains. In 1750 wheat was something of a rarity over most of central, eastern and northern Europe, and by no means the exclusive grain even in the Mediterranean. Moreover, it can be argued that in some regions wheat consumption per head was

[3] A.O. Baker, 'The potential supply of wheat,' *Economic Geography,* I, 1925, p. 18; *Journal Statistical Society,* 48, 1885, p. 312.

[4] F. Braudel *Capitalism and Material Life 1400-1800,* Fontana edn. 1974, pp. 66-120.

then very little higher, or possibly even lower than in the fifteenth century. In the early modern period, and again in the later eighteenth and early nineteenth centuries, burgeoning population growth led to the colonization of areas where either wheat could not be cultivated or where environmental conditions favoured the production of other grains. For instance, rye was best adapted to the acidic, phosphate-deficient, forest-soils of eastern Europe, and mountain areas. Over a broad arc from Biscay to the Black Sea, and northward to the Baltic, the range of alternative food grains was broadened in the fifteenth and sixteenth centuries by the introduction of maize and buckwheat.[5] Demographic trends, too, discriminated against wheat in so far as population growth was faster in the rye and maize regions than in the wheat-eating Mediterranean. Wheat surpluses were at this stage too small to support a large export trade while, away from the coasts and in the remote hinterlands, inter-regional trade was restricted by the high cost of transport.

The position in the mid-nineteenth century was little changed. As yet, wheat was the majority grain in only a very few countries — Spain, Italy, Greece and Turkey in the Mediterranean; Hungary and Bulgaria; and Britain, France and Switzerland. Elsewhere, it was a luxury in most rural areas and a minority grain even in the towns. Fine wheaten flour, of 60-70 per cent extraction, was a great rarity which, outside the houses of the nobility and well-to-do, was reserved mainly for pastry.

Reliable statistics of grain consumption are scarce prior to the 1950s when the FAO Food Balance Sheets and the OEEC and

[5] For maize, see: J. BURTT-DAVY, *Maize,* 1914; M.D.W. JEFFERYS 'Pre-Columbian Maize in the Old World: an Examination of Portuguese Sources,' in, M.L. Arnott, (ed), *Gastronomy,* Hague 1975, pp. 23-66; T. Stoianovich 'Le mais dans les Balkans,' *Annales,* 21 1966, pp. 1026-40; J. Humlum, *Zür Geographie der Maisbaus,* Copenhagen, 1942; *P.M. Hohenberg,* 'Maize in French Agriculture,' *Journal of European Economic History,* 6, 1977. Maize seems often to have taken over from millet, a traditional grain throughout the Mediterranean and south-east Europe which, like maize, thrived best on a fertile soil with late spring and early summer rainfall. For millet, see *Agricultural Gazette,* 16 July 1870, p. 965; N.W. Simmonds (ed) *Evolution of Crop Plants,* 16, 1976, p. 91; *Oxford Book of Food Plants,* Oxford. 1969, pp. 12-13.

OECD consumption statistics provide the first comprehensive view of dietary trends.[6] A major difficulty in measuring grain utilization is that a large proportion of oats, barley and maize, and, from 1920 onwards, increasing quantities of wheat and rye, especially the softer varieties unsuitable for bread-making, were fed to animals. At present, over 70 per cent of all grain in the European Community is consumed by livestock and just over 20 per cent fed directly to human beings in the form of bread or other cereal preparations.[7] It can be safely concluded that in virtually all European countries the wheat share of total food grain consumption rose from the mid-nineteenth century. The upward trend was interrupted in the 1930s by the 'depression effect' of falling real incomes and restrictive trade policies which in some countries, as far apart developmentally as Germany and Rumania, caused a temporary halt.[8] Due to shortages, rationing and lack of substitutes, bread grain consumption rose in the immediate post-war period, but resumed its downward path from the early 1950s. However, as will be shown, wheat consumption in many poorer countries, in south

[6] *Les grands produits agricoles: Compendium international de statistiques* 1924-1938, FAO Rome 1948; *International Wheat Situation,* Wheat Advisory Commission, 1938; M.K. Bennett, 'World Wheat Utilization since 1885-86,' *Wheat Studies,* XII, 1936; J.H. Schollenberger, *Wheat requirements in Europe,* USDA Technical Bulletin, no. 535, 1936; N. Jasny *Competition Among Grains,* Stanford, 1940; W. Malenbaum *The World Wheat Economy 1885-1939,* Cambridge, Mass., 1953. The aforementioned studies are based on a number of questionable assumptions and are concerned mainly with wheat with, as Jasny admitted, only 'sidelong glances at other grains,' *op. cit.* pp.82-83. Malenbaum's chief criticism of early estimates was that they are devoted to the determination of an aggregate demand curve for wheat and do not sufficiently distinguish the demand elasticity of the different types of usage — food, feed, etc. The best study in fact, less statistical but probably more reliable and better informed about grains at the household level, is the Report on Bread, in *Rural Dietaries in Europe,* European Conference on Rural Life, Geneva, 1936, which examines food grain consumption in 17 countries in the 1930s, with comparison back to 1914.

[7] M.K. BENNETT reckoned that pre-WWI only 5-6% of mainly tailwheat, was fed to stock in 13 western European countries, but that this had risen to 10% in the early 1930s, a depression phenomenon. Over much of central Europe and Scandinavia a large proportion of rye was used for feed by the later date. 'Per Capita Wheat Consumption in Western Europe, pt. 1' *Wheat Studies,* XI, 1935, p. 302.

[8] See P.L. YATES, *Food, Land and Manpower in Western Europe,* 1960, chapter 2; C.Clark, *The Conditions of Economic Progress,* 1951, p. 368; and for 'trade', 'income' and 'depression' effects in the inter-war period, Bennett (1935, 1936), *loc. cit.*

east Europe and the Mediterranean, but especially in North Africa, increased absolutely and relative to other grains up to the 1950s, and in some cases the 1970s. Within this process several distinctive stages can be identified. In the first, at relatively low but steadily improving income levels, wheat consumption per head and food grain consumption per head rise together. In the second, wheat consumption per head continues to rise while total grain consumption per head begins to fall. In the third, the two fall together, total consumption faster than wheat consumption. The fourth, and most recent stage, occurs in high income countries where the pattern of food grain consumption has reached a definitive form and there is diversity at the margin, as consumers begin to experiment with other grains and grain foods, some of which, such as rye crisp-breads or long-grained rice and pasta, became an established part of the cereal diet. In the mid-1930s wheaten bread was made normally from wholemeal or high-bran flours, but there were also many mixed breads made from flour mixtures in which wheat was blended in varying proportions with one or more grains. The position as it appeared in the mid-nineteenth century was that to expand the proportion of wheat-eaters to modern levels, or to raise wheat consumption per head to the levels then obtained in Britain and France, that is about 150Kg per year, compared with a European average of less than 60, required a dramatic increase in wheat supplies. In the mid-1930s M. K. Bennett saw the key difference as between countries where wheat was the preferred grain and consumption was held back by low or falling incomes (e.g. south east Europe), and those which were traditionally attached to other grains, and consumption was held back by force of custom, as in Germany, Czechoslovakia, Austria and Denmark, where he believed, wrongly as it turned out, that wheat consumption may have reached saturation point.

The observed tendency was for wheat consumption per head to range from 3.6-5.0 bushels in countries where living standards were high, and grain consumption falling, but to be either more than 5 bushels or less than 3.6 bushels in countries with relatively low living

standards where grain consumption was steady or rising.[9] National differences cannot be explained wholly in terms of income. Environment was still a major determinant, as was custom and preferred taste. Persistently high levels of rye or maize consumption in some former Eastern bloc countries since 1945 were due in part to autarkic trade and agricultural policies which aimed to limit purchases of wheat from outside the bloc and encourage the use of home-produced grains.

II

It is an undisputed fact that, over the long run, wheat and the wheaten loaf displaced other types of grain and grain preparations to become the standard grain and grain-food in most European countries. There now follows a brief summary of trends in the principal European regions from the mid-nineteenth century up to the post-war period.

The Mediterranean Region: S. Europe, N. Africa and the Near East

Bread wheat, *Triticum vulgare,* introduced into Egypt, Greece and Italy in the first millennium B.C.[10], was by no means the exclusive grain in the Mediterranean region in the mid-nineteenth century. Because of their lower winter rainfall and higher temperatures, the lower latitudes, comprising most of North Africa, the Arabian Peninsula and Palestine, were better suited to barley, millet and sorghum, which were the staple food grains of the indigenous population up to the Second World War. The native wheats of North Africa were entirely of the hard *durum* variety and were eaten in the

[9] Bennett (wheat utilization), *loc. cit.* p. 347-8, 378-81, 387.

[10] N. Jasny, 'The daily bread of the ancient Greeks and Romans', *Osiris,* 9, 1950, p. 230 ff. J. André, *L'alimentation et la cuisine à Rome,* Paris, 1961, pp. 52-72; T. Braun, 'Ancient Mediterranean Food', in G.A. Spiller (Ed.), *The Mediterranean Diets in Health and Disease,* New York, 1991, pp. 16-40.

form of pasta, couscous or *burghul* (boiled wheat) [11]. Soft wheat, and with it oven bread, was introduced only at the end of the nineteenth century by French settlers. [12] Egypt was a seminal source of bread wheat in the Mediterranean, but, outside the province of Gizeh and the private estates of the Khediv, barley, maize and millet occupied a substantially larger area than wheat in the 1870s. [13] Crop statistics confirm the dominant position of non-wheaten grains and durum over most of North Africa in the 1930s. [14] Barley, followed by maize or sorghum comprised 70-75 per cent of the cereal diet in French and Spanish Morocco. The Berber peoples of the Rif Atlas ate large quantities of rye, (a grain much despised by Arabs who resisted French attempts at popularizing it), whilst the French community ate almost exclusively wheaten bread. [15] In Palestine, wheat constituted about 60 per cent of total food grain consumption, otherwise barley. [16] By 1964-66 wheat was the major food grain in all Middle Eastern and North African countries except Saudi Arabia and Yemen where millet and sorghum, and Egypt where maize, rice and millet were the principal grains. Barley was still significant especially in the drier, more rural areas, but millet, the traditional famine grain, had by this stage effectively vanished from popular dietaries, or had been replaced by rice. [17]

In the upper Mediterranean region — that is Spain, Italy, Greece

[11] *Rachis,* 3, no. 2, 1984, pp. 30-33.

[12] T.S. Githens and S.E. Wood, *The Food Resources of Africa,* Univ. of Penn. Press, Philadelphia, 1943, pp. 65-67.

[13] 'The Climate, Agriculture, Commerce... of Egypt' in *Journal of Statistical Society,* 39, 1876, p. 218.

[14] Naval Intelligence Division. Geographical Handbook Series. *Morocco,* vol. 2, 1942, p. 133, 166, 171.

[15] *Ibid.* pp. 133-35, 159-61; Githens and Wood, *op. cit,* pp. 70-71 H. Bruneton, 'Bread in the Region of the High Atlas...' in Arnott, *op.cit.,* Hague, 1975, p. 276.

[16] Naval Intelligence Division. Geographical Handbook Series. *Palestine and Transjordan,* 1943, pp. 246-47.

[17] *Food Balance Sheets 1964-66,* FAO, Rome, 1971. Wheat consumption was 86% in Algeria, 62% in Morocco, 88% in Tunisia and 75% in Syria. Maize exceeded 10% only in Egypt; barley exceeded 20% in Iraq and Morocco; rice exceeded 10% in Egypt, Iraq and Saudi Arabia. Millet and sorghum are stated to have comprised 100% of consumption in Yemen cf. 38% in Saudi Arabia.

and Turkey — wheat was the chief food grain in the mid-nineteenth century, but with a number of important regional exceptions. In the Old Kingdom of Greece wheat was the staple grain of about half, and in the enlarged Kingdom about two thirds of the population on the eve of the Great War. In the late 1930s, notwithstanding a dramatic increase in wheat production in the north and centre, barley was still the principal grain in Crete and the Aegean Islands, as was rye in the Rhodope mountains of Macedonia and Dhekeli Thrace, and maize either by itself or mixed with wheat, in the moist north-west, in Epirus and Arta. Overall, due to its predominance in the large, rapidly expanding urban centres of Athens and Salonika, wheat accounted for perhaps 70-75 per cent of food grains at the outset of the Second World War, rising to over 85 per cent by the 1960s. [18]

In Turkey, too, other grains were locally very important in the 1930s when the wheat proportion amounted to just over 70 per cent. Maize, the second grain, was popular around the Black Sea, rye and rye mixtures in the mountains of the west and north-west, and millet in the Kurdish lands in eastern Anatolia beyond Lake Van. As in Greece, wheat gained ground after the Second World War, chiefly at the expense of maize, and in 1984 stood at 86 per cent. [19]

In Italy, where wheat had long been the established grain, maize and rye were the principal grains in Lombardy, Veneto and lower Piedmont in the late eighteenth century which, together with a little barley, mainly in Sicily, made up perhaps 30 per cent of food grain consumption in 1850. Wheat consumption per head grew steadily during the second half of the nineteenth century and by the 1930s

[18] Greece: D. Bikelas, 'Statistics of the Kingdom of Greece', in *Journal of Statistical Society,* XXXI, 1868, p. 292; M. Sivignon, 'The Demographic and Economic Evolution of Thessaly 1880-1940', in, F.W. Carter (ed.), *An Historical Geography of the Balkans,* 1977, p. 390; Naval Intelligence Division, Geographical Handbook Series. *Greece,* II, 1944, pp. 56-60; *Food Balance Sheets 1964-66,* FAO, Rome, 1971; *European Conference on Rural Life.* Dietaries in Europe. Report on Bread, League of Nations, Geneva, 1939, pp. 68-69.

[19] Turkey: P.Joukovsky, *La Turquie agricole,* Leningrad, 1933, pp. 28-29, 49-50, and *passim;* G. Stratil-Sauer, 'Cereal Production in Turkey,' *Economic Geography,* 9, 1933, pp. 325-36; OECD Food Consumption Statistics, 1984, *op. cit.*

wheat was the dominant grain in the northern plains, but with maize *polenta* still widely eaten in the rural areas. By the mid-1950s maize accounted for 5 per cent of total consumption compared with 16.5 per cent pre-war, while the wheat continued to advance, reaching almost 90 per cent by 1984. [20]

Iberia, too, was a region of strong contrasts. The pattern in Spain was similar to if less pronounced than that in Italy. Wheat was much the most popular food grain, but rye was important in the mountain provinces of the north and centre, rice in Valencia, maize in Galicia, sorghum in Andulusia, and millet in Catalonia. Maize had almost disappeared by the 1950s and rye by the 1980s. [21] Maize and rye were much more important in the northern provinces of Portugal. Pre-war they accounted for an estimated 44 per cent and, as recently as 1984, still about 28 per cent, and rice about 12 per cent of total grain consumption. Between the late 1930s and mid-1980s the wheat share increased but slightly from 48 per cent to 57 per cent, among the lowest in Europe. [22]

South East Europe and the Balkans

Maize and rye rather than wheat were the principal food grains of much of this region in the nineteenth century. Wheat predominated in the Hungarian Plain, the Danube district of Yugoslavia, the

[20] Italy: *Agricultural Gazette,* 9 May 1868, pp. 499-500; Naval Intelligence Division. Geographical Handbook Series. *Italy,* III, 1945, pp. 32-35; M. Aymard, 'Dietary changes in Europe from 16th to 20th century with particular reference to France and Italy,' in H. Baudet and H.van der Meulen, *Consumer behaviour and economic growth in the modern economy,* 1982, pp. 120-21; OECD Food Consumption Statistics 1984, *op. cit.*

[21] Spain: 'Contestacion al interrogatorio publicado... 1881,' *Estudias d'historia agraria* 2, 1979, pp. 254-59; M. Tunon de Lara *El movimento obrero en la historia de España,* Madrid, 1972, *passim;* European Conference on Rural Life (Report on Bread), *op. cit.* p. 47; Naval Intelligence Division. Geographical Handbook Series. *Spain and Portugal, III,* 1944, pp. 202-14.22.

[22] Portugal: Naval Intelligence Report, *ibid. II,* 1942, pp. 160-65; *The Agricultural Crisis,* League of Nations, Geneva, 1931, II, pp. 48, 50; European Conference on Rural Life (Report on Bread), *op. cit.* p. 47; OECD Food Consumption Statistics 1984, *op. cit;* Bennett (Utilization), *loc. cit.* XII, 1936, p. 384.

Rumanian Bhat, and eastern Bulgaria. Rye or maslin (wheat and rye) was common in Trans-danubian Hungary, Galicia, Ruthenia and mountain areas generally. The dominant grain in Rumania, Yugoslavia, and Albania, introduced there in the seventeenth century, was maize, whose importance grew *pari passu* with population until, by the mid-nineteenth century, maize cake and maize porridge, the infamous *mamagalia,* were the common grain foods. Here, as in the Po Valley, and northern Portugal, the deficiency disease, *pellagra,* was a common medical condition. In 1936-37 it was estimated that maize constituted 58 per cent of food grains in Yugoslavia, and 70 per cent in Rumania. A standard practice in poor farming areas was to sell wheat and live on cheaper grains. The type of grain consumed varied according to the time of year and the size of the preceding harvest. Yugoslavian peasants, for example, consumed a remarkable range of grains and grain mixtures; — wheat, barley, maize, millet, oats, rye, emmer and spelt. In the 1930s, even in predominantly wheat-eating countries such as Bulgaria, maize and rye comprised over 45 per cent of grains in the rural areas.[23] The post-war period saw a significant increase in per capita wheat consumption in most countries and a corresponding decrease in rye, millet and barley. By the mid-1960s, wheat comprised about 85 per cent of total food grain consumption in

[23] South East Europe and Balkans: G. DOBRE, *Romanian Economy Structure and Level,* Bucharest, 1982, pp. 8-9, 12, 19; G. Ionesco-Sisestri, *L'agriculture de la Rumanie pendant la guerre,* Paris, 1922, pp. 13-14, 56; M. C. Roberts, 'Rumania Today', *Economic Geography,* 9, 1933, pp. 238-42; O. Vaduva, 'The Introduction of Maize into the Food of the Rumanian People and its Impact,' in A. Fenton and T. M. Owen (eds), *Food in Perspective,* Edinburgh, 1981, pp. 333-342; L. D. Turnock, *An Economic Geography of Rumania,* 1974, p. 219; T. Stoianovitch, 'Le mais dans les Balkans,' *Annales,* 21, 1966, pp. 1028-40; H. Evershed, 'Variations in the Price and Supply of Wheat,' *Journal Royal Agricultural Society of England,* 2nd ser; 5, 1869, pp. 233-34; J. S. Roucek, 'Economic Conditions in Albania,' *Economic Geography,* 9, 1933, p. 260; O. Lodge, *Peasant Life in Yugoslavia,* 1941, pp. 113, 125, 139; F.E.I. Hamilton, *Yugoslavia,* 1968, pp. 203-4; Naval Intelligence Division. Geographical Handbook Series. *Yugoslavia, III,* 1945, pp. 78-90; L. F.Sheppick, *The World's Wheat Crop,* Liverpool, 1927, pp. 63-64; T.S. Dymond, *Agricultural Industry and Education in Hungary,* Chelmsford, 1902, pp. 116-17; 'The Danube Basin as a Producer and Exporter of Wheat,' *Wheat Studies,* VI, 1929-30, pp. 238, 254-55; European Conference on Rural Life. *Yugoslavia.* League of Nations, Geneva, 1939, p. 68; European Conference on Rural Life (Report on Bread), *op. cit.* pp. 71-72, 77-78, 80-83.

Yugoslavia, Hungary and Bulgaria, compared with 60 per cent in Rumania and 53 per cent in Albania, where in rural areas maize and maize-wheat mixtures were still the staple grains. [24]

Russia and Eastern Europe

Between the mid-nineteenth century and 1980, Russia was transformed from a rye-barley-buckwheat to a mainly wheat-eating country. In parts of the far north rye replaced barley, but the more significant trend was the rise of wheat, initially in the south-east but much later in the north and north-west where, up to at any rate 1914, rye, supplemented by barley, buckwheat and oats, remained the basis of the diet. Due to the export of a large part of the wheat crop, other grains then accounted for about 70 per cent of Russian consumption. Following the Revolution, the increase in wheat production on collective and state farms, together with a reduction in wheat exports, raised wheat availability per head from 136kg to over 200kg per annum. The effect on consumption is uncertain because a large quantity of wheat is believed to have been fed to livestock. Even so, the period saw a notable decline in barley and buckwheat to the point where, by the mid-1930s, the wheat fraction had risen to 45-50 per cent, and the majority of bread was made from wheat and rye mixtures. Crop statistics show a threefold increase in wheat output between 1940 and 1976-80, from 31.8 to 99.7 m. metric tons, a halving of rye output from 21.1 to 10.9 m. metric tons (but rising imports), and a decline in millet and buckwheat from 5.7 m. to 3.9 m. metric tons. This suggests a growth in wheat consumption to current levels of upwards of 70-75 per cent. [25]

[24] Food Balance Sheets 1964-66, *op. cit.*

[25] Russia: V. P.Timeshenko, *Agricultural Russia and the Wheat Problem,* Stanford, 1932, pp. 366ff; 'The Place of Wheat in the Diet,' *Wheat Studies,* V, 1929; V. Kerblay, 'L'evolution del'alimentation rurale en Russe,' *Annales,* 17, 1962, p. 898; Z. A. Medvedev, *Soviet agriculture,* New York, 1982, pp. 217-18; *Economy of the USSR: Statistical Annual,* Central Statistical Office, Moscow, 1987, p. 182 (In Russian: information by courtesy of Dr. S. B. Ward).

The trend in Russia is in sharp contrast to that in Poland which is much less well-suited to the growing of wheat. In the mid-nineteenth century wheat occupied an estimated 9 per cent of the grain area, compared with 43 per cent under rye, 35 per cent under oats and 13 per cent under barley. Here, as in adjoining parts of Russia, rye gained at the expense of barley and oats. Wheat consumption per head increased only very slowly from the 1880s, standing in 1935 at 34kg per annum, the lowest in Europe, compared with 159kg of rye. In Warsaw even, bakers used over 80 per cent rye, while the rural population relied almost entirely on whole rye meal bread, barley bannocks and gruels, and buckwheat porridge. Indeed, on many farms bread itself was a rarity after New Year, as families retrenched on diets of potatoes, barley meal, even lupin. Wheat increased after the Second World War and by the mid-1960s represented just over 50 per cent of grain consumption. In the mid-1970s rye consumption, at 41kg per head, was the highest in Europe. [26]

Scandinavia

Rye, barley and oats, were the staple grains throughout Scandinavia in the mid-nineteenth century. Environmental conditions favoured the cultivation of spring grains which, up to the 1930s, occupied two-thirds or more of the cereal area. Home-grown wheat and rye were naturally too soft for bread-making with the consequent dependence on Russian ryes and North American wheats.

[26] European Conference on Rural Life (Report on Bread), *op. cit.;* pp. 75-76; Evershed, *op. cit.* pp. 199, 213; 'Polish Countryside in the Years 1929-1935,' *Acta Poloniae Historica,* IX, 1963; Food Balance Sheets, 1964-66, *op. cit.*
L. Munck, 'Nutrition and Health Aspects of Cereals in the Human Diet,' in S. Rajki and A. Bruce (eds), *Round Table Conference on Food Production, Nutrition and Health,* Budapest, 1983, p. 122; H. Faber, 'Agricultural Production in Denmark,' *Journal Royal Statistical Society,* 1924, pp. 47-48; H. Osvald, *Swedish Agriculture,* Stockholm, 1952, pp. 42-49, 60-61; H. M. Jenkins, 'Report on the Agriculture of Sweden and Norway,' *Journal of Royal Agricultural Society of England,* 2nd ser., XI, 1875, pp. 166-67; p. 180; W. R. Mead, 'Agriculture in Finland, pt. II', *Economic Geography,* 15, 1939; European Conference on Rural Life (Report on Bread) *op. cit.* pp. 49-57; Food Balance Sheets 1962-64 (and provisional 1975-77), *op.cit.;* OECD Food Consumption Statistics 1984 *op. cit.*

In contrast to the other northern countries, barley was the chief food grain in Denmark, supplemented by oats and rye. An interesting feature was that subsequently wheat replaced rye in urban areas while, in rural areas, oats replaced barley which in turn was replaced by wheat. By 1914, barley was the third-ranking grain, and rye, followed closely by wheat, the market leader. Rye and wheat were still roughly equal in the 1930s by which stage oats had superseded barley as the chief non-bread grain. In contrast to Norway and Sweden, the wheat fraction increased only slowly in the post-war period, from 46 per cent in 1934-38 to 63 per cent in 1984, one of the lowest in Europe. In Sweden there occurred a switch from oats to rye in the eighteenth century or sooner. In the 1870s the grain relatives were estimated as follows: rye 28 per cent, barley 28 per cent, oats 18 per cent and wheat 7 per cent. Wheat consumption grew from 1880, but rye was still very much the leading grain here and in Norway in 1914, rye-wheat ratios being then of the order of 2:1 and 3:1 respectively. By the later 1930s the wheat fraction in both countries had risen to 60 per cent compared with about 30 per cent for rye, and under 10 per cent for barley and oats. Again, especially in Sweden where *knackebrod* or crisp-bread remains a favourite food, rye occupies an important place in the modern cereal diet. Wheat took hold more slowly in Finland, accounting for less than 20 per cent of consumption in 1914, rising to 35-40 per cent in 1939, and 60 per cent in 1984, a similar level to Denmark. [27]

Central Europe including the Low Countries

Central Europe is a transitional zone between the winter wheat, rye-buckwheat, and oat belts. Traditionally, bread and porridges

[27] N. JASNY, *Competition Among Grains,* Stanford, 1940, p. 46; M. Tracy, *Agriculture in Western Europe,* 1964, p. 102; H. J. Teuteberg, 'Food Consumption in Germany since the Beginning of Industrialization.....', in, Baudet and van der Meulen, *op. cit.* pp. 240-41; *Statistical Yearbook of the German Democratic Republic,* 1988, p. 115. (by courtesy of Agricultural Attaché, GDR Embassy, London); OECD Food Consumption Statistics 1984, *op. cit.*.

constituted the backbone of German diets, with rye much commoner in the east than the west and south. After a hiatus or possibly even a retreat in the early nineteenth century, wheat began to advance again from 1850. By 1914 rye and wheat were more nearly equal where in 1850 rye and oats and accounted for more than three quarters of the grain diet. As a result of trade and agricultural policies, wheat consumption stagnated between the wars. In West Germany (GFR), the wheat fraction in the later 1930s was about 55 per cent, and in East Germany (former DDR) about 45 per cent, increasing to 70 per cent and 62 per cent respectively by 1984. In both Germanies rye and rye-wheat mixtures have retained their popularity, whilst oatmeal porridge, a mainstay of the traditional diet, has now largely disappeared. [28]

In Czechoslovakia rye was the most popular grain in 1914. By 1939 it had declined to about 45 per cent and by the mid-1960s to 22 per cent of grain consumption. In Switzerland wheat, already the dominant grain in the mid-nineteenth century, consolidated its position until by the 1930s it amounted to over 80 per cent of total consumption. Rye mixtures were then confined to the German-speaking districts, and pure rye to the remote mountain villages. [29]

Belgium and Holland followed the same trend as the central European countries, except that the changeover from rye to wheat was accomplished rather earlier. In Belgium, rye comprised 46 per cent, wheat 32 per cent and maslin 22 per cent of food grains in the mid-nineteenth century. In the 1850s, in the city of Antwerp, 86 per cent of bread was made from wheat, compared with 68 per cent in the 1820s. Thereafter, imports were the key to the growth in wheat,

[28] European Conference on Rural Life (Report on Bread), *op. cit.* pp. 47-48.

[29] *Ibid.* p. 42,45; C. Vandenbroecke, *Agriculture et Alimentation,* Gent, 1975, *passim;* Verhulst and G. Bublot (eds), *Agriculture in Belgium: Yesterday and Today,* Brussels, 1980 pp. 34-35; Evershed, *loc. cit.* pp. 221-222; C. Lis and H. Soly, 'Food Consumption in Antwerp Between 1807 and 1859...', *Economic History Review,* 2nd ser., XXX, 1977, pp. 467-68, 472, 475; Naval Intelligence Division. Geographical Handbook Series. *Belgium,* 1944, pp. 241-43; Food Balance Sheets 1964-66, *op. cit;* OECD Food Consumption Statistics 1984, *op. cit.*

whose share of the total consumption rose to 70 per cent in 1890, 85 per cent in 1914, and over 90 per cent in 1939. In Holland, its advance was less rapid; rye was still the leading grain in 1850 and in 1914 was on an equal footing with wheat. By 1939, however, the wheat fraction stood at over 70 per cent and by the mid-1950s at over 85 per cent. Even then, as over much of Central Europe, a little rye was still added to the wheat as a flavouring. [30]

North-West Europe

Comprising just France and Britain, north-west Europe was the only major region outside the Mediterranean where, in the mid-nineteenth century, wheat was the major food grain, to the point where the proportion of wheat consumed now exceeded that of Spain and Italy. In France, the geographical complexity of food grain consumption — the then still sizeable concentrations of maize in the south-west and Alsace, rye in the Massif Central, maslin in Nord, Pas de Calais and the Paris Basin, and buckwheat in the maritime north-west — is documented in the *Enqûetes*. The wheat proportion, already 55-60 per cent about 1830, had risen to 85-90 per cent by 1914. [31] In Britain, meanwhile, it comprised over 85 per cent in England and Wales (compared with 66 per cent in 1800), but only 44 per cent in Scotland, where oatmeal, in the form of cake and porridge, was still the major grain. Otherwise, the principal exceptions were small quantities of barley and rye in parts of upland Wales and, in northern England, a rapidly weakening preference for oat foods. By

[30] N. J. G. POUNDS, *An Historical Geography of Europe* 1800-1914, Cambridge, 1985, p. 72; R. Weber *Peasants into Frenchmen,* 1977, pp. 137-41; H. D. Clout, *Agriculture in France on the Eve of the Railway Age,* 1980, pp. 88-89, 100-102, 194ff (an excellent summary); J. C Toutain, *Le produit de l'agriculture francaise de 1700 à 1958,* Paris, 1961, II, p. 16.

[31] E. J. T. COLLINS, 'Dietary Change and Cereal Consumption in Britain in the Nineteenth Century,' *Agricultural History Review,* 23, 1975, pp. 97-115; K. O'Danachair 'Bread in Ireland,' in Fenton and Owen, *op. cit.* p.57ff. P. Brears, *Traditional Food in Yorkshire,* Edinburgh, 1987, is one of the best examples of an ethnological study of grain foods (pp. 59ff).

1900 wheat accounted for 95 per cent of food grain consumption in Britain overall. Wheat followed by oats (in the north), with a smattering of barley (in the south east), were the chief grains in Ireland, plus, following the Famine, imported American maize which was either mixed with wheat for bread, or made into griddle cakes. By the 1920s, as in mainland Britain, wheat had become the more or less exclusive grain.[32]

The long-term trends, pre- and post-war, are summarized in Tables 1-3. Table 1, based on Melenbaum's classic study of the world wheat economy, suggests an increase in per capita consumption in almost all European countries between the later 1880s and the First World War and a continuing rise in the post-war period, apart that is from the advanced countries where consumption stabilized at between approximately 5 and 6 bushels per head, tending slightly to fall. Table 2 demonstrates a much more significant decline in the wealthier countries but a continuing rise in the three lowest income countries — Turkey, Yugoslavia and Portugal, and a rising wheat proportion in central and northern Europe. Table 3 suggests a continuing shift from rye and maize to wheat in the old Eastern bloc countries and, more questionably, an increase in total consumption between the mid-60s and early 80s. Whilst wheat is everywhere dominant, significant quantities of other grains — maize in the south-east and rye in the north — are still eaten, suggesting that some countries at any rate actually prefer a diet of mixed grains and will resist further inroads by alien wheat. The position in eastern Europe is uncertain; time will tell whether it has arrived at the optimum consumer choice or whether external social and cultural pressures, or grain shortages requiring large inputs of western wheat, will lead to a further weakening of the position of traditional grains.

[32] BAKER *loc. cit.*, p. 18.

Table 1
PER CAPITA WHEAT CONSUMPTION IN EUROPE, 1885-1939[1] (in bushels)

	1885-9	1899-04	1909-14	1934-9	% change 1885-9 to 1909-14	% change 1909-14 to1934-9
Austria	2.79	2.90	2.21	2.70	–20.8	22.2
Belgium	5.10	6.92	7.26	5.80	42.4	–20.1
British Isles	5.47	5.61	5.63	4.90	2.9	–13.0
Bulgaria	3.50	3.75	4.14	6.41	18.3	41.4
Czechoslovakia	—	—	—	3.24	—	—
Denmark	1.42	2.33	2.81	2.57	97.9	– 8.5
Finland	0.46	1.16	1.70	2.13	269.6	15.3
France	7.66	7.74	8.07	6.50	5.4	–19.5
Germany	1.85	2.66	2.69	2.51	45.4	– 6.7
Greece	3.80	4.00	3.90	5.34	2.6	36.9
Hungary	3.90	4.02	4.47	5.42	14.6	21.3
Italy	5.11	5.42	5.96	5.95	16.6	0
Netherlands	3.38	3.70	3.97	3.86	17.5	– 2.8
Norway	0.67	1.20	1.61	3.11	140.3	93.2
Poland	1.15	1.40	1.40	1.75	21.7	18.8
Portugal	1.83	1.79	1.51	2.08	–17.5	37.7
Rumania	3.05	3.16	2.18	3.42	–28.5	56.9
Spain	4.63	5.50	5.62	4.95	21.4	–12.0
Sweden	1.02	1.82	2.09	2.55	104.9	22.0
Switzerland	5.17	5.73	5.61	4.80	8.5	–14.4
Yugoslavia	1.30	1.80	1.79	4.39	37.7	145.3

[1] bushel = c. 60lb or 27kg
Source: W Malenbaum. *The World Wheat Economy 1885-1939*, Harvard UP, Cambridge, Mass., 1953, pp. 244-5.

Table 2
PRINCIPAL FOOD GRAINS CONSUMED IN SELECTED EUROPEAN COUNTRIES
as a percentage of total food grain consumption 1934-8 - 1984-5 (per cent and kg)

	Wheat	Barley	Oats	Rye	Maize	Rice	Total annual consumption (kg)
DENMARK							
1934-8	48.3	2.0	3.1	43.5	3.1	—	96.7
1965-6	56.3	0.6	5.1	34.2	1.7	2.1	72.5
1984	63.3	0.1	4.7	25.9	3.2	2.8	72.5
GERMANY (GFR)							
1935-8	49.1	0.5	0.8	47.4	2.1	—	108.4
1965-6	68.6	0.3	1.6	24.7	2.0	2.7	73.5
1984-5	69.7	0.3	1.6	17.4	8.7	2.4	74.5
ITALY							
1945-8	76.3	0.5	—	1.5	16.5	4.7	166.6
1965-6	92.4	0.8	—	0.4	2.9	3.7	132.1
1984-5	89.4	0.1	—	0.1	6.3	4.1	123.2
PORTUGAL							
1934-8	47.0	2.7	—	11.1	32.8	6.3	127.4
1965-6	56.5	0.2	—	14.2	19.4	9.1	125.7
1984-5	57.3	0.8	0.1	5.6	22.8	13.5	124.4
TURKEY							
1934-8	72.4	1.7	—	7.0	14.2	1.1	192.3
1976	85.5	—	—	4.8	7.1	1.9	220.7
1984-5	84.5	—	—	2.2	8.5	2.3	183.7
SWEDEN							
1934-8	60.4	3.2	5.2	28.4	0.8	1.9	97.5
1965-6	73.6	0.6	3.2	19.8	1.3	1.7	69.7
1984-5	76.2	0.6	3.3	20.5	2.5	4.0	64.3
SWITZERLAND							
1934-8	85.2	NA	NA	NA	NA	NA	109.3
1965-6	81.9	3.1	1.9	7.3	1.1	2.3	69.7
1984-5	82.4	1.6	1.5	4.0	2.1	4.7	67.7
YUGOSLAVIA							
1950-51	47.5	2.8	—	3.3	46.1	0.2	174.0
1976	86.3	0.3	—	—	12.5	0.8	172.3
1984-5	35.4	0.2	—	—	13.0	0.7	169.6

Source: *Food Balance Sheets* (FAO, Rome, 1953, 1955, 1966, 1984); *Agricultural Production and Food consumption in Western Europe* (USDA, Washington, 1951); *Food Consumption in OECD Countries* 1960.

Table 3
PRINCIPAL FOOD GRAIN CONSUMED IN EASTERN EUROPEAN COUNTRIES
as percentage of total food-grain consumption, 1964-66, 1979-81 (per cent and kg)

	Wheat		Rye		Maize		Barley		Rice		Total food grain consumption per head per annum (kg)	
	A	B	A	B	A	B	A	B	A	B	A	B
Albania	53.4	—	2.0	—	42.2	—	0.3	—	2.0	—	158.6	—
Bulgaria	85.6	91.8	2.0	—	5.2	1.3	3.4	3.5	2.3	2.9	194.8	225.2
Czechoslovakia	73.2	75.0	22.2	17.4	—	3.0	—	—	3.6	4.7	127.1	145.7
German D.R.	54.7	60.3	42.4	31.8	—	—	—	—	7.9	2.1	98.6	132.4
Hungary	84.5	94.8	12.5	1.4	—	—	—	0.3	2.7	3.6	138.5	154.7
Poland	51.3	67.8	38.0	22.0	—	—	5.7	5.7	1.4	2.4	139.7	180.8
Romania	60.5	71.7	1.0	—	36.2	24.5	0.9	0.7	1.4	3.0	182.6	191.2
USSR	—	76.3	0.0	13.0	—	—	—	0.9	—	7.4	—	184.0

A = 1964-6

B = 1979-81

Source: *Food Balance Sheets* (FAO, Rome, 1966, 1984).

III

Wheat was described in the early years of this century as the 'White Man's Food' [33]. Yet not only in Europe and the countries of European settlement, but also Latin America, North Africa, the Middle East — regions and sub-continents of widely differing cultures and grain-eating traditions — wheat is now the most popular food grain. The question, which we will now address, is why the many divergent patterns should have converged. In short, why wheat?

Wheat is regarded as superior to all other grains on account of its texture, colour, taste and digestibility. [34] Its singular advantage is as a bread-making material, in that it alone contains sufficient gluten to make possible the raising of the loaf. [35] Gluten is physically a tough, somewhat elastic substance, either grey or yellowish-brown in colour, with no distinctive taste. Insoluble in water, it forms a gum-like mass which, when heated, slowly releases the gases formed by the fermentation of the yeast or leaven, and in this way raises while at the same time aerating the dough. Gluten consists of two very complica-

[33] For general discussion on the comparative qualities of the different food grains see, A. F. Hill, *Economic Botany,* 2nd edn. n.d. New York, chapter XIV; N. W.Simmonds (ed.), *Evolution of Crop Plants,* 1976; *Oxford Book of Food Plants,* Oxford, 1969; W. R. Aykroyd and J. Doughty *Wheat in Human Nutrition,* FAO, Rome, 1971; Elizabeth David, *English Bread and Yeast Cookery, 1977.*

[34] The following section is distilled from a variety of modern and historical texts on agricultural botany and cereal chemistry, and discussions with scientific colleagues, in particular Dr. D. Drennan and Prof. J. Hawkes. The following works contain useful information: J. Percival, *Agricultural Botany,* 5th edn. 1918, J. Wilson, *Our Farm Crops,* 1, 1859; T. B. Wood, 'The Composition and Food Value of Bread' *Journal Royal Agricultural Society of England,* 72, 1911, J. Kirkland, *The Modern Baker,* new edn., 1, 1924; N. Jasny, *Competition Among Grains,* Stanford, 1940; D. W. Kent-Jones and A. J. Amos, *Modern Cereal Chemistry,* 4th edn. Liverpool, 1947.

[35] M. E. Lavenberg *et al, Food and Man,* 2nd edn., 1974; David *op. cit.* p. 29; W. P.Taunton, 'On the St. John's Day Rye,' *Journal Royal Agricultural Society of England,* VII, 1846, pp. 336-37; J. A. Moore, 'Science as a way of knowing - human ecology,' in American Society of Zoologists, *Science as a Way of Knowing,* 1985, pp. 534-35; Percival, *op. cit.* chapter 8. See also fn. 34. For a detailed discussion of the primitive grain spelt, historically and at the present day, see J.P. Devroey and J.J. Van Mol (Eds), *L'epeautre (Triticum spelta): histoire et ethnologie*, Treignes (Belgium), 1989.

ted compounds both belonging to the proteid or albumin series, glutenin and gliadin.

The unique chemical property of wheat is that glutenin, which provides the elasticity, comprises nearly two thirds of the proteids, compared with less than 20 per cent in most other grains. For instance, rye, the other important bread grain, whilst possessing some of the same characteristics as wheat, has a high percentage of gliadin but very little water-soluble glutenin, so that its dough is lacking in spring and elasticity. Moreover, its coat is less digestible and its flour more fibrous. Thus rye bread is dense with water streaks under the crust, bread made from wholemeal rye flour having a specific weight almost three times that of good wheaten bread. Maize has a gliadin fraction of nearly 50 per cent and is a very poor breadstuff, much inferior to rye. Barley and oats are rich in protein but deficient in gluten, as are millet and buckwheat, and so also make a poor loaf.

Another advantage of wheat is its sweetness compared with the slightly sour, bitter taste of rye. Perhaps its principal psychological appeal was its whiteness. This is due partly to the colour of the grain which varies from a dull white to a very pale red, and partly to the fact that the wheat berry itself contains a much higher proportion of starchy endosperm and a smaller proportion of skin and bran than other grains, thus yielding a whiter flour. Having a much higher bran and fibre content, extraction rates as low as 50 per cent were sometimes needed to produce a suitable bread-flour from some ryes, compared with 70-80 per cent for wheat. Normally, the higher the bran content the coarser and, due to the presence of cellulose and lignin, the less digestible the bread. In pumpernickel, made from coarse wholemeal rye flour, upwards of 40 per cent of the proteids are indigestible.

A great disadvantage of barley and oats (and most primitive wheats) is that unlike wheat and rye the grain does not thresh out but remains enveloped in the husk. In barley, the aleurone layer of the berry consists of four rows of cells compared with one in wheat, with the result that the outer husk is difficult to separate. Indeed it was often necessary to roast the grain in order to loosen the husk

sufficiently to be milled off. Because of imperfect separation barley meal contained particles of husk and made a very coarse bread. Bread could be made from inferior grains. It tended though, to be flat, dark, dense and difficult to digest. To improve the colour and flavour, and, through the addition of gluten to impart lightness and digestibility, wheat was often added to other flours. Rye-wheat mixtures rather than pure rye became the standard in the traditional rye-eating regions of the north and centre as did maize-wheat mixtures in the Biscay region, and barley-sorghum and millet-wheat mixtures in North Africa and the Middle East.

The wheaten breads of the present day owe much of their whiteness to the use of high-gluten flours made from imported hard wheats, reduced to a fineness in modern roller-mills and, not infrequently, chemically bleached. True high-quality bread-making flours were virtually unknown in Europe outside the Mediterranean until the mid-late nineteenth century when hard wheats began to be imported from southern Russia and North America on a large enough scale to affect average bread quality. Typical wheaten breads before the nineteenth century were very different from those of today. Many would now be regarded as unacceptable, being much darker, coarser and heavier than those to which we have become accustomed. This raises the interesting question of the extent to which, in the past, the benefits of wheaten bread may have been overstated.

Very little is known about the physiology and bio-chemistry of grains and grain products before the nineteenth century. It is clear that in the historic past, as today, not all wheats were ideal for bread-making or even as grain foods. A serious drawback of the ancient wheats — einkorn, emmer and spelt — was that their berries were covered with a tough protective coat or glume which was difficult to remove. Before they could be converted into flour such grains had often to be roasted and ground out by pestle and mortar or put through a specially set mill. For this reason alone, the preparation of wheaten flour was very laborious, and if done imperfectly yielded a very coarse meal. Emmer, the predominant wheat of ancient Greece and Rome, was eventually superseded by common bread wheat,

Triticum vulgare, and other so-called 'naked' wheats with freer glumes and a higher starch content than their progenitors. These improved varieties may not have reached central Europe until the Middle Ages. Even *rivet (Triticum turgidum),* which was commonly grown in north-west Europe until the later nineteenth century, had a rather adhesive glume. A further disadvantage of the primitive wheats was that the *rachis* (or stem), was very brittle so that when threshed the ear tended to break up into complete spikelets with short pieces of *rachis* attached, which made for a very coarse flour.[36]

The unique properties of wheat became apparent in the Classical period following the discovery of fermented bread made with yeast or sour dough. Wheaten flours were judged thereafter on the basis not just of colour or fineness, but also baking quality, that is to say 'strength'. 'Strength' is difficult to define, but it describes the water-absorptive capacity, elasticity, and consistency of the dough, and the number of fully risen loaves of good shape and texture that could be produced from a given quantity of flour. Strength was partly, but by no means wholly related to the protein content which ranged from as low as 7 to as high as 15-20 per cent. At one extreme were the hard, almost vitreous *durum* or macaroni wheats *(Triticum durum),* grown in the lower Mediterranean and Middle East. These yielded a dough of almost glue-like consistency, excellent for *pasta* or *couscous* but, by themselves, quite unsuitable for bread. In central and western Europe wheats were much weaker, and many were of a very poor bread-making quality. A loaf made from a soft, low-gluten wheat was barely superior in texture and density to one made from a strong hard rye. In England and northern France, the once popular 'red' (e.g. *rivet*) wheats, though very productive, yielded a soft darkish flour, deficient in gluten, and a dense, non-porous bread; they were regarded by bakers as best suited for puddings and pastry or for blending purposes.

[36] *Oxford Book of Food Plants, op. cit.;* J. H. Shollenberge, 'Wheat Consumption and Trade in Netherlands,' *Foreign Crops and Markets,* 17 July 1933, p. 149. (see also, *loc. cit,* 4 Dec 1933, pp. 650-56; European Conference on Rural Life (Report on bread), *op. cit.*pp. 41-43, 52; Percival, *op. cit,* chapter 8; J. Percival, *Agricultural Botany* 5th edn. 1918, pp. 525ff.

Indeed, it seems probable that in north-west Europe baking quality deteriorated during the Agricultural Revolution with the switch to more prolific varieties, higher in starch but lower in gluten than the older varieties.[37] The weakness of English wheats was demonstrated scientifically about 1800 by Sir Humphrey Davy who found by analysis that Middlesex wheat contained far less gluten than Polish, Sicilian and American wheats, and that spring-sown wheat was more glutinous than winter-sown wheat.[38] The way ahead was thus unknowingly signalled. The utility of wheat as a bread-grain was much enhanced when, in the later nineteenth century, large quantities of hard spring wheats became available with the opening up of the continental interiors of eastern Europe and north America on which the world's bakers came increasingly to depend for bread-making material.

Advances in cereal chemistry provided a scientific explanation of the mystery of bread and the reactions of the different types of flours. As early as 1806 an English domestic cookery writer, Mrs Rundell, was recommending her readers to buy American flour because it absorbed almost twice as much water as English flours and made upwards of 15 per cent more loaves from a given quantity.[39] The grading of wheats on the objective basis of the nitrogen and protein content became possible after 1883 when the Danish chemist, Kjeldahl, made public a relatively simple method for calculating nitrogen. It confirmed Manitoba Number 1 as the world's premier grade, and Moldavian followed by Bulgarian and Hungarian as the premier European bread wheats. By the time of the Great War, scientifically-minded bakers were aware that big well-piled loaves and high bread-flour ratio depended on strong flours rich in gluten and soluble phosphates; and that soft flours containing too much sulphate and chloride produced a short and crumbly gluten, good for confectionery, but quite unsuitable for modern bread making. This

[37] Percival, (Wheat) *op. cit.* p. 72.
[38] Wilson, *op. cit.*, pp. 2-3.
[39] David, *op. cit.* pp. 10-11.

was true also of Scandinavian ryes which were too soft for bread making and so had to be mixed with hard ryes from Russia or Argentina. Russian rye had a high water absorption and good baking quality but a poor colour. Thus in Germany it became usual to blend Russian with the more brightly coloured home-grown rye. By the 1930s, rye-wheat (3:1) mixtures were the general rule throughout northern Europe, producing a bigger, better-aerated and sweeter loaf than rye alone. [40]

As imported hard wheats became more plentiful so they tended progressively to replace soft home-grown wheats which were used for pastry and biscuits or fed to livestock. Thus, by the 1930s, over 95 per cent of the wheat used in British bread and over 80 per cent of that used in Belgian, was of foreign origin. Port millers, but bakers especially, agitated strongly in favour of a reduction in wheat import duties. They were the loudest protesters when, in the 1930s, legislation was introduced in many European countries requiring the incorporation of a certain proportion of home-grown wheat into bread flours, thereby reducing flour strength and the output of loaves.

The increased usage of hard wheat was coupled with a revolution in milling techniques. [41] Traditional millstones were, in the main, too soft for wheat, and required re-dressing every 4-6 days of operation. Hard wheats, being still more difficult to mill, were less popular among millers and so cheaper than soft wheats. The roller-milling process, developed in the 1870s, and spreading rapidly from central Europe to Canada and the United States, overcame the problem by cracking the kernel rather than crumbling it. This removed the bran and germ and separated the germ and oil as a first stage in the reduction process, prior to the milling proper. There were important developments also in bolting and sieving which traditionally had been time-consuming and indeed difficult operations. The very finest flours, such as French *manchet,* cost up to three or four times the price

[40] Kent-Jones and Amos, *op. cit.* pp. 93-94.

[41] European Conference on Rural Life (Report on Bread), *op. cit.* p. 41 (see also, pp. 42-43, 52 etc.).

of ordinary household flours. [42] Only very late on, from the end of the eighteenth century and, for bulk delivery, not until the 1860s, following improvements in sifting and dressing, did really fine flours, with the coarse particles and discolourants now almost entirely removed, become available at affordable prices. [43]

Thus it is argued, up to the nineteenth century the superiority of wheat as a bread-making material may have been over-estimated. Indeed, in many respects the bread grains, wheat and rye, were the least versatile. Their uptake signified a change not just in the type of grain but in the basic structure of the diet, and was part of a process, beginning in pre-historic times and still on-going, whereby baked grains replaced boiled grains as the staple grain food.

Due to their lack of gluten, other grains were much better adapted for boiling than bread-making. Boiled food could be cooked in a pot over a slow fire where bread required a hot oven. It could be made from whole grain, meal, grits, or groats. Boiling was the more effective method of cooking barley, oats and emmer which, as has been noted, were difficult to separate from the husk and too coarse for baking. Of the grain foods bread is a relative newcomer. In the early Classical period porridge made from emmer, barley and millet, was the principal food in Greece and Rome. It was part of the main meal, a stodgy accompaniment to meat, or a meal by itself, with oats, offal, seeds or meat added. Bread became an everyday food in Germany only in the later Middle Ages, while oatmeal porridge was a principal foodstuff over much of northern England and Scotland, northern Germany and northern France, until the nineteenth century.

Throughout central and northern Europe, gruels and porridges made from barley, oats, buckwheat and millet, were staple foods up to the modern period. Buckwheat porridge, or *grütze,* was very popular in nineteenth century Germany as is *masha* in Russia today. Up to the present century barley porridge, barley and potato soup, and oatmeal porridge were important foods in Scandinavia. Millet, one of the

[42] H. E Jacob, *Six Thousand Years of Bread,* New York, 1944, pp. 261-3, 349-50.
[43] David, *op. cit.* pp. 30-31.

standard grains of the ancient world, was eaten mainly in the form of gruel. The *bouille* tradition passed from millet to maize; by the early nineteenth century boiled maize pudding became a principal foodstuff in Rumania *(mamagalia),* Yugoslavia *(zgunce),* Albania and the Epirus region of Greece, and a bread substitute in the maize-growing districts of Spain, France, and Portugal.[44]

Throughout Europe, wheaten bread was a high status food while other grains and boiled foods carried the stigma of poverty. To what extent wheat was regarded as not just socially but also nutritionally superior is not at all clear. Rye bread was black and bitter, and barley bread dry and coarse. Wholemeal rye bread was especially despised. In Le Morvan, in the Nivernais region of France, it was described thus: 'trop mou, gluant les premier jours, ne tardait pas a dursir comme pierre'.[45] Wheaten bread was lighter, sweeter, more digestible but not necessarily more nutritious. Barley, indeed, was always reckoned a 'strong food'. It was the food of the ancient gladiators, the *hordearii,* or barley men. *Alphita,* a dish made from coarsely ground toasted barley, was food for the Gods, while even today, in the mountain villages of Crete, where barley bread was regularly eaten up to the Second World War, it is remembered as the only 'real' food.[46] Similar properties were claimed for oatcake and oatmeal porridge. In Germany, it was said of rye bread that, being so difficult to digest, it lasted longer in the stomach and so was a more filling food. Throughout central and eastern Europe, rye was thought to contribute more to muscular strength than wheat and was preferred by labourers at harvest time.[47] Barley bread kept for 2-3 days

[44] I am grateful to Dr. Gavin Bowie for this and other information on milling techniques.

[45] N. JASNY, *Competition Among Grains,* Stanford, 1940, pp. 35-37; J. André, *op. cit.;* Jasny (daily bread), *op. cit.* pp. 230-47, David, *op.cit. passim; Agricultural Gazette,* 8 Aug. 1863, p. 853; Collins, *loc. cit.;*P. Montagne and D. Gottschalk, *Larousse Gastronomique,* 1961, p. 622; Medvedev, *op. cit;* J. Berger, *Maize Production and the Manuring of Maize,* Geneva, 1962. A. Maurizio, *Histoire de l'alimentation vegetale...,* Paris, 1932 is still the best account of the history of grain-foods, especially *bouillées* and non-leavened breads.

[46] G. THUILLRER, 'L'alimentation en Nivernais an XIXe siecle,' in, J. J. Hemardinquer (ed), *Pour une histoire de l'alimentation, Cahiers des Annales,* 28, 1970, p. 155.

[47] Simmonds, *op. cit.* p. 95; E. S. Beaven, *Barley,* 1947, p. 8.

compared with 24-27 hours for rye-wheat bread, and 14-16 hours for pure wheaten bread made from fine flours.[48] Rye, it was claimed, possessed 'certain hygrometric properties' which made it moister than wheaten bread and fresher.[49] Short summers in Scandinavia meant that the rye had often to be threshed before it was fully ripe and, as unripe grains did not store well, they were ground and made into a form of crisp bread, 'smorgasbord', which kept for weeks or even months.[50] Maize tortillas and oat cake were also very durable. In many parts of southern Europe millet was traditionally a famine food, which could be stored for up to ten years.[51] Buckwheat, another famine grain, yielded a very fine flour, much favoured for pancakes.[52]

In the eighteenth century the view gained ground that wheat, being a light fermented foodstuff made with yeast, was the healthiest grain food, and that gruels, being unfermented, were taxing on the stomach and harmful to health. Until recent times, when the nutritional benefits of other grains and of wholemeal breads were rediscovered, medical opinion came out strongly in favour of wheat as the perfect grain and the raised loaf as the most desirable human grain food. 'Wheat', wrote Wilson in 1859, 'seems to have been given specially to man as the fittest source of supply of his daily food, the subordinate animals, companions of his daily toil, and necessary for his existence, contenting themselves, nay preferring other of the grains — barley, oats, or beans — when left to their own selection'. The other grains, he argued, if used exclusively as substitutes for wheat, 'generally derange the bodily health of the consumer'.[53] This is in contrast to earlier centuries when, within fairly broad limits, the different grains were regarded in large measure as inter-changeable, and when, about 1700, Robinson Crusoe could rejoice in 'the

[48] Taunton, *loc.cit.* p. 340.

[49] M. Rakoswska and T. Wolski, 'Prospects of rye and triticale production for human and animal nutrition in central Europe,' in, S. Rajki and A. Bruce (eds), *Round Table, Conference on Food Production, Nutrition and Health,* Budapest, 1983, p. 142.

[50] Wilson, *op. cit.* pp.184-85.

[51] Private communication. Kellogg Company of Great Britain.

[52] Braudel, *op. cit.* p.70.

[53] Simmonds, *op. cit.* pp. 234-36.

inestimable comfort' of being able to grow on his desert island a perfect barley of the European kind with which he could make bread.

Together with rising real incomes, the most important factor of change was urbanization. Wheaten bread had always been much commoner in the towns than rural areas. In Paris, in the late eighteenth century, over 80 per cent of the population ate white wheaten bread compared with 50 per cent for France as a whole, and 35 per cent in country districts. About the same time, in northern Italy, an estimated 87.5 per cent ate wheat in the city of Venice, compared with one third in rural households where rye bread or maize *polenta* was the standard. In late nineteenth century Russia, two thirds of the urban but only one third of the rural population ate wheat.[54] Not only other grains, but also other grain foods, were more widely consumed and survived longer in the countryside than in the towns. This reflects differences in real income, relative prices, and accessibility. Moreover, the towns could realise, where rural areas might not, scale economies in manufacturing and distribution. For the townsman, if he could afford it, baker's bread was an essential convenience food especially where fuel was expensive and households were without ovens. As wheaten bread quickly became stale, fresh bread had to be made once or even twice a day, thus increasing his dependence on the professional baker. Breads made from other grains, on the other hand, could be baked in large batches, once or twice a week. Urban employment generally, but especially factory work, left little time or energy for the preparation of food. Thus, working class diets became increasingly based on baker's bread. For their part, bakers preferred wheaten flour; it made a better dough and, because it absorbed and retained more water, was more economical than other flours, and thus more profitable. In the countryside, on the other hand, real incomes were lower and more families baked at home. Peasants grew their own food and wages were paid in the common grain of the locality. In many regions, the

[54] Wilson *op. cit.* I, p. 3.

poorer farmers would often sell their wheat and subsist on cheaper grains. Rural diets were rigidified by custom whereas in the towns the colour and composition of the daily loaf was much more a mark of social standing, and the demonstration effect a major force in the breaking down of traditional food habits.

In Europe today, non-wheaten foods are seldom still eaten because of lack of income, but because they have created for themselves a niche in the modern diet, as speciality or ceremonial foods, or because of strongly entrenched consumer preferences. Germans and Scandinavians are said to eat large quantities of pumpernickel, rye biscuit, and wheat-rye breads on account of their liking for the intense taste of rye and its distinctive smell. In Germany, rye is a deeply symbolic food the use of which was advocated in the 1930s on cultural and patriotic grounds. Rye, it was asserted, sustained the remnant of the population after the Thirty Years War, and was only second in importance to Moltke in the Franco-Prussian war! In World War I people were urged to return to rye on the grounds that over-reliance on wheat had softened the German constitution.[55] In southern Europe, rice was adopted in place of maize pudding. Oatmeal was reintroduced into Britain from North America as a health then a breakfast food in the later nineteenth century, and rye biscuit from Scandinavia as a slimming food in the 1920s.[56] An interest in non-wheaten grains and in breads, brown or off-white, leavened and unleavened, made from mixed and wholemeal flours, has been a feature of modern dietary in now highly fibre-conscious western Europe. At the same time, diets are becoming more international, reflected in Britain by the rising consumption of rice, pasta and popadoms,[57] and by a return to favour of the once much despised and long extinct ryebreads, from Germany and Scandinavia.

[55] J. J. HENARDINQUER, 'Note sur l'alimentation à la fin du XVIIIe siècle,' *Annales,* 23, 1968, pp. 819-22; Timeschenko, *op. cit.* pp.323-27.

[56] Rakowska and Wolski, *loc. cit.* p. 142.

[57] E. J. T. COLLINS, 'The consumer revolution and the growth of factory foods...,' in, D. J. ODDY and D. S. MILLER, *The Making of the Modern British Diet,* 1976.

IV

This paper is concerned more with the consumption that with the supply of wheat. The two are linked through the price mechanism and so can be analysed in terms of price relatives and cross-price-income elasticities of demand and substitution. On the supply side, the chief limiting factors, historically, were low yields together with the fact that large parts of Europe were environmentally better-suited to the cultivation of other grains. The great expansion of wheat-eating after 1850 was made possible by a rise in wheat output per head in Europe itself, coupled with a rise in imports. Malenbaum (Table 1) suggests that in Europe (excluding the USSR), between 1885-9 and 1934-9, total availability per head (home output plus imports) rose by about 55 per cent. By 1980, it was more than treble the pre-war figure, while the majority was fed not to humans but to livestock.

In the post-war period a declining demand in Europe has been offset by expanding demand elsewhere, in China, the Middle East, Africa, and Latin America. A recent study published in *Maize Facts and Figures* (2nd report, 1984), sets out the likely future trend in wheat consumption in these other continents. In Africa, for example, the observed income elasticity of demand for maize varied from 0.15 in west Africa to 0.35 in southern Africa, compared with 0.6 to 1.0 for wheat and 0.5 to 1.5 for rice. In Latin America, too, wheat was substantially higher while, in India, maize was negative compared with 0.3 for rice and 0.7 for wheat. A process that began in Europe in Classical times is as yet incomplete, but promises to gather pace in the developing world concomitant with urbanisation and rising real incomes, with which historically the advance of the wheaten loaf has been associated. The relative position of the different grains in the late 1960s, in terms of their contribution to total calorie consumption, is tabulated below (Table 4).

TABLE 4

PRINCIPAL FOOD GRAIN CONSUMED IN EASTERN EUROPEAN COUNTRIES
as percentage of total food-grain consumption, 1964-66, 1979-81 (per cent and kg)

A = 1964-6
B = 1979-81

	Total calorie consumpion per day	Percentage supplied by				
		Wheat	Rice	Maize	Other grains	Other starchy grains
N.Europe	3060	23.4	0.6	0.4	3.6	6.9
S. Europe	2720	40.1	2.4	2.5	1.3	6.0
E. Europe	3000	32.1	1.0	5.7	10.8	7.8
C.America & Caribbean	2240	8.8	9.4	19.2	3.8	12.7
N. Africa	2210	26.4	3.1	7.6	28.6	1.3
W.C. Africa	2460	1.2	5.7	10.0	17.2	45.3
E. Africa	2390	2.3	3.4	34.1	21.8	12.4
W. Asia	2350	48.0	4.2	4.2	4.6	1.6
E. Asia (excl.Japan)	2150	1.8	50.1	7.1	0.6	12.7
S. Asia (excl.India)	2120	19.4	47.1	1.9	3.0	1.0

Source M Milner (ed) *Protein-Enriched Cereal Foods for World Needs*, Annual Association of Cereal Chemists, St. Paul, Minnesota, 1969, p.3

A very recent development holds out the prospect of an alternative path for some low income countries hitherto dependent on imported wheat for the manufacture of bread. Scientists in the Netherlands have produced a vegetable gell, a thick starch paste, as a replacement for gluten with a view to enabling locally grown grains, such as maize, millet and sorghum, to be made into raised loaves. It remains to be seen whether the new breads gain wide acceptance or, if they do, whether they will be looked upon as temporary expedients until imported wheat becomes freely available or plant scientists succeed in developing the veritable tropical wheat.