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ECONOMICS 303Y1

The Economic History of Modern Europe to 1914

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Lecture Topic No. 30:

VII. PROBLEMS AND GROWTH IN THE BRITISH ECONOMY, 1870 - 1914

C. The Varieties of Industrial Experience: Real Incomes and the Strengths of the Old Industries

D. The Varieties of Industrial Experience: the New Industries and Industrial-Commercial Advances, 1870 - 1914: the Consumer Goods Revolution

VII. PROBLEMS AND GROWTH IN THE BRITISH ECONOMY, 1870 - 1914

C. THE VARIETIES OF ECONOMIC AND INDUSTRIAL EXPERIENCES: Real Incomes and the Strengths of the Old Industries

1. **Britain's Pre-War Economic Strengths: Continued Supremacies:**

Even in 1914, on the eve of World War I, Britain still retained industrial and economic pre-eminence in many respects, as the following statistics and crucial economic facts indicate:

a) **Per capita industrial output and per capita incomes:**

i) **As can be seen in the several tables on the screen (and the appendix):**

(1) per capita outputs and incomes still remained substantially higher in Great Britain than in Germany;

(2) 36% higher, according to Crafts and Bairoch, or anywhere else in Europe in 1914;

(3) **In 1914,** we find in comparisons with other European countries and the U.S.

- that only the US then had a higher per capita output
- and by only 10%:
- but the US did have even higher levels of real wages: see the table below

ii) **As the graphs on wages and related statistical indices also show,**

(1) real wages had risen substantially in Britain from the 1860s to World War I,

(2) and rose faster than in other European countries – though of course, to repeat, they were always behind those in the U.S. – the world's richest nation, with the highest standard of living.

(3) On the eve of World War I, the level of real wages (mean) in the US was almost 60% higher than the British level of real wages.

(4) In Western Europe, Denmark came close by 1910, but did not surpass Great Britain before 1914.

(5) Real wages in Great Britain were substantially ahead of those in Belgium and Germany, and far ahead of those in France, before World War I

(6) See Jeffrey Williamson's table on comparative real wages, 1861 - 1913[1]

Williamson: Real Wages in the US and Europe, 1861 - 1913

[1] Note that real wages are usually determined, by using index numbers, with this formula: NWI/CPI = RWI: i.e., the Nominal (Money) Wage Index divided by the Consumer Price Index = the Real Wage Index, in index numbers. Another method is to compute the number of 'baskets of consumables', whose value serves as the base for the Consumer Price Index, that can be purchased with either the daily money wage, or the annual money wage income.

100 = Real Wage Level in Great Britain in 1905

Years	Gr Britain	U.S.	Belgium	France	Germany
1861-65	61.20	87.60	50.80	45.00	56.20
1866-70	63.20	100.40	56.60	48.20	55.40
1871-75	74.00	120.60	66.00	50.60	61.60
1876-80	83.60	115.60	64.60	54.80	63.80
1881-85	88.00	129.60	71.00	59.60	66.60
1886-90	95.40	139.80	79.80	62.60	73.20
1891-95	100.00	145.00	83.00	63.60	75.60
1896-00	104.80	152.00	89.40	67.60	82.20
1901-05	100.40	163.00	85.80	71.60	83.40
1906-10	107.40	170.20	86.00	74.80	87.00
1911-13	105.00	166.67	88.67	65.33	89.00

Source: Jeffrey Williamson, 'The Evolution of Global Labor Markets Since 1830: Background Evidence and Hypotheses', *Explorations in Economic History*, 32 (1995), 141-96.

b) **The Human Development Index:** a more recent method of computing living standards and the quality of life, beyond just the question of real incomes.

i) **This index measures not only real incomes, but also educational attainments and longevity,** giving equal weights to each: (Real Income + Education + Longevity)/3

ii) **In this table**, all three measures are in terms of potential maximum attainments in 1999

iii) **This allows us not only to compare rank orders of the HDI for major countries,** in 1870, 1913, and 1999, **but also** absolute degrees of growth in the HDI since 1870.

iv) **By and large the rank order in 1870**, at least for those countries providing such data, determines roughly their rank orders in 1913 and 1999, with some exceptions (especially Argentina)

v) **Note as well that, for the top 15 countries** (with Germany and Austria at the bottom of this topmost list), the differences are really quite marginal.

Human Development Indexes for 1870, 1913, and 1999

HDI = (Education + Income + Longevity)/3

Income: based on GDP per person in 1999 PPP$ (USD in terms of purchasing power parity)

1.000 = optimum values for 1999

Country (rank order based on 1870)	**1870**	**Rank 1870**	**1913**	**Rank 1913**	**1999**	**Rank 1999**
				* tied		* tied
Australia	**0.516**	1	**0.696**	1	0.936	2*
Switzerland	0.515	2	0.643	6*	0.924	10*
Denmark	0.512	3	0.660	2	0.921	13*
USA	0.506	4	0.643	6*	0.934	6
United Kingdom	0.500	5	0.644	5	0.923	12
Canada	0.488	6	0.646	4	0.936	2*
Netherlands	0.486	7	0.649	3	0.931	7
Sweden	0.483	8	0.641	8	0.936	2*
Belgium	0.469	9	0.590	12	0.935	5
France	0.463	10	0.607	11	0.924	10*
Germany	0.463	11	0.614	10	0.921	13*
Norway	0.454	12	0.631	9	**0.939**	1
Argentina			0.511	13	0.842	18
Austria	0.331	13	0.501	14	0.921	13*
Spain	0.301	14	0.421	18	0.908	17
Italy	0.268	15	0.485	15	0.909	16
Japan	0.248	16	0.466	16	0.928	8
Finland	0.239	17	0.450	17	0.925	9
Russia			0.345	19	0.775	19
Brazil		18	0.249	20	0.750	20
India		19	0.143	21	0.571	21

Source: Nicholas Crafts, 'The Human Development Index, 1870 - 1999: Some Revised Estimates', *European Review of Economic History*, 6:3 (December 2002), 395-405.

vi) **education, economic growth, and living standards**: mass primary schooling

(1) for a less clear and less direct index of growth and prosperity, note the relatively high levels of primary schooling (ages 5-14) in Great Britain (if not Ireland), at least by the early 20th century:

(2) On the other hand, from the 1870s to 1890s, Britain did lag behind both Prussia and France, despite having higher GDP/per capita and higher real incomes,

(3) and significantly behind Canada and the US,

(4) but far ahead of those countries that were indisputably underdeveloped ('backward') in the non-NW parts of Europe and in Asia, though Japan was not that far behind.

Table 6: The Comparative Political Economy of Mass Schooling Before 1914

Elementary School Students per 1000 Children Aged 5 - 14

in 1870, 1882, 1890, 1900, and 1910

COUNTRY	1870	1882	1890	1900	1910
England-Wales	609	608	626	772	821
Scotland	698	770	803	659	729
Ireland	381	440	503	522	573
Belgium	597	481	479	592	616
Netherlands	622	620	639	654	692
France	695	816	831	859	857
Prussia	717	741	747	713	757
Switzerland	758	753	790	727	707
Austria	426	528	620	661	711
Hungary	334	436	536	542	526
Italy	307	346	389	393	452
Spain	401	517	506	475	473
Russia			99	149	
NON-EUROPEAN					
Canada	771	790	817	899	911
USA	779	800	971	954	992
Australia	621	864	730	768	762

COUNTRY	1870	1882	1890	1900	1910
Argentina		197	279	321	379
Japan	181	306	370	508	599
India		42	45	49	71

Peter Lindert, *Growing Public Social Spending and Economic Growth Since the Eighteenth Century*, 2 vols. (Cambridge and New York: Cambridge University Press, 2004), vol. I: *The Story*; vol. II: *Further Evidence*

(5) These educational indices, if imperfect, certainly do provide some indicators of what countries were more likely to enjoy economic progress in the 20th century, than others:

(6) and why, in particular, countries like Argentina, enjoying high living standards in the 19th century have fared so poorly in the 20th century.

vii) **health, longevity, and living standards:**

(1) consider now the significance of the graph, from the recent article by Richard Easterlin:[2] showing the very dramatic rise in longevity, in England and Wales, from the 1870s,

(2) very dramatic when compared to the data on life-expectancy for the previous three centuries.

(3) In some part that was due to one of the most important scientific discoveries of this very era:

- the discovery of the bacterial transmission of diseases.
- a veritable medical revolution that proved to be one of the most important for human welfare and for living standards:

(4) **The two major scientists responsible for this discovery:**

- Louis Pasteur (1822-95): who 'established that putrefaction and fermentation were caused by micro-organisms, thus providing an impetus to microbiology. In a famous experiment in 1881, he showed that sheep and cows 'vaccinated' with the attenuated bacilli of anthrax received protection against the disease' [also: 'Pasteurized' milk]
- Robert Koch (1843-1910): 'He discovered the tuberculosis bacillus (1882), and led a German expedition to Egypt and India, where he discovered the cholera bacillus (1883). In 1905, he won the Nobel Prize for Medicine & Physiology for these discoveries'.

(5) **N.B:** Before this time, and for the previous six centuries, most believed, as an article of faith, in the *miasma* theory of disease: i.e., that diseases were caused by poisonous vapours, often seen to be volcanic in

[2] Richard Easterlin, 'How Beneficent is the Market: A Look at the Modern History of Mortality', *European Review of Economic History*, 3:3 (December 1999), 262.

origin, dispersed through the atmosphere.[3]

(6) The impact of this discovery was enormous:

- especially in improvements in sanitation and cleanliness, and household management,
- in particular, proper sewage and water purification systems
- to reduce infectious contagion and the risks of contracting diseases,
- though with the added costs of so improving household (and office + factory conditions), a cost for the household largely born by the wives and mothers.[4]

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[3] For an example of this viewpoint, expressed as late as the 1860s, by one of the world's then most eminent historians, see the following explanation for the origins and nature of the Black Death, i.e., Bubonic Plague, that afflicted Europe from 1347-48: in James E. Thorold Rogers, *A History of Agriculture and Prices in England*, Vol. I: *1259 - 1400* (Oxford: Clarendon Press, 1866), pp. 292-94: 'The Black Death appears to have had its origins in the centre of China, in or about the year 1333. It is said that it was accompanied at its outbreak by various terrestrial and atmospheric phaenomena of a novel and most destructive character, phaenomena similar to those which characterized the first appearance of the Asiatic Cholera, of the Influenza, and in even more remote times of the Athenian Plague. It is a singular fact that all epidemics of an unusually destructive character have had their home in the farthest East, and have travelled slowly from those regions towards Europe....The disease still exists under the name of the Levant or Oriental Plague, and is endemic in Asia Minor, in parts of Turkey, and in Egypt. It is specifically a disease in which the blood is poisoned, in which the system seeks to relieve itself by suppuration of the glands, and in which, the tissues becoming disorganized, and the blood thereupon being infiltrated into them, dark blotches appear on the skin. Hence the earliest name by which the Plague was described [i.e., Black Death]. The storm burst on the Island of Cyprus at the end of the year 1347, and was accompanied, we are told, by remarkable physical phaenomena, as convulsions of the earth, and a total change in the atmosphere. Many persons affected died instantly. The Black Death seemed, not only to the frightened imagination of the people, but even to the more sober observation of the few men of science of the time, to move forward with measured steps from the desolated East, under the form of a dark and fetid mist. It is very likely that consequent upon the great physical convulsions which had rent the earth and preceded the disease, foreign substances of a deleterious character had been projected into the atmosphere, had permanently infected its lower regions, and could not, by the ordinary powers of dispersion possessed by the air, be easily eliminated or neutralized. We are informed, as part of a physical theory which may account for the prevalence of bronchitis accompanied by severe depression of the vital powers, that such a state may be induced by accidentally inhaling very small quantities of the vapour of selenium, and if this substance, a product of volcanic action, were dispersed in the air, that there might be, probably is, a general affection of all who are subject to its influences. Hereafter, perhaps, chemical analysis, which has already succeeded in detecting the most minute particles of inorganic substances contained in compound bodies, may be able to discover these abnormal admixtures in the air.'
Historical note: Bubonic Plague was in fact caused by the bacillus *Yersinia pestis*, discovered by the Swiss-born Alexandre Yersin (1863-1943), in Hong Kong, in 1894, with the outbreak of the Third Pandemic of this disease. Having studied at the Pasteur Institute in Paris, he founded two similar Institutes in China and developed a serum against the Plague. The First Pandemic, known as the 'Justinian Plague' [Roman Emperor, 527-65 CE], took place during the 6th, 7th, and 8th centuries; the Second, from 1348-1721 (in Western Europe; until the 1820s in eastern Europe); the Third, from 1894 to 1947.

[4] On this, see: Joel Mokyr, 'Why "More Work for Mother?" Knowledge and Household Behavior, 1870 - 1945', *Journal of Economic History*, 60:1 (March 2000), 1-41.

- Note, however, that the discovery of the nature of viruses and viral diseases came much later.[5]

iv) **Water Purification Systems:** a major consequence of this discovery of the bacterial transmission of diseases, and thus of the mortality decline:[6]

(1) One of the major means of transmitting bacterial diseases was through water systems: whether rivers, streams, or water pipes delivering water from those rives and streams

(2) For the obvious reasons: that a very major mechanism for the disposal of urban human wastes, other forms of sewage and garbage was by dumping these effluents into rivers

(3) I have seen a woodcut representation of a very telling scene in which such urban sewage is dumped upstream and a hospital downstream has a water-intake pipe for its water supply.

(4) Whoever produced that scene had absolutely no idea of its medical significance.

(5) But once Pasteur and Koch had revealed the very nature of the bacterial transmission of diseases it did not take to realize the consequences of polluting rivers and streams with sewage.

(6) Thus began, from the 1880s, in both North American and Western Europe, widespread urban water-purification and sewage disposal systems (including Toronto).

(7) As the American economic historians Louis Cain and Elcye Rotella have demonstrated, the adoption of such systems almost immediately led to dramatic declines in mortality: they were undoubtedly the single-most important mechanism for producing that morality decline.[7]

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[5] For this subject of viruses see *Answers.com,* on the internet: 'The existence of submicroscopic infectious agents was suspected by the end of the 19th century; in 1892 the Russian botanist Dimitri Iwanowski showed that the sap from tobacco plants infected with mosaic disease, even after being passed through a porcelain filter known to retain all bacteria, contained an agent that could infect other tobacco plants. In 1900 a similarly filterable agent was reported for foot-and-mouth disease of cattle. In 1935 the American virologist W. M. Stanley crystallized tobacco mosaic virus; for that work Stanley shared the 1946 Nobel Prize in Chemistry with J. H. Northrup and J. B. Summer'.

[6] According to the *Globe and Mail,* 7 March 2009, in the article 'Gandhi of the Ganges', one of the world's most seriously polluted river systems, 'water-borne illnesses are the leading cause of child death – and a world in which unsafe water and sanitation are the source of 85 percent of all disease'. The article also contends that 'one in every six people on Earth has no access to clean drinking water.' Industrial pollution may be a major cause, but fecal waste, human and animal, in the form of fecal-coliform is the major agent of disease transmission. From the Ganges itself, many tens of millions annually contract typhoid fever, polio, jaundice, cholera, dysentery, trachoma, and hepatitis, and many other noxious diseases.

[7] See in particular: Louis P. Cain and Elcye J. Rotella, 'Epidemics, Demonstration Effects, and Investment in Sanitation Capital by U.S. Cities in the Early Twentieth Century', in Joshua L. Rosenbloom, ed., *Quantitative Economic History: the Good of Counting* (London and New York: Routledge, 2008), pp. 34-53; Louis P. Cain and Elcye J. Rotella, 'Death and Spending: Urban Mortality and Municipal Expenditure on Sanitation', *Annales de démographie historique*, 101:1 (2001), 139-54. See also Michael Haines, 'The Urban Mortality Transition in the United States, 1800-1940', *Annales de démographie*

c) **British Economic and Industrial Growth, 1870 - 1914:**

i) **Britain, furthermore, still retained in 1913 her decisive world leadership in several major industries:**

(1) **in cotton textiles and in coal-mining,**

(2) and also in the maritime-based fields of shipbuilding, shipping, world trade, banking and finance.

(3) **Even in the steel industry,** as seen before, the British in following the 'law of comparative advantage' still maintained a healthy position in certain lines of quality steels (Siemens-Martin).

ii) **As we shall see next, Britain also developed many new industries of considerable importance,** especially to consumers, in the post-1870 period.

d) **The real and much more crippling blows to the British economy:**

i) **were to come only with and after World War I;**

ii) **and during the following decades of the 20th century, until the 1970s:** when Britain not only:

(1) lost her leadership in most fields but also

(2) fell behind a large number of industrial countries in per capita incomes.

(3) see the table on the screen.

2. **<u>The Question of Industrial Scale:</u>**

a) **The question of post-1870 industrial scale, and comparative industrial scales amongst countries,** became a major issue in the debate about French industrialization in the 19th century:

i) **the pessimists, or proponents of the slow-growth thesis, have focussed particularly on the Landes thesis concerning the predominance of very small scale family firms in the French industrial scale:** i.e., small scale, conservative firms, which were highly resistant to outside financing and to change.

ii) **at that time I warned you that precisely the same charges were often made, if less dramatically, about the structure of British business in the later 19th century;**

iii) **and I also expressed my doubts that:** we would really find significant differences between French and British industrial scales.

iv) **Furthermore, in an attempt to counter the influence of the negative Landes thesis on the literature concerning 19th-century French industrialization,** I provided evidence for very large scale industrial organization in some key industries: especially steel, transport, automobiles.

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historique, 101:1 (2001), 33-64; Joseph P. Ferrie and Werner Troesken, 'Water and Chicago's Mortality Transition, 1850 - 1925', *Explorations in Economic History*, 45:1 (2005), 1-16; David Cutler and Grant Miller, 'The Role of Public Health Improvements in Health Advances: the Twentieth-Century United States', *Demography*, 42:1 (2005), 1-22. Such improvement in water purification and sanitation applied chiefly to urban areas.

v) **Nevertheless, the current standard assumption for the post-1870 era is that both Germany and the United States enjoyed the advantages of significantly larger industrial scale,** in comparison with Britain and France.

vi) **You will remember the pithy observation of David Landes concerning international competition in the steel industry:** that 'the Germans put big and big together, while the British kept small and small apart'.

b) **Recently Janice Kinghorn and John Vincent Nye have published an article to challenge those assumptions concerning Britain, France, and Germany:**[8]

i) **See their table and graph on the screen:**

(1) This table indicates that, although US industry does seem to be typified by generally larger scales, industrial scales in Britain and France are by no means inferior to those in Germany, and in many surprising instances appear to be even larger.

(2) The accompanying graph, which does not include British industries, shows that the average scale of French and German industries were almost identical,

- at least for gross assets below $50 million;
- but both the French and German scales were much below the American average scale.

ii) **Unfortunately the British statistics (at least in this article):** do not permit comparisons with the other countries for establishments in the 20-plus and 50-plus ranges.

c) **In studying for the final examination, you should review the evidence to consider the factors that either promoted or retarded an increase in industrial scale in Britain:**

i) **Legislation:** the Limited Liability legislation of the 1850s, that also permitted a far lower-cost establishment of legal corporate status with limited liability rights for investors.

ii) **Cartels and the role of Free Trade:**

(1) consider, for Great Britain, whether the virtual absence of tariffs cartels hindered formation of cartels

(2) and consider also the role of Parliament and the courts in opposing cartels.

iii) **Capital markets** and the structure of banking and investment institutions

iv) **The changing nature of industrial technology.**

v) **International competition.**

3. **<u>For Analyses of the Britain's Old Industries: the Industrial Mainstays</u>**

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[8] Janice Kinghorn and John Vincent Nye, 'The Scale of Production in Western Economic Development: A Comparison of Official Industry Statistics in the United States, Britain, France, and Germany, 1905-1913,' *Journal of Economic History*, 56:1 (March 1996), p. 97.

Independent reading on:

a) The Coal Mining Industry

b) The Iron and Steel Industries (already covered)

c) Cotton Textiles

d) Shipbuilding and Shipping (already covered)

D. THE VARIETIES OF INDUSTRIAL EXPERIENCE: THE NEW INDUSTRIES AND INDUSTRIAL-COMMERCIAL ADVANCES, 1870 - 1914: THE CONSUMER GOODS REVOLUTION

1. The Production and Distribution of Consumer Goods:

a) **The Consumer Goods Sector:** and the Consumer Good Revolution:

i) **Consider first the dictum of Adam Smith, in his *Wealth of Nations*:**

(1) as chief *raison d'être* for attacking Mercantilism and promoted a liberal, laissez-faire economy:[9]

> Consumption is the sole end and purpose of all production; and the interest of the producer ought to be attended to, only so are as it may be necessary for promoting that of the consumer. The maxim is so perfectly self-evident, that it would be absurd to attempt to prove it. But in the mercantile system [Mercantilism], the interest of the consumer is almost constantly sacrificed to that of the producer; and it [Mercantilism] seems to consider production, not consumption, as the ultimate and object of all industry and commerce.

(2) In other words, we economists and economic historians must always ask this fundamental question about the processes of modern economic growth, and industrialization in particular: do they lead to human betterment, to increased human welfare, especially from the vantage point of the average consumer, not the average producer

(3) The major theme of this lecture, but of the course as a whole, is that those processes of economic growth and industrialization led to a vast improvement in both mass and individual human welfare.

(4) That is measured not only by the per capita consumption of material goods (including food stuffs) but also in human health, welfare more broadly defined, and longevity: that we are able to lead much longer, more fruitful, more beneficial and more enjoyable, less risky lives, than did our ancestors.

ii) **The Consumer Goods represents** the most important overall advance of the British industrial economy in the era from 1870 to World War I (1914).

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[9] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, ed. with an introduction and notes by Edwin Cannan (New York: the Modern Library, 1937), Book III, chapter 8, p. 625.

iii) **Note, however,** that this so-called 'Consumer Goods' Revolution did not require any really substantial capital investments, in either the production or distribution facilities.

b) **Economic Forces promoting the Consumer Goods Revolution**:

i) **There were three major economic forces to be considered:**

(1) **rising real incomes,**

(2) **increased literacy,** with improvements in mass elementary education

(3) **expanded urbanization to produce more efficient markets for mass consumption**

ii) **the sharp rise in real incomes,** as just shown on the graph, especially rises in real wages for the working classes, is the prime reason for the rapid expansion of the consumer goods industries in the post-1870 era.

iii) **The rise in real incomes was not so much from the rise in money wages as it was from the very sharp fall in the cost of living:** with the previously discussed post-1870 deflation

iv) **in particular that specifically involved these real factors:**

(1) the transportation revolution in drastically cutting shipping costs and thus import prices.

(2) Especially the drastic fall in food prices:

- because of agricultural modernization, opening up of vast new agricultural lands,
- and again, because of the transportation revolutions and the consequent steep fall in ocean freight rates (as noted earlier in the lecture on British Agriculture after 1815: no. 15)

(3) In general, the fruits of a multiplicity of technological changes that slashed production costs in so many manufactured goods – especially those of the Second Industrial Revolution:

v) **In the previous section, several tables demonstrated that the British standard of living was much higher,** in the late 19th and early 20th centuries,

(1) than in any other European country (except Denmark, by 1910, just behind Great Britain

(2) and second only to the US, in real incomes and the standard of living.

vi) **The consequence of high and rising living standards was that consumers chose to spend their increased disposable incomes on a wide range of manufactured goods**:

(1) **The major ones to mention now are:**

- sewing machines, electrically powered (but originally foot-powered),
- bicycles,
- and then much later, automobiles;
- and also later, various electrical appliances, though never on the scale of the German economy.
- machine-made boots and shoes and clothing; canned and packaged foods;
- rubber goods; plastic goods of an immense variety;

- cheap paper goods -- including books, journals, and newspapers, and commercial packaging.

(2) Note that both the bicycle and then the automobile industry provided a massive increase in demands for new materials and new products:

- rubber, above all, for inflatable tires; but also for other parts
- plastics, to be discussed, as part of yet another new chemicals industry

(3) The automotive industries, of course, had a massive impact in promoting the growth of the petroleum industries, for both;

- fuels, for propulsion (automobiles, trucks, aeroplanes, etc.)
- petroleum-based chemical products

(4) Some of these will be examined in more detail in the final sector on consumer manufacturing industries.

c) **The Revolution in Marketing Consumer Goods: the Distributive Trades (or Tertiary Sector)**: an equally important and indeed matching revolution that helped make possible the revolution in the manufacture of consumer goods:

i) **The spread of department and chain stores (originating in France)**: was the chief feature.

ii) **Such merchandising was characterized by:**

(1) the use of pre-established fixed prices (no haggling, bargaining).

(2) the standardization of products and packaging for each commodity.

(3) widespread advertizing, and advertised sales.

iii) **Such merchandising was on a very large scale, with significant savings on transaction costs**: especially with administrative overheads spread across many stores, each with large sales volumes.

iv) **Advertizing**: by newspapers and magazines was the key to that mass-merchandising, and that in turn was made possible by the development of the paper and publishing industries, to be discussed shortly.

v) **Let us now examine the successes and some failures of the new British industries,** beginning with the major failure.

2. **<u>The Electrical Industries</u>**:

The so-called 'missed chances' and an exceptional failure:

a) **electric power:**

i) **If this was a British failure, as most historians agree that it was,** that was somewhat surprising

ii) **for Britain had again been the pioneer in the development of electricity:**

(1) beginning with the famed Michael Faraday (1791-1867): especially his *Experimental Researches on Electricity* (1839-55).

(2) Britain established the world's first electric telegraph, in 1836, followed by US in 1837.

iii) **the steam turbine: Charles Parsons (1884)**

(1) Britain had been especially important in producing the key innovation for the mass production of electric power.

(2) Charles Parsons' steam turbine of 1884, as the machine critically necessary to mass produce electric power: to operate generators and dynamos (as well as screw propellers in shipping).

b) **Many other British scientists and engineers made numerous other small contributions to the development of the electrical industry:**

i) **especially including J. W. Swan,** who developed the filament from carbonised cellulose that made possible the electric light bulb.

ii) **Britain also had established the first electric power station in Europe:** at Godalming, in 1881.

c) **But Britain did not for long remain the leader in the electrical industry:**

i) **as we have already seen, it was German and American scientists and engineers,** like Siemens and Edison, who made the major advances:

ii) **the British simply failed to develop a strong and major electrical industry:** certainly not along German and American lines, until after World War I.

iii) **Britain did not even possess an integrated power grid:** i.e., for mass distribution of electric power, until 1926.

d) **Chief problem**: was the curse of cheap coal and coal-gas.

i) **So cheap was coal-fired steam power and coal-gas for urban lighting:** that there was no strong incentive to displace these with electric power.

ii) **Thus the electrical industry was denied mass urban consumption:** necessary to make large-scale electric power generation commercially feasible.

iii) **path dependency may have been a related reason**: i.e., the fact that:

(1) Britain and British cities had for so long depended on coal gas for lighting, and

(2) had heavy investments in the production and distribution of coal gas for this purpose.

3. **<u>The Chemicals Industry</u>**:

a) **The chemicals industry is usually also considered to be another 'missed chance' for Great Britain,**

i) **in failing to develop an aniline dyestuffs industry,** along the German model

ii) **in failing to switch from the costly LeBlanc process**

(1) to the new Solvay process for making alkali compounds:

(2) again, as with coal gas, having sunk much capital in the production and distribution of LeBlanc process chemical installations

(3) thus another form or aspect of path dependency.

b) **The failure to establish the necessary link between science and industry**: is usually cited as the chief reason.

i) **While there is no doubt that that link was much weaker in Britain than in Germany, this reason does not entirely wash:** because Britain in fact did make some important advances in an entirely different branch of the chemicals industry.

ii) **These advances were not in the coal-based chemicals industry but rather in the new cellulose branch:** based on wood and plant fibres -- in which Britain obviously did not have any natural resource advantage.

c) **The development of the Paper Industry**: from the 1880s

i) **The economic pressure and challenge that developed here came from three sources:**

(1) a high and strongly growing standard of living (rising real wages), as already noted

(2) and from the relatively high level of literacy – if still less than in France – and urbanization.

(3) from urbanization and rapidly growing city populations: with many more towns and cities, and more rapidly growing cities than elsewhere in Europe.

ii) **That had led to a veritable explosion of publishing from the 1870s:** in newspapers, books (penny dreadfuls), magazines, etc.

iii) **Problem to be solved: that traditional high quality paper made from linen fibres was too inelastic in supply and far too expensive to meet this exploding demand:** and so much cheaper and far more elastic paper supplies were required.

iv) **The solution was found in using lime sulphite on wood chips:**

(1) to make a pulp that could be converted into highly usable and very cheap paper.

(2) From that a major pulp and paper industry developed in Britain.

(3) But such paper has a very low life span because of its acidic content: and acid paper is the chief curse of modern-day libraries, including my own.

(4) Far inferior in quality to paper made from linen rags, but obviously far cheaper.

e) **Development of the Nitrocellulose Chemicals Industry**: **Plastics**

i) **economic pressure and challenge for innovation here was rapidly growing demand for industrial materials fairly inelastic in supply:** namely animal bone and horn (where used instead of wool or metals).

ii) **The first plastic materials to be developed were celluloid products in the 1860s:** produced from adding nitric acid and camphor to plant cellulose fibres.

iii) **Bakelite plastics were developed from 1909**:

(1) combination of formaldehyde and phenol.

(2) Although this was an American innovation, the British became the major producers.

f) **Synthetic Textiles**: **Rayons from Nitrocellulose chemicals**

i) **rayon** was another major British achievement

(1) rayon is a textile fibre produced from the cellulose contained in wood pulp (from nitrocellulose chemicals).

(2) *viscose* is the name given to the cellulose solution from which rayon is extracted.

(3) It was accidentally discovered in 1892, by scientists working for the silk-making firm of Courtaulds: who had been seeking a synthetic substitute for silks.

(4) Instead, it proved exceptionally popular as a cheap substitute for cottons.

(5) According to the *Cambridge Encyclopedia*, 'improvements in manufacturing methods have made modern rayon fibres important as domestic and industrial materials'.

ii) **By 1920,** Courtaulds was producing 50% of the world output of rayon.

g) **Conclusion:**

i) **By the 1920s, the British chemicals industry,** with a leading role in cellulose-based chemicals, had become a very important industry;

ii) **It was led by the giant amalgamated firm of Imperial Chemicals Industries Ltd. (ICI),** which divided up world markets with I.G. Farbenindustrie (Germany) and DuPont (official name: E. I. du Pont de Nemours and Co: United States)[10]

4. **<u>Internal Combustion</u>**: **<u>the Automobile Industry</u>**

a) **The European Innovators:**

i) **Here France and Germany had led, in pre-war Europe,** in achieving the major scientific, technical, and industrial advances.

ii) **The British, however, did at least develop an automobile industry before World War I**: and did so in a rather curious fashion:

b) **The Curious Evolution of the British Automobile Industry:** from sewing machines

i) **the sewing machine industry**:

(1) provides the origins: as itself a major consumers goods industry.

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[10] See the Appendix for both of these chemical companies; and for I. G. Farbenindustie, see the lecture on Germany industry.

(2) Based in Coventry (Midlands), the sewing machine industry was experiencing slack times during the 1870, from overproductions, and market recessions

(3) then many factories decided to build bicycles, which had become popular in France from the 1850s.

ii) **the bicycle industry:**

(1) British doctors were now recommending bicycles for physical fitness, for lazy, sedentary city dwellers.

(2) From the later 1870s, Coventry rose to world leadership in bicycle making, while the bicycle industry also spread elsewhere in England.

(3) Importance of the bicycle for the later automobile industry: in creating a demand for personal transport.

iii) **From the 1890s:** the Coventry bicycle industry then shifted into making automobiles, which involved similar engineering and assembly skills.

c) **The Pre-War British Automobile Industry:** From 1896 to 1914, almost 200 separate automobile companies were established in Britain, with the chief centre at Coventry.

i) **But this indicates that the parallel with the bicycle industry was in that respect harmful:**

(1) it was similarly small-scale, labour intensive,

(2) most were custom building cars – a very costly and thus expensive process

(3) and far too much so, when other countries were developing larger-scale, more mass production techniques.

(4) Remember the key significance of the Ford Motor Company: mass production using assembly line techniques

ii) **So in automobile production, the British were quite far behind the Germans and the French,** not to mention the Americans, before World War I.

d) **The Post-War (WW I) Industry:** after 1918

i) **During World War I**, the British were forced to adopt assembly-line mass production techniques to produce massive numbers of armoured cars and tanks

ii) **By the 1930s, Britain would rise to second place in world production of automobiles,** second only to the US;

iii) **and by that time of course the British had fully rationalized the industry,** with large scale firms using mass-production assembly-line techniques (in the Oxford-Coventry region).

e) **Real importance of the automobile industry**:

i) **of course lies in the 20th century,** when it would have as big an impact on industrialization and economic development as railways in the 19th century:

ii) **i.e., in terms of backward and forward linkages in the economy:** steel, electrical, glass, plastics,

rubber, petroleum; impact on urban development, highways, etc.[11]

5. **Conclusions:**

a) **For one conclusion, let us consider some observations by W.A. Lewis,** from his book on the British economy, *Growth and Fluctuations* (1978), concerning the significance of industrial innovations in post-1870 period:

i) '**The essence of the industrial and agricultural revolutions in the first three-quarters of the nineteenth century was in new ways of doing old things:** of making iron, textiles, and clothes, of growing cereals, and of transporting goods and services.

ii) '**Thus a rich man in 1870 did not possess anything that a rich man of 1770 had not possessed; he might have more or larger houses,** more clothes, more pictures, more horses and carriages, or more furniture than say a school teacher possessed, but as likely as not, his riches were displayed in the number of servants whom he employed rather than in his personal use of automobiles'.

iii) **[But] In the last quarter of the nineteenth century the revolution added a new twist** -- t**hat of making new commodities**: telephones, gramophones, typewriters, cameras, automobiles, and so on, a seemingly endless process whose latest twentieth-century additions include aeroplanes, radios, refrigerators, washing machines, television sets and pleasure boats'.

iv**) Lewis has obviously omitted various consumer durables already important in his day, such as stereo equipment**

(1) since then, i.e., since 1978, we could add in particular:

- micro-wave ovens, personal computers, printers, scanners, and then the internet,
- fax machines, cellular telephones, PDAs (personal digital assistants, such as Palm Pilots, the Blackberry, and I-Phones, etc.),
- for music: CDs, VCRs, DVD players, and now the I-Pod, I-Pad, and related devices (MP3 players, etc;)
- and various other forms of electronic equipment (including of course HD TV; and for music, SACD);
- and also: digital cameras (which some graduate students and colleagues use in the archives).

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[11] Note this information from Statistics Canada, on the web (5 April 2000):
Of every $100 of retail spending in 1999, Canadians purchased $35.70 worth of motor vehicles and related parts and services, $19.50 worth of food and non-alcoholic beverages, and $9.70 worth of clothing, accessories and footwear. The fourth largest category was home furnishings and electronics, which in 1999 took $7.60 of every $100 consumers spent at retail stores. Alcohol and tobacco took $5.70, and prescription and over-the-counter drugs accounted for $4.10, outpacing the $3.80 spent on sporting and leisure goods. http://www.statcan.ca/Daily/English/000405/d000405.pdf. For a more recent study, in tabular form, for the years 2003 - 2005, see Table 8.

(2) Which of these is more of a curse than a benefit?

- I would place cellular telephones at the topic of this negative category (followed, perhaps, by fax machines that deliver unwanted messages).
- But most people would disagree with me, contending that cellular or mobile phones are vital to their businesses and lifestyle
- especially important for building contractors, but also real estate agents, other salesmen, and perhaps most businessmen in general.
- Finland reputedly has the world's highest per capita use of cellular phones.

b) **Costs and Benefits of Modern Industrialization and Economic Growth** [12]

i) **Unquestionably the modern Industrial Revolution, beginning in Great Britain in the mid 18th century,** has produced a truly phenomenal and completely unanticipated increase in real incomes and in all other measures of rises in standards of living, from the lowest levels of the working classes

ii) **And it has led as well to equally phenomenal fall in mortality,** which is obviously part and parcel of that unprecedented and truly revolutionary rise in living standards, in all industrialized regions of the world (though varying considerably amongst) them.

iii) **And thus, as indicated in the beginning of the course, the Industrial Revolution marked and produced a true watershed in human history,** by which the Malthusian trap was forever broken, so that industrialized societies have enjoyed both these unprecedented rises in both population growth and in per capita growth, with all the adduced evidence for continually rising living standards (if not so much in the past 20 years)

c) **What is the downside of this phenomenon? Global Warming:**

i) **for if the essence of modern industrialization has been the use of fossil fuels** — coal from the 18th century and petroleum from the late 19th century.[13]

ii) **then those carbon-based emissions have not just been a major source of environmental pollution,** but more so of global warming, with the Green House gas effects.

(1) the evidence for global warming is now so overwhelming it would be difficult to dispute it (though right-

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[12] This concluding part of this lecture, and thus of the course, was given for the first time only a few years ago (in April 2008). Perhaps I had previously been reluctant to offer these opinions; but now I all the more convinced of their validity and of my educational duty to express them. You need not, however, necessarily agree with them.

[13] For the most recent contribution to the debate about energy, especially coal-produced energy, and the Industrial Revolution, see: E. Anthony Wrigley, *Energy and the English Industrial Revolution* (Cambridge and New York: Cambridge University Press, 2010).

wing organizations certainly do so, and not just oil companies)

(2) what the solutions are difficult to say – apart from drastic reductions in living standards

(3) but without such adequate solutions, the future may be more grim than we had anticipated.

(4) as one student remarked to me after class, perhaps we have not abolished the Malthusian trap, that of overpopulation, but merely postponed its consequences

- obviously demographic growth has been and will always be a problem: in increasing the consumption of goods whose production requires ever greater amount of expenditures of fossil-based fuels —
- unless we are willing to experiment more with alternative fuels, including nuclear energy, despite its own inherent risks and costs

d) **Growing inequalities of wealth and income:**

i) **For most of this course, except for the actual period of the initial Industrial Revolution (i.e., ca 1780 to ca. 1820), the major theme has been mankind's escape from the Malthusian Trap** – i.e., from the threat of overpopulation leading to mass impoverishment:

ii) **from the 1820s, Great Britain, and then much of western Europe was able to enjoy an unprecedented growth in both population and per capita real incomes:** undreamt in past millennia.

iii) **That also involved, generally, an improvement in the Lorenz curve:**[14] i.e., a reduction in the gap indicating inequalities in wealth and income, and what appeared to be a fulfilment of the Kuznets curve (introduced in the first lecture of this course).

iv) **Such a remarkable improvement in both real incomes and in income equalities (or reductions in the degree of inequality):** was also true for much of the twentieth century: until perhaps the 1970s

v) **Since then, however, much of the world, especially the western world, has experienced a reversal of those trends:** and a seeming negation of the Kuznets curve.[15]

vi) **Two Nobel-prize winning American economists recently concerned with this problem (which also concerns me):** are Joseph Stiglitz and Paul Krugman.

See: my website for 'Economists' Opinions':

http://www.economics.utoronto.ca/munro5/EconomistOpinions.htm

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[14] Answers.com: A graph for showing the concentration of ownership of economic quantities such as wealth and income; it is formed by plotting the cumulative distribution of the amount of the variable concerned against the cumulative frequency distribution of the individuals possessing the amount. Read more: http://www.answers.com/topic/lorenz-curve#ixzz2PLC7vPBI

[15] See the first lecture in this course.

Table 1. **Per Capita Product in Selected European countries, 1850 - 1910: Measured in Constant 1970 US Dollars**

COUNTRY	1850	1870	1890	1910	Percent-age Total Growth 1850-1910
BRITAIN	660	904	1,130	1,302	197%
FRANCE	432	567	668	883	204%
GERMANY	418	579	729	958	229%
BELGIUM	534	738	932	1,110	208%
NETHER-LANDS	481	591	768	952	198%

Source: Nicholas Crafts, 'Gross National Product in Europe, 1870 - 1910: Some New Estimates,' *Explorations in Economic History*, 20 (October 1983), 387-401.

Table 2. **Aggregate and Per Capita Indices of Industrial Production (United Kingdom in 1900 = 100)**

and percentage shares of world industrial production, for various countries: in 1860 and 1913

Country	Total Industrial Output		Per Capita Industrial Output		Percentage Shares of World Industrial Production	
With 1913 Frontiers	**1860 Index**	**1913 Index**	**1860 Index**	**1913 Index**	**1860 %**	**1913 %**
United Kingdom*	45	127	64	115	20%	14%
Germany	11	138	15	85	5%	15%
France	18	57	20	59	8%	6%
Russia	16	77	8	20	7%	8%
ALL EUROPE	**120**	**528**	**17**	**45**	**53%**	**57%**
United States	16	298	21	126	7%	32%
Canada	1	9	7	46	--	1%

Source: Paul Bairoch, 'International Industrialization Levels from 1760 to 1980,' *Journal of European Economic History*, 11 (Fall 1982), 269-333, tables 4 - 13.

* The United Kingdom of Great Britain and Ireland: the values for its aggregate and per capita industrial outputs for 1900 are taken as the base 100 for all the indices in columns 1 to 4. Note that columns 5 and 6 are percentages of total world industrial output.

Table 3.

Williamson: Real Wages in the US and Europe, 1861 - 1913

100 = Real Wages in Great Britain in 1905

Years	Gr Britain	U.S.	Belgium	France	Germany
1861-65	61.20	87.60	50.80	45.00	56.20
1866-70	63.20	100.40	56.60	48.20	55.40
1871-75	74.00	120.60	66.00	50.60	61.60
1876-80	83.60	115.60	64.60	54.80	63.80
1881-85	88.00	129.60	71.00	59.60	66.60
1886-90	95.40	139.80	79.80	62.60	73.20
1891-95	100.00	145.00	83.00	63.60	75.60
1896-00	104.80	152.00	89.40	67.60	82.20
1901-05	100.40	163.00	85.80	71.60	83.40
1906-10	107.40	170.20	86.00	74.80	87.00
1911-13	105.00	166.67	88.67	65.33	89.00

Source: Jeffrey Williamson, 'The Evolution of Global Labor Markets Since 1830: Background Evidence and Hypotheses', *Explorations in Economic History*, 32 (1995), 141-96.

Table 4. **Indices of Relative GDP per capita, compared to US GDP per capita (1.000) for each year of the series**

Country	1820	1830	1840	1850	1860	1870	1880	1890	1900	1913	1929	1938
United Kingdom	0.965	1.004	0.975	1.000	0.971	1.004	0.903	0.915	0.917	**0.847**	0.774	0.898
France	0.713	0.784	0.790	0.781	0.821	0.809	0.753	0.784	0.768	**0.770**	0.605	0.623
Nether-lands	0.800	0.768	0.814	0.791	0.766	0.787	0.708	0.735	0.715	**0.668**	0.594	0.704
Belgium			0.749	0.742	0.792	0.836	0.793	0.791	0.772	**0.743**	0.560	0.698
Germany				0.609	0.681	0.679	0.620	0.738	0.753	**0.742**	0.607	0.811
Austria		0.551	0.554	0.541	0.518	0.575	0.523	0.543	0.531	**0.532**	0.504	0.570
Denmark	0.513	0.584	0.616	0.661	0.626	0.659	0.618	0.644	0.668	**0.667**	0.662	0.741
Switzerland							0.687	0.726	0.741	**0.726**	0.674	0.761
Italy					0.641	0.589	0.535	0.525	0.512	**0.526**	0.472	0.529
Spain				0.638	0.638	0.554	0.564	0.567	0.521	**0.511**	0.463	0.331
Russia							0.410	0.445	0.452	**0.451**		
Australia	1.022	1.174	1.370	1.096	1.304	1.130	1.049	1.085	0.976	**0.976**	0.860	0.924
Canada				0.827	0.834	0.828	0.740	0.809	0.853	**0.968**	0.900	0.914
Japan							0.265	0.307	0.335	**0.375**	0.412	0.440
Argentina							0.734	0.782	0.762	**0.813**	0.648	0.558

Source: Leandro Prados de la Escosura, 'International Comparisons of Real Product, 1820 - 1990: An Alternative Data Set', *Explorations in Economic History*, 37:1 (January 2000), 1-41.

Table 5 **Human Development Indexes for 1870, 1913, and 1999**

HDI = (Education + Income + Longevity)/3

Income: based on GDP per person in 1999 PPP$ (USD in terms of purchasing power parity)

Country (rank order based on 1870)	**1870**	**Rank 1870**	**1913**	**Rank 1913**	**1999**	**Rank 1999**
				* tied		* tied
Australia	**0.516**	1	**0.696**	1	0.936	*2
Switzerland	0.515	2	0.643	*6	0.924	*10
Denmark	0.512	3	0.660	2	0.921	*13
USA	0.506	4	0.643	*6	0.934	6
United Kingdom	0.500	5	0.644	5	0.923	12
Canada	0.488	6	0.646	4	0.936	* 2
Netherlands	0.486	7	0.649	3	0.931	7
Sweden	0.483	8	0.641	8	0.936	*2
Belgium	0.469	9	0.590	12	0.935	5
France	0.463	10	0.607	11	0.924	*10
Germany	0.463	11	0.614	10	0.921	*13
Norway	0.454	12	0.631	9	**0.939**	1
Argentina			0.511	13	0.842	18
Austria	0.331	13	0.501	14	0.921	*13
Spain	0.301	14	0.421	18	0.908	17
Italy	0.268	15	0.485	15	0.909	16
Japan	0.248	16	0.466	16	0.928	8
Finland	0.239	17	0.450	17	0.925	9
Russia			0.345	19	0.775	19
Brazil		18	0.249	20	0.750	20
India		19	0.143	21	0.571	21

Source: Nicholas Crafts, 'The Human Development Index, 1870 - 1999: Some Revised Estimates', *European Review of Economic History*, 6:3 (December 2002), 395-405.

Table 6: The Comparative Political Economy of Mass Schooling Before 1914

Elementary School Students per 1000 Children Aged 5 - 14

in 1870, 1882, 1890, 1900, and 1910

COUNTRY	1870	1882	1890	1900	1910
England-Wales	609	608	626	772	821
Scotland	698	770	803	659	729
Ireland	381	440	503	522	573
Belgium	597	481	479	592	616
Netherlands	622	620	639	654	692
France	695	816	831	859	857
Prussia	717	741	747	713	757
Switzerland	758	753	790	727	707
Austria	426	528	620	661	711
Hungary	334	436	536	542	526
Italy	307	346	389	393	452
Spain	401	517	506	475	473
Russia			99	149	
NON-EUROPEAN					
Canada	771	790	817	899	911
USA	779	800	971	954	992
Australia	621	864	730	768	762
Argentina		197	279	321	379
Japan	181	306	370	508	599
India		42	45	49	71

Peter Lindert, University of California at Davis: paper presented to the Economic History Workshop, University of Toronto, March 2000.

Table 7: Demographic Data for Contemporary Countries in Europe, North and South America, and Eastern Asia-Pacific

Country	Population in millions	Birth Rate per 1000	Death Rate per 1000	Infant Mortality	Life Expectancy Total	Life Expectancy Males	Life Expectancy Females
Canada	32.90	11	7	5.30	80	78	83
U. S. A.	302.20	14	8	6.50	78	75	80
Argentina	39.40	19	8	14.40	75	71	79
Cuba	11.20	11	8	6.20	77	75	79
U.K.	61.00	12	10	4.90	79	77	81
Belgium	10.60	11	10	4.40	79	76	82
Netherlands	16.40	11	8	4.40	80	78	82
France	61.70	13	9	3.70	81	77	84
Germany	82.30	8	10	3.80	79	76	82
Switzerland	7.50	10	8	4.20	81	79	84
Norway	4.70	13	9	3.20	80	78	83
Sweden	9.10	12	10	2.80	81	79	83
Italy	59.30	10	9	3.70	81	78	84
Spain	45.30	11	8	3.80	80	77	83
Russia	141.7	10	15	10.00	65	59	72
Japan	127.7	9	9	2.80	82	79	86
China	1318.0	12	7?	27.00	72	71	74
Taiwan	22.9	9	6	5.00	77	74	80
Australia	21.0	13	6	5.00	81	79	83

Source: *2007 World Population Data Sheet* (Population Reference Bureau): http://www.prb.org/

Table 8. Establishment Size Measures within Manufacturing Industries in France, Germany, the United States, and Great Britain, 1905-1913

Industrial Firm	FRANCE	GERMANY	US	BRITAIN
A. Average number of workers per establishment				
Textiles	8	3	73	78
Paper & Printing	20	11	15	20
Lumber	4	4	25	15
Leather	5	4	58	31
Iron & Steel	712	265	535	247
Food	4	3	8	13
Ceramics	18	21	29	42
Chemicals	24	16	25	42
B. Average number of workers in establishments employing more than 50 workers				
Textiles	198	161	199	
Paper & Printing	163	132	162	
Lumber	110	105	108	
Leather	136	132	178	
Iron & Steel	825	433	576	
Food	144	135	123	
Ceramics	190	144	112	
Chemicals	183	209	138	

Industrial Firm	FRANCE	GERMANY	US	BRITAIN
C. Percentage of workers employed in industrial establishments with more than 50 workers				
Textiles	46	38	93	
Paper & Printing	57	51	67	
Lumber	13	22	81	
Leather	27	25	90	
Iron & Steel	100	98	99	
Food	8	13	67	
Ceramics	63	55	85	
Chemicals	64	70	85	

Source:

Janice Rye Kinghorn and John Vincent Nye, 'The Scale of Production in Western Economic Development: A Comparison of Official Industry Statistics in the United States, Britain, France, and Germany, 1905-1913', *Journal of Economic History*, 56:1 (March 1996), 90-112.

Table 9.

CONSUMER EXPENDITURES IN CANADA, 2003 - 2005

Annual sales by commodity, all retail stores COMMODITY	2003 $ millions	2004	2005	percent shares in 2005	2003 to 2004 percentage change	2004 to 2005 percentage change
Food and beverages	73,284	76,869	81,071	**21.96%**	4.90	5.50
Health and personal care products	27,154	29,283	30,815	**8.35%**	7.80	5.20
Clothing, footwear and accessories	28,156	29,206	30,360	**8.22%**	3.70	4.00
Furniture, home furnishings and electronics	29,874	31,605	33,325	**9.03%**	5.80	5.40
Motor vehicles, parts and services	76,271	76,599	80,784	**21.88%**	0.40	5.50
Automotive fuels, oils and additives	25,325	29,016	34,164	**9.25%**	14.60	17.70
Housewares	7,039	7,287	7,503	**2.03%**	3.50	3.00
Hardware, lawn and garden products	20,998	23,189	25,190	**6.82%**	10.40	8.60
Sporting and leisure goods	12,038	12,292	12,830	**3.48%**	2.10	4.40
All other goods and services	31,889	32,357	33,133	**8.97%**	1.50	2.40
TOTAL	332,027	347,704	369,175	**100.00%**	4.70	6.20

Source: http://www.statcan.gr.ca/Daily/English/060411 (11 April 2006).

Table 10:

June 2008 **CANADA: CONSUMER PRICE INDEX AND RELATIVE IMPORTANCE OF THE MAJOR COMPONENTS**

February 2009

		Index: 2002 = 100				
	Percentage share of the components	June 2007	June 2008	June 2007 to June 2008 per cent change	Feb 2009	June 2008 to Feb 2009 per cent change
All-items	**100.00**	**111.90**	**115.40**	**3.13%**	**113.80**	**-1.39%**
Food	17.04	112.60	115.80	2.84%	121.20	4.66%
Alcoholic beverages and tobacco products	3.07	125.70	127.70	1.59%	129.20	1.17%
Shelter	26.62	116.80	122.30	4.71%	123.20	0.74%
Household operations and furnishings	11.10	103.00	104.30	1.26%	106.40	2.01%
Clothing and footwear	5.36	93.10	92.50	-0.64%	93.60	1.19%
Transportation	19.88	119.20	125.80	5.54%	110.20	-12.40%
Health and personal care	4.73	107.90	108.70	0.74%	110.40	1.56%

	Percentage share of the components	June 2007	June 2008	June 2007 to June 2008 per cent change	Feb 2009	June 2008 to Feb 2009 per cent change
Recreation, education and reading	12.20	102.50	102.90	0.39%	101.10	-1.75%
All-items (1992=100)	**100.00**	**133.20**	**137.30**	3.08%	**135.40**	-1.38%

Source: Statistics Canada: http://www.statcan.gc.ca/

Note: in the Consumer Price Indexes used for England and the Low Countries, in the later-medieval and early-modern eras, up to the 18th century, foodstuffs – grains, meat, fish, drink – constitute an 80% weighting of the total index, compared to just 20% in this Canadian CPI.

Keep in mind that alcoholic products were, before the late 19th century, more of a necessity than a luxury: to provide bacteria-free beverages, or those known to be safe, when water and milk were so dangerous – before Koch's and Pasteur's discovery of the bacterial transmission of diseases, most of which were water-borne.

Dupont

E. I. du Pont de Nemours and Company (NYSE: DD), commonly referred to as DuPont, is an American chemical company that was founded in July 1802 as a gunpowder mill by Eleuthère Irénée du Pont.
DuPont was the world's third largest chemical company based on market capitalization and ninth based on revenue in 2009. Its stock price is a component of the Dow Jones Industrial Average.

Establishment: 1802.

DuPont was founded in 1802 by Eleuthère Irénée du Pont, using capital raised in France and gunpowder machinery imported from France. The company was started at the Eleutherian Mills, on the Brandywine Creek, near Wilmington, Delaware two years after his family and he left France to escape the French Revolution. It began as a manufacturer of gunpowder, as du Pont noticed that the industry in North America was lagging behind Europe. The company grew quickly, and by the mid 19th century had become the largest supplier of gunpowder to the United States military, supplying half the powder used by the Union Army during the American Civil War. The Eleutherian Mills site was declared a National Historic Landmark in 1966 and is now a museum.

Expansion: 1902 to 1912

DuPont continued to expand, moving into the production of dynamite and smokeless powder. In 1902, DuPont's president, Eugene du Pont, died, and the surviving partners sold the company to three great-grandsons of the original founder. The company subsequently purchased several smaller chemical companies, and in 1912 these actions gave rise to government scrutiny under the Sherman Antitrust Act. The courts declared that the company's dominance of the explosives business constituted a monopoly and ordered divestment. The court ruling resulted in the creation of the Hercules Powder Company (now Hercules Inc.) and the Atlas Powder Company (purchased by Imperial Chemical Industries (ICI) and now part of AkzoNobel).[3] At the time of divestment, DuPont retained the single base nitrocellulose powders, while Hercules held the double base powders combining nitrocellulose and nitroglycerine. DuPont subsequently developed the Improved Military Rifle (IMR) line of smokeless powders.[4]
In 1910, DuPont published a brochure entitled "Farming with Dynamite". The pamphlet was instructional, outlining the benefits to using their dynamite products on stumps and various other obstacles that would be easier to detonate with dynamite as opposed to other more conventional, inefficient means.[5]

DuPont also established two of the first industrial laboratories in the United States, where they began the work on cellulose chemistry, lacquers and other non-explosive products. DuPont Central Research was established at the DuPont Experimental Station, across the Brandywine Creek from the original powder mills.
Automotive investments: 1914

In 1914, Pierre S. du Pont invested in the fledgling automobile industry, buying stock of General Motors (GM). The following year he was invited to sit on GM's board of directors and would eventually be appointed the company's chairman. The DuPont company would assist the struggling automobile company further with a $25 million purchase of GM stock. In 1920, Pierre S. du Pont was elected president of General Motors. Under du Pont's guidance, GM became the number one automobile company in the world. However, in 1957, because of DuPont's influence within GM, further action under the Clayton Antitrust Act forced DuPont to divest itself of its shares of General Motors.

Major breakthroughs: 1920s-1930s

In the 1920s DuPont continued its emphasis on materials science, hiring Wallace Carothers to work on polymers in 1928. Carothers discovered neoprene, the first synthetic rubber; the first polyester superpolymer; and, in 1935, nylon. The discovery of Teflon followed a few years later. DuPont introduced phenothiazine as an insecticide in 1935.

Second World War: 1941 to 1945

Throughout this period, the company continued to be a major producer of war supplies. As the inventor and manufacturer of nylon, DuPont helped produce the raw materials for parachutes, powder bags,[6] and tires.[7]

DuPont also played a major role in the Manhattan Project in 1943, designing, building and operating the Hanford plutonium producing plant in Hanford, Washington. In 1950 DuPont also agreed to build the Savannah River Plant in South Carolina as part of the effort to create a hydrogen bomb.

Space Age developments: 1950 to 1970

After the war, DuPont continued its emphasis on new materials, developing Mylar, Dacron, Orlon, and Lycra in the 1950s, and Tyvek, Nomex, Qiana, Corfam, and Corian in the 1960s. DuPont materials were critical to the success of the Apollo Project of the United States space program.

DuPont has been the key company behind the development of modern body armor. In the Second World War DuPont's ballistic nylon was used by Britain's Royal Air Force to make flak jackets. With the development of Kevlar in the 1960s, DuPont began tests to see if it could resist a lead bullet. This research would ultimately lead to the bullet resistant vests that are the mainstay of police and military units in the industrialized world.

Conoco holdings: 1981 to 1995

In 1981, DuPont acquired Conoco Inc., a major American oil and gas producing company that gave it a secure source of petroleum feedstocks needed for the manufacturing of many of its fiber and plastics products. The acquisition, which made DuPont one of the top ten U.S.-based petroleum and natural gas producers and refiners, came about after a bidding war with the giant distillery Seagram Company Ltd., which would become DuPont's largest single shareholder with four seats on the board of directors. On April 6, 1995, after being approached by Seagram Chief Executive Officer Edgar Bronfman, Jr., DuPont announced a deal whereby the company would buy back all the shares owned by Seagram.

Divestiture: 1999

In 1999, DuPont sold all of its shares of Conoco, which merged with Phillips Petroleum Company.

DuPont describes itself as a global science company that employs more than 60,000 people worldwide and has a diverse array of product offerings.[9] In 2005, the Company ranked 66th in the Fortune 500 on the strength of nearly $28 billion in revenues and $1.8 billion in profits.[10]

DuPont businesses are organized into the following five categories, known as marketing "platforms": Electronic and Communication Technologies, Performance Materials, Coatings and Color Technologies, Safety and Protection, and Agriculture and Nutrition.

The agriculture division, Dupont Pioneer makes and sells hybrid seed and genetically modified seed, some of which goes on to become genetically modified food. Genes engineered into their products include the LibertyLink gene, which provides resistance to Bayer's Ignite/Liberty herbicides; the Herculex I Insect Protection gene which provides protection against various insects; the Herculex RW insect protection trait which provides protection against other insects; the YieldGard Corn Borer gene, which provides resistance to another set of insects; and the Roundup Ready Corn 2 trait that provides crop resistance against glyphosate herbicides.[11] In 2010 Dupont Pioneer received approval to start marketing Plenish soybeans, which contains "the highest oleic acid content of any commercial soybean product, at more than 75%. Plenish provides a product with no trans fat, 20% less saturated fat than regular soybean oil, and more stabile oil with greater flexibility in food and industrial applications."[12] Plenish is genetically engineered to "block the formation of enzymes that continue the cascade downstream from oleic acid (that produces saturated fats), resulting in an accumulation of the desirable monounsaturated acid."[13]

In 2004 the company sold its textiles business, which included some of its best-known brands such as Lycra (Spandex), Dacron polyester, Orlon acrylic, Antron nylon and Thermolite, to Koch Industries. DuPont also manufactures Surlyn, which is used for the covers of golf balls, and, more recently, the body panels of the Club Car

Precedent golf cart.

As of 2011, DuPont is the largest producer of titanium dioxide in the world, primarily provided as a white pigment used in the paper industry.[14]

DuPont was listed No. 4 on the Mother Jones Top 20 polluters of 2010; dumping over 5,000,000 pounds of toxic chemicals into New Jersey/Delaware waterways.[15]

DuPont has its R&D facilities located in China, Japan, Taiwan, India, Germany, and Switzerland with an average investment of $1.3 billion annually in a diverse range of technologies for many markets including agriculture, genetic traits, biofuels, automotive, construction, electronics, chemicals, and industrial materials. DuPont employs more than 5,000 scientists and engineers around the world.[16]

Imperial Chemical Industries

From Wikipedia, the free encyclopedia

Imperial Chemical Industries (ICI) was a British chemical company, taken over by a number of chemical companies, including Huntsman Corporation, a United States-based company, and AkzoNobel, a Dutch conglomerate, two of the largest chemical producers in the world. In its heyday, ICI was the largest manufacturing company in the British Empire, and commonly regarded as a "bellwether of the British economy".[1] It produced paints and speciality products (including ingredients for foods, speciality polymers, electronic materials, fragrances and flavours). It employed around 29,000 people and had a turnover of just over £4.8 billion in 2006. The company was independent from 1926 to 2008, headquartered for most of that time in Millbank, London, and was a constituent of the FT30 Index and FTSE 100 Index. After the January 2008 change of ownership, AkzoNobel fully integrated ICI's operations within its existing organisation.[2][3][4]
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History

Development of the business

The company was founded in December 1926 from the merger of four companies: Brunner Mond, Nobel Explosives, the United Alkali Company, and British Dyestuffs Corporation.[5] It established its head office at Millbank in London in 1928.[5]

Competing with DuPont and IG Farben, the new company produced chemicals, explosives, fertilisers, insecticides, dyestuffs, non-ferrous metals, and paints.[5] In its first year turnover was £27 million.[5]

In the 1920s and '30s the company played a key role in the development of new chemical products, including the dyestuff phthalocyanine (1929), the acrylic plastic Perspex (1932),[5] Dulux paints (1932, co-developed with DuPont),[5] polyethylene (1937)[5] and polyethylene terephthalate fibre known as Terylene (1941).[5]

ICI also owned the Sunbeam motorcycle business, which had come with Nobel Industries, and continued to build motorcycles until 1937.[6]

In the 1940s and '50s the company established its pharmaceutical business and developed a number of key products including Paludrine (1940s, an anti-malarial drug),[5] halothane (1951, an anaesthetic agent), Inderal (1965, a beta-blocker),[5] Tamoxifen (1978, a frequently used drug for breast cancer),[7] and PEEK (1979, a high performance thermoplastic).[5] ICI formed ICI Pharmaceuticals in 1957.

ICI developed a fabric in the 1950s known as Crimplene. Crimplene is a thick polyester yarn used to make a fabric of the same name. The resulting cloth is heavy, wrinkle-resistant and retains its shape well. The California-based fashion designer Edith Flagg was the first to import this fabric from Britain to the USA. During the first two years, ICI gave Flagg a large advertising budget to popularise the fabric across America.

Early pesticide development included Gramoxone (1962, a herbicide),[5] the insecticides pirimiphos-methyl in 1967 and pirimicarb in 1970, brodifacoum (a rodenticide) was developed in 1974; in the late 1970s, ICI was involved in the early development of synthetic pyrethroid insecticides such as lambda-cyhalothrin.

ICI was confronted with the nationalisation of its operations in Burma on 1 August 1962 as a consequence of the military coup.[8] The company acquired Atlas Chemical Industries Inc., a major US competitor, in 1971.[5]

During the 1980s (from 1982 to 1987,) the company was led by the charismatic John Harvey Jones.[9] Under his

leadership the company acquired the Beatrice Chemical Division in 1985 and Glidden Coatings & Resins, a leading paints business in 1986.[10]

From 1991 to 2007: reorganisation of the business

In 1991 ICI sold the agricultural and merchandising operations of BritAg and Scottish Agricultural Industries to Norsk Hydro.[11]

In 1991, the company successfully fought off a hostile takeover bid from the Hanson plc conglomerate.[12] It also divested its soda ash products arm to Brunner Mond. This ended an association with the trade which had existed from the company's inception, inherited from the original Brunner, Mond & Co. Ltd.

In 1993, the company demerged its pharmaceutical bioscience businesses: pharmaceuticals, agrochemicals, specialities, seeds and biological products were all transferred into a new and independent company called Zeneca Group, which subsequently merged with Astra AB to form AstraZeneca PLC.[13]

Charles Miller Smith was appointed Chief Executive Officer in 1994. This was one of the few times that someone from outside ICI had been appointed to lead the company, Smith having previously been a director at Unilever. Shortly afterwards the company acquired a number of former Unilever businesses, in an attempt to move away from the company's historical reliance on commodity chemicals.

In 1997 ICI acquired National Starch & Chemical, Quest, Unichema, and Crosfield, the speciality chemicals businesses of Unilever for $8bn.[14] This step was part of a strategy to move away from cyclical bulk chemicals and to progress up the value chain to become a higher growth, higher margin business.[5] Later that year it went on to buy Rutz & Huber, a Swiss paints business.[15]

Having taken on some £4 billion of debt to finance these acquisitions, the company had to sell off its commodity chemicals businesses.

Disposals of bulk chemicals businesses at that time included the sale of its Australian subsidiary, ICI Australia, for £1bn in 1997,[16] and of its polyester chemicals business to DuPont for $3 billion also in 1997.[17]

The following year it bought Acheson, an electronic chemicals business.[18]

In 2000 ICI sold its diisocyanate, advanced materials, and speciality chemicals businesses at Teesside and worldwide (including plants at Rozenburg, Holland, in South Africa, Malaysia, and Taiwan), and Tioxide, its titanium dioxide subsidiary, to Huntsman Corporation for £1.7 billion.[19] It also sold the last of its industrial chemicals businesses to Ineos for £300 million.[20]

In 2006 the Company sold Quest International, its flavours and fragrances business, to Givaudan, for £1.2 billion[21] and Uniqema, its textile auxiliaries business, to Croda International, for £410 million.[22]

Having sold off much of its historically profitable commodities businesses, and many of the new speciality businesses, which it had failed to integrate, the company consisted mainly of the Dulux paints business, which quickly found itself the subject of a takeover by AkzoNobel.

Dutch firm Akzo Nobel (owner of Crown Berger paints) bid £7.2 billion (€10.66 billion or $14.5 billion US) for ICI in June 2007. An area of concern about a potential deal was ICI's British pension fund, which had future liabilities of more than £9 billion at the time.[23] Regulatory issues in the UK and other markets where Dulux and Crown Paints brands each have significant market share were also a cause for concern for the boards of ICI and Akzo Nobel. In the UK, any combined operation without divestments would have seen Akzo Nobel have a 54% market share in the paint market.[24] The initial bid was rejected by the ICI board and the majority of shareholders.[25] However, a subsequent

bid for £8 billion (€11.82 billion) was accepted by ICI in August 2007, pending approval by regulators.[26]

At 8.00am on 2 January 2008 completion of the takeover of ICI plc by Akzo Nobel NV was announced.[2] Shareholders of ICI received either £6.70 in cash or Akzo Nobel loan notes to the value of £6.70 per 1 nominal ICI share. The adhesives business of ICI was transferred to Henkel as a result of the deal,[27] while Akzo agreed to sell its Crown Paints subsidiary to satisfy the concerns of the European Commissioner for Competition.[28]