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Part 2: Empirical Studies

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Measuring Long Term Growth and Productivity Change on a Macro-economic Level

This note is intended as a comment on Patrick O'Brien's proposal for a cooperative research effort to measure performance of the West European economies. It has three parts:
a) it summarises the findings of a study I recently finished on long term changes in per capita income and productivity in sixteen advanced capitalist countries;
b) it makes some suggestions pertinent to further research by economic historians in this area in which I stress the virtues of trying to make rather aggregative macro-economic measures for periods usually considered too remote for such treatment;
c) the annex provides long term estimates of GDP in 16 countries with source notes, as an illustration of the wealth of material already available for performance measurement on the macroeconomic level.

Findings

In my own recent work[1] I have attempted to analyse the changes in the rhythm of growth in capitalist countries since 1820, dividing the past 160 years into four phases, each with significantly different economic performance as measured by macro-economic indicators. I also made a rough comparison of the macro-economic performance of the "capitalist" epoch as a whole, since 1820, with characteristic performance in three preceding epochs in Western Europe's economic history, i.e. an epoch of "agrarianism" from 500 to 1500 AD during which there were fluctuations but little net growth in population and income; an epoch of "expanding agrarianism" from 1500 to 1700 during which population rose by half and real income per head by about a quarter; and an epoch of "merchant capitalism" from 1700 to 1820 when both population growth and real income per capita increased twice as fast as from 1500 to 1700.

Performance in the four epochs and four phases is summarised in table 1. It can be seen that in all the four phases of "capitalist" development, macro-economic performance has been very much better than in any of the previous epochs.

1. Maddison, A., *Phases of Capitalist Development*, Oxford 1982 (also in French, in 1981, *Les Phases du Développement Capitaliste*, Paris).

Table 1: Performance Characteristics of Epochs and Phases

annual average compound growth rates

	Population	GDP per Head	GDP
		Epochs	
500–1500	0.1	0.0	0.1
1500–1700	0.2	0.1	0.3
1700–1820	0.4	0.2	0.6
1820–1980	0.9	1.6	2.5
		Phases	
1820–1913	1.1	1.2	2.3
1913–1950	0.7	1.2	1.9
1950–1973	1.0	3.8	4.9
1973–1980	0.4	2.0	2.5

Source: This table and the following ones are all derived from A. Maddison, *Phases of Capitalist Development,* Oxford University Press, 1982 (available in French in 1981 Les *Phases du Développement Capitaliste,* Economica, Paris).

For the periods before 1820, the quantitative evidence on growth is, of course, quite weak, and it may seem foolhardy to advance quantitative assessments at all in such a situation. Nevertheless, given the fact that there are important differences of opinion on performance in e.g. the 1500–1700 period, even rough quantitative specification of likely amplitudes helps to sharpen critical analysis of the evidence, and points to areas where the evidence can be improved by further research. For 1500–1700, opposing schools of thought on Western per capita performance are represented by Kuznets and Landes on the one hand, Le Roy Ladurie and Abel on the other.[2] My own tentative view of performance in this period (as represented in table 1) is a compromise between the Kuznets and Le Roy Ladurie positions, but it is clearly possible to improve on evidence by further research directed to the performance of nation states. One weakness of the distinguished work of French quantitative historians for this period is that it is nearly all regional or oecumenic rather than national in scope.

For the 1700–1820 period, more elaborate analyses of growth are available and the best evidence on output trends in Western performance is for France, the Netherlands, and the U.K. I have relied heavily on the work of Phyllis Deane for the U.K.

2. Kuznets, S., *Population Capital and Growth,* London 1974, pp. 139 and 167 suggests a growth rate of 0.2 per cent a year for per capita income in Europe from 1500 to 1750. Landes, D.S., *The Unbound Prometheus,* Cambridge 1969, p. 14 suggests that from the year 1000 to the eighteenth century European real income per head may have tripled. Le Roy Ladurie, E., *Les Paysans de Languedoc,* Paris 1966 suggests stagnant income from 1500 to 1700. Abel, W., *Agrarkrisen und Agrarkonjunktur,* Hamburg 1978, pp. 285–9 suggests a per capita decline in this period.

and Jan Marczewski for France.[3] For the Netherlands, which was still the economic leader for most of this periods, there is a good deal of evidence on economic performance which has yet to be recast systematically in national accounting terms.[4]

There is rather little early evidence on working hours, activity rates or unemployment, so estimates of GDP per man hour are more shaky than those for GDP per head of population. However, if one relies on the reasoning of Esther Boserup[5] about the likelihood of increased labour effort as a source of increase in agricultural output in the early stages of accelerated growth, it seems quite unlikely that in the pre-capitalist epochs labour productivity grew faster than output per capita. If anything it was likely to have grown more slowly.

Within the "capitalist" period since 1820, my estimates of labour productivity generally start only in 1870, but since then average working hours have fallen by roughly half, from around 3,000 to 1,600 a year, so it is clear that labour productivity has increased faster in the "capitalist" epoch than per capita GDP—probably around 20 fold from 1820 to 1980 compared with a 13 fold increase in per capita GDP.

Table 2: Growth of Output (GDP at Constant Prices) per Head of Population 1700-1979
annual average compound growth rates

to	1700 1820	1820 1870	1870 1913	1913 1950	1950 1973	1973 1979	1820 1979
Australia		n.a.	0.6	0.7	2.5	1.3	n.a.
Austria		0.7	1.5	0.2	5.0	3.1	1.5
Belgium		1.9	1.0	0.7	3.6	2.1	1.7
Canada		n.a.	2.0	1.3	3.0	2.1	n.a.
Denmark		0.9	1.6	1.5	3.3	1.8	1.6
Finland		n.a.	1.7	1.7	4.2	2.0	n.a.
France	0.3[a]	1.0	1.5	1.0	4.1	2.6	1.6
Germany		1.1	1.6	0.7	5.0	2.6	1.8
Italy		n.a.	0.8	0.7	4.8	2.0	n.a.
Japan		0.0	1.5	0.5	8.4	3.0	1.8
Netherlands	−0.1	1.5	0.9	1.1	3.5	1.7	1.5
Norway		1.0	1.3	2.1	3.1	3.9	1.8
Sweden		0.6	2.1	2.2	3.1	1.5	1.8
Switzerland		1.7	1.2	1.5	3.1	−0.2	1.6
U.K.	0.4	1.5	1.0	0.9	2.5	1.3	1.4
U.S.A.		1.4	2.0	1.6	2.2	1.9	1.8
Arithmetic Average	0.2	1.1	1.4	1.2	3.8	2.0	1.6

a) 1701/10-1820

3. See their work cited in the annex.
4. See the annex.
5. See Boserup, E., *The Conditions of Agricultural Growth*, London 1965, for a major contribution to anti-Malthusian analysis of growth processes and productivity.

Table 3: Growth of Output (GDP at Constant Prices) 1700–1979

annual average compound growth rates

	to 1700	1820	1870	1913	1950	1973	1820
	1820	1870	1913	1950	1973	1979	1979
Australia		n.a.	3.2	2.1	4.7	2.5	n.a.
Austria		(1.4)	2.4	0.2	5.4	3.1	2.0
Belgium		2.7	2.0	1.0	4.1	2.3	2.3
Canada		n.a.	3.8	2.9	5.2	3.2	n.a.
Denmark		1.9	2.7	2.5	4.0	2.1	2.6
Finland		n.a.	3.0	2.4	4.9	2.3	n.a.
France	0.6[a]	1.4	1.7	1.0	5.1	3.0	2.0
Germany		2.0	2.8	1.3	6.0	2.4	2.6
Italy		n.a.	1.5	1.4	5.5	2.6	n.a.
Japan		(0.4)	2.5	1.8	9.7	4.1	2.7
Netherlands	0.1	2.4	2.1	2.4	4.8	2.4	2.7
Norway		(2.2)	2.1	2.9	4.0	4.4	2.7
Sweden		(1.6)	2.8	2.8	3.8	1.8	2.5
Switzerland		(2.5)	2.1	2.0	4.5	−0.4	2.4
U.K.	1.1	2.4	1.9	1.3	3.0	1.3	2.0
U.S.A.		4.4	4.1	2.8	3.7	2.7	3.8
Arithmetic Average	0.6	2.1	2.5	1.9	4.9	2.5	2.5

a) 1701–10 to 1820. The figures are adjusted to exclude the impact of boundary changes.

One of the objectives of my study was to examine the Schumpeterian literature on the dynamics of capitalist development, but I reject Schumpeter's theories about regular long term rhythms and waves of innovation in favour of more *ad hoc* explanations of changes in momentum which in my view are due to factors such as wars, changes in economic policy, and in the productivity gaps between the successive lead countries (the U.K. and the U.S.A.) and the follower countries. I also argue that the pace of technical progress has been much smoother than Schumpeter suggested.

Another conclusion I reach is that the Rostow-Gerschenkron thesis of staggered take-offs into capitalist type growth in the nineteenth century is in conflict with the evidence we have, and that all the sixteen countries I examined (except Japan and possibly Italy) probably maintained a significant growth rhythm from 1820 onwards. This conclusion is based largely on the GDP and GDP per capita evidence in tables 2 and 3 but is also buttressed by the evidence on foreign trade growth.

My productivity estimates are in terms of labour, rather than total factor productivity. Estimates of the latter are now feasible, because measures of growth in capital stock are available for the seven biggest countries over rather long periods, using existing national estimates, of which those of Feinstein for the U.K. have the longest coverage. Apart from major theoretical problems in finding appropriate weights for

total factor productivity indices, there are obvious pitfalls in their use in historical analysis as revealed in McCloskey's comparison of the British and U.S. iron and steel industry which finds little difference in the performance of the two countries in terms of total factor productivity.[6] This tends to conceal the fact that U.S. labour productivity grew faster than that of the U.K. because its investment effort was bigger.

Table 4: GDP per Man Hour in 1970 U.S. Relative Prices ($)

	France	Germany	Japan	Netherlands	U.K.	U.S.A.
1700				0.35		
1785				0.33	0.32	
1820				n.a.	0.38	
1870	0.42	0.43	0.17	0.74	0.80	0.70
1890	0.58	0.62	0.24	0.97	1.06	1.06
1913	0.90	0.95	0.37	1.23	1.35	1.67
1929	1.31	1.19	0.64	1.82	1.70	2.45
1950	1.85	1.40	0.59	2.27	2.40	4.25
1960	2.87	2.72	1.03	3.17	2.99	5.41
1973	5.80	5.40	3.49	6.17	4.84	7.60
1979	7.11	6.93	4.39	7.48	5.48	8.28

Table 5: Gross Non-Residential Fixed Capital Stock per Person Employed 1820–1978

(Dollars of 1970 U.S. purchasing power)

	1820	1870	1890	1913	1950	1973	1978
Canada	n.a.	n.a.	n.a.	n.a.	16.279	29.760	33.553
France	n.a.	n.a.	n.a.	6.481	10.346	23.653	28.800
Germany	n.a.	3.597	5.311	7.888	9.386	26.733	34.877
Italy	n.a.	n.a.	2.059	3.150	6.151	16.813	20.178
Japan	n.a.	n.a.	.713	1.178	2.873	14.172	20.103
U.K.	3.922	6.068	6.658	7.999	9.204	17.718	20.931
U.S.A.	n.a.	5.066	6.838	13.147	18.485	30.243	32.001

Research Strategy in Measuring Productivity and Growth Trends

There is, of course, a huge literature on problems of growth analysis, and some of

6. See McCloskey, D. N., *Economic Maturity and Entrepreneurial Decline, British Iron and Steel 1870–1913,* Harvard 1973.

these e.g. index number problems, have been pretty exhaustively diagnosed. I confine myself to four points which are relevant to the type of comparative research effort which Patrick O'Brien has been advocating.

a) Use of a National Accounts Framework

My first recommendation is to anchor analysis of growth trends in aggregates which measure total economic activity. The economic significance of GDP or GNP as a measure of economic performance is clearer than that of partial measures such as agricultural or industrial output, or indicators for individual commodities, which earlier growth analysts were forced to use. The fact that aggregate activity can be crosschecked in several dimensions e.g. as a sum of expenditures, of incomes, or of output is also of major help. Estimates of these aggregates are now available for many countries back into the nineteenth century, and can be pushed back further. A concerted effort for a number of countries will throw up many hints of how data gaps can be filled. It is now about twenty years since Kuznets and Abramovitz launched a cooperative research effort of this type which led to production of Malinvaud's study on France, Fua's on Italy, Ohkawa and Rosovsky on Japan, and the forthcoming Matthews' study on the U.K.[7] What I am suggesting is another round of this type but pushed back to 1820.

There are, of course, problems in measuring output for the whole economy, but this is true for partial measures too. The logic of the national accounts aggregates has been explored in a highly sophisticated way over the past 40 years, and I think the literature already provides negative answers to some of the arguments of O'Brien and Keyder in favour of excluding services from the aggregates to be studied.[8]

I am not suggesting that partial measures are not worth using in growth analysis, but there has been a rather marked tendency in the past for users of partial measures to claim that they can thereby discern movements in aggregate economic activity. This temptation is much weaker if an articulate national accounting framework is used.

b) Measure Levels as Well as Growth

A second point worth stressing in productivity or growth analysis is the great value of benchmark estimates which make it possible to compare levels of performance between countries as well as their growth rates. Here O'Brien and Keyder are on the right path in their U.K./French comparisons, but the whole business of international comparisons has been greatly faciliated over the past thirty years by the work of Irving Kravis.[9] This work is another firm anchor for international comparisons which should be exploited wherever possible in long run analysis of productivity trends.

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7. These studies are all cited in the annex, except Matthews, R. C. O., Feinstein, C., and Odling-Smee, J., *British Economic Growth,* Stanford, forthcoming.
8. See O'Brien, P., and Keyder, C., *Economic Growth in Britain and France 1780–1914,* London, 1978, pp. 28–32.
9. See Kravis, I. B., Heston, A., and Summers, R., *International Comparisons of Real Product and Purchasing Power,* Baltimore and London 1978.

c) Appropriate Periodicity
A third important problem in such studies is getting the most appropriate periodicity for the analysis or comparison. Getting this right usually involves a good deal of iterative testing. But there are some traps to be avoided. One is to neglect the economic history of war years. This has been the practice in several distinguished studies of long term growth, e.g. Hoffmann's study on German growth. But if we compare peacetime growth in Germany and another country with a totally different war experience, judgements on the causes for differential peacetime performance can be heavily distorted. Another trap is to compare the growth performance of one country with that of another at a different period when they are alleged to have experienced similar "stages of growth". This type of comparison must be handled very carefully because the technological options of countries are different at different times, and the lead country- follower country gap may also be very different.

d) Identifiable National Aggregates
Finally, I would stress that in spite of changes in boundaries, it is worth trying to frame quantitative analysis of European progress over the past two centuries in terms of national units. In the case of GDP or population it is probably possible to do this. For individual sectors of the economy this is more difficult, and for foreign trade it may be very difficult for periods when the customs boundaries were changed. These problems are perhaps most important for Germany, and are not very satisfactorily handled in Hoffmann's basic study. But the problem arises in several other countries to an important degree, e.g. there is the problem of Ireland whose pace and level of development was different from that in the rest of the U.K. economy in the nineteenth century. But this point is often neglected in international comparisons and may lead to error.

Zusammenfassung:
Die Messung von langfristigem Wirtschaftswachstum und Produktivitätsänderungen auf makroökonomischer Ebene

Mit diesem Beitrag soll ein Kommentar zu Patrick O'Briens Vorschlag geliefert werden, in einem kooperativen Forschungsvorhaben die wirtschaftliche Leistung westeuropäischer Länder zu messen. Die Arbeit gliedert sich in drei Teile:

a) zunächst werden die Ergebnisse meiner kürzlich fertiggestellten Studie über die langfristigen Änderungen des Pro-Kopf-Einkommens und der Produktivität in sechzehn fortgeschritten kapitalistischen Ländern zusammengefaßt;
b) sodann werden Wirtschaftshistorikern, die weitere Forschung auf diesem Gebiet betreiben, einige Vorschläge gemacht. Vor allem wird dabei betont, wie sinnvoll es ist, makroökonomische Messungen auf ziemlich hohem Aggregationsniveau selbst für die Zeiträume durchzuführen, die wegen ihrer zeitlichen Distanz dieser Methode nicht zugänglich sein sollen;
c) in einem Anhang sind langfristige Schätzungen des Bruttoinlandsproduktes (Gross Domestic Product) von sechzehn Ländern aufgeführt. Die Quellenhinweise dazu belegen, wie reichhaltig schon jetzt Material über die Messung wirtschaftlicher Leistung auf makroökonomischer Ebene zur Verfügung steht.

Table 6: Movement in G.D.P. 1700–1849[a]

1913 = 100

	Austria	Belgium	Denmark	France	Germany	Netherlands	U.K.	U.S.A.
1700				12.51[b]		11.20	3.91	
1760				15.52		10.50	5.52	
1800							9.13	
1810							10.93	
1820		(11.3)	12.6	24.2	(11.2)	12.56	13.8	2.03
1821			13.2	26.1				
1822			13.4	25.1				
1823			13.4	26.5				
1824			13.8	27.6				
1825			13.9	26.6				
1826			14.1	27.2				
1827			14.5	27.8				
1828			14.7	28.0				
1829			14.4	28.7				
1830	21.1		14.5	27.2			18.8	
1831			14.4	27.5	14.6		19.7	
1832			14.8	30.1			19.5	
1833			14.7	30.4			19.7	
1834			15.5	30.0			20.5	
1835			15.4	31.8			21.6	
1836			15.4	31.2			22.4	
1837			15.8	32.6			22.1	
1838			15.9	33.0			23.3	
1839			16.1	30.4			24.4	
1840	24.0		16.6	34.7			23.7	5.07
1841			16.6	35.1			23.2	
1842			16.7	34.9			22.7	
1843			17.6	35.4			23.1	
1844			18.5	37.5			24.5	
1845		22.5	19.0	36.0			25.8	
1846		23.6	19.4	35.2			27.5	
1847		23.7	19.3	40.5			27.7	
1848		24.4	20.3	38.4			28.0	
1849			21.5	39.9			28.5	

a) Estimates adjusted as far as possible to exclude the impact of frontier changes. Figures in brackets derived by interpolation or extrapolation.
b) 1701–10.

Table 7: Movement in G.D.P., Annual Data 1850-1869[a]

1913 = 100

	Australia	Austria	Belgium	Denmark	Finland	France	Germany	Italy	Norway	Sweden	U.K.	U.S.A.
1850		27.8	25.4	22.7		40.0	20.3				28.2	7.8
1851			26.1	21.6		39.4	20.2				29.4	
1852			26.8	22.4		41.5	20.6				29.9	
1853			27.5	22.5		39.1	20.5				31.0	
1854			29.2	22.6		41.2	21.0				31.8	
1855			29.4	25.1		40.7	20.7				32.7	
1856			31.0	23.7		42.6	22.4				34.0	
1857			31.8	24.1		46.1	23.5				34.6	
1858			32.0	23.9		48.5	23.4				34.7	
1859			32.0	25.5		44.8	23.5				35.6	
1860		32.1	33.6	25.3	22.8	47.1	24.9				36.4	12.7
1861	15.2		34.1	25.7		45.4	24.3	48.7		24.1	37.4	
1862	15.0		35.0	26.5		48.3	25.5	49.7		24.9	37.7	
1863	15.5		36.0	28.2		50.7	27.4	48.9		25.6	38.0	
1864	17.2		37.2	27.9		50.3	28.2	50.2		26.1	39.0	
1865	17.1		37.2	28.9		51.8	28.3	52.5	37.6	26.7	40.2	
1866	18.2		38.3	28.9		51.9	28.5	54.7	38.3	27.7	40.8	
1867	20.4		38.5	28.9		48.4	28.6	50.1	39.3	27.9	40.4	
1868	21.4		39.9	29.4		54.4	30.3	51.9	39.1	26.4	41.7	
1869	21.6		41.4	31.1		56.7	30.5	52.9	40.7	27.7	42.0	

a) estimates adjusted to exclude the impact of frontier changes.

Table 8: Movement in GDP, Annual Data 1870–1913[a]

1913 = 100

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany
1870	25.6	35.9	42.5	20.1	32.4	27.8	49.4	30.4
1871	24.6	38.5	42.6	20.7	32.5		51.2	30.2
1872	27.3	38.8	45.2	17.4	34.3		55.1	32.3
1873	30.2	37.9	45.5	19.1	34.1		51.7	33.7
1874	31.2	39.6	47.0	23.1	35.1		58.5	36.2
1875	34.5	39.8	46.9	22.3	35.7		61.0	36.4
1876	34.5	40.7	47.5	22.5	36.4		58.6	36.2
1877	35.8	42.1	48.1	23.1	35.4		59.9	36.0
1878	39.2	43.5	49.5	22.7	36.8		58.7	37.7
1879	39.9	43.2	50.0	26.6	38.0		56.9	36.8
1880	42.0	43.8	52.5	29.6	38.9	35.5	60.3	36.5
1881	45.0	45.6	53.2	33.6	39.3		62.1	37.4
1882	42.4	45.9	55.0	33.4	40.7		64.4	38.0
1883	48.7	47.8	55.8	32.8	42.1		63.1	40.1
1884	49.1	49.1	56.3	36.1	42.3		61.6	41.1
1885	52.3	48.8	57.0	40.0	42.6		62.1	42.1
1886	52.8	50.4	57.7	36.1	44.3		62.9	42.4
1887	60.4	53.9	59.9	36.1	45.9		63.1	44.1
1888	58.9	53.8	60.3	38.0	46.2		62.7	45.9
1889	63.9	53.3	63.2	37.1	46.8		63.7	47.2
1890	61.7	56.2	64.6	38.0	49.6	44.4	65.5	48.7
1891	66.5	58.2	64.7	44.3	50.6		66.7	48.6
1892	58.3	59.5	66.3	43.3	51.8		68.6	50.6
1893	55.1	59.9	67.3	42.1	52.8		66.9	53.1
1894	57.0	63.4	68.3	41.9	53.9		71.7	54.4
1895	53.7	65.1	69.9	44.1	56.9		70.2	57.0
1896	57.8	66.1	71.3	48.4	59.0		72.4	59.0
1897	54.6	67.5	72.6	42.0	60.4		71.1	60.7
1898	63.1	71.3	73.8	49.8	61.4		75.0	63.3
1899	63.2	72.8	75.3	47.7	64.0		78.9	65.6
1900	66.9	73.4	77.5	49.9	66.2	69.1	80.3	68.4
1901	65.0	75.7	78.2	54.8	69.0	67.4	77.6	66.8
1902	65.9	76.6	79.8	58.8	70.6	65.3	77.6	68.4
1903	67.3	77.3	81.6	60.5	74.8	71.1	80.3	72.2
1904	70.4	78.5	83.7	61.6	76.4	74.1	84.2	75.1
1905	71.3	82.9	86.1	66.3	77.7	75.0	82.9	76.7
1906	78.0	86.1	87.9	70.1	79.9	77.8	84.2	79.0

Table 8 (Fortsetzung)

1913 = 100

Italy	Japan	Netherlands	Norway	Sweden	Switzerland	U.K.	U.S.A.
53.5	(35.2)	40.6	40.6	30.9	41.3	44.6	17.3
53.1			41.2	32.0		47.0	18.4
52.6			43.8	34.0		47.1	19.8
54.7			44.7	35.9		48.2	20.1
54.7			46.2	36.3		49.0	20.0
56.2			47.6	35.6		50.2	20.7
55.6			49.0	37.8		50.7	21.6
55.5			49.2	37.8		51.2	23.0
55.7			47.7	37.7		51.4	24.4
56.3			48.3	40.0		51.2	25.8
57.2			49.8	40.3		53.6	27.7
54.4			50.2	40.9		55.5	28.9
57.2			50.0	41.0		57.1	30.1
56.9			49.8	43.2		57.5	30.9
57.6			50.8	43.2		57.6	31.5
58.2	45.6		51.4	43.8		57.3	32.1
59.3	49.4		51.7	44.3		58.2	34.3
59.7	51.7		52.3	43.7		60.5	35.7
59.0	49.4		54.6	45.5		63.2	36.6
57.2	52.0		56.5	46.0		66.6	38.7
61.2	56.6		58.0	47.4	58.0	66.9	41.5
61.8	54.0		58.5	49.3		66.9	43.3
59.4	57.6		59.8	50.0		65.3	47.5
61.4	57.8		61.4	51.4		65.3	45.2
60.7	64.6		61.6	52.8		69.7	43.9
62.0	65.6		62.2	55.9		71.9	49.2
63.0	62.0		64.1	57.8		74.9	48.2
60.5	63.2		67.3	60.2		75.9	52.8
64.4	75.2		67.5	61.8		79.6	53.9
65.3	69.7		69.4	63.0		82.9	58.8
69.8	72.7	74.1	70.6	64.6		82.3	60.4
73.4	75.2	74.3	72.5	63.9		82.3	67.2
73.8	71.4	77.1	74.0	66.3		84.4	67.9
74.8	76.3	78.8	73.7	69.7		83.5	71.2
74.9	77.0	79.4	73.6	71.9		84.0	70.3
77.5	75.7	82.2	74.5	73.3		86.5	75.5
79.1	85.5	81.1	77.2	79.8		89.4	84.2

Table 8 (Fortsetzung)

1913 = 100

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany
1907	80.0	91.4	89.2	70.4	82.9	82.6	85.5	82.5
1908	78.3	91.8	90.1	73.4	85.5	82.4	86.8	83.9
1909	82.1	91.5	91.8	81.7	88.8	83.0	88.2	85.6
1910	88.2	92.8	94.2	83.3	91.5	85.3	88.2	88.7
1911	91.3	95.7	96.4	90.5	96.4	88.7	92.1	91.7
1912	95.1	100.5	98.7	92.2	96.4	96.1	100.0	95.7

a) estimates adjusted to exclude the impact of frontier changes.

Table 8 (Fortsetzung)

1913 = 100

Italy	Japan	Netherlands	Norway	Sweden	Switzerland	U.K.	U.S.A.
87.1	88.2	87.1	80.1	83.1		91.1	85.5
87.0	88.8	86.9	82.7	83.4		87.4	78.5
92.4	88.7	89.7	84.9	83.6		89.4	88.1
87.7	90.2	89.3	87.9	88.8		92.2	89.0
93.1	95.0	91.6	90.6	92.6		94.9	91.9
95.3	98.6	98.6	94.7	96.1		96.3	96.2

Table 9: Movement in GDP, Annual Data 1913-49[a]

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany
1914	94.4			93.9	106.3	92.9	94.4	85.2
1915	93.5			96.8	98.9	91.0	86.9	80.9
1916	97.1			101.1	103.1	95.6	83.2	81.7
1917	94.7			103.3	97.0	81.0	80.7	81.8
1918	95.0			104.2	93.8	63.9	76.4	82.0
1919	93.4			109.1	105.9	75.3	75.2	72.3
1920	97.0	66.4	92.5	103.7	110.9	88.7	81.8	78.6
1921	105.9	73.5	94.1	94.3	107.7	92.0	80.5	87.5
1922	110.5	80.1	103.3	101.9	118.6	103.0	93.1	95.2
1923	114.5	79.3	107.0	108.3	131.1	109.1	98.1	79.1
1924	120.5	88.5	110.5	108.1	131.5	115.2	108.2	92.6
1925	122.5	94.5	112.2	112.8	128.5	122.2	109.4	103.0
1926	123.2	96.1	116.0	122.7	136.0	126.7	110.7	105.9
1927	125.7	99.0	120.3	134.3	138.7	137.4	109.4	116.5
1928	123.4	103.6	126.6	146.6	143.4	142.0	115.7	121.6
1929	123.1	105.1	125.5	147.2	153.0	141.2	125.8	121.1
1930	118.1	102.2	124.3	140.9	162.1	138.9	122.0	119.4
1931	113.3	94.0	122.1	125.0	163.9	132.8	117.0	110.3
1932	117.6	84.3	116.6	110.2	159.6	135.2	112.0	102.0
1933	123.3	81.5	119.1	102.9	164.7	144.7	117.0	108.4
1934	127.0	82.2	118.1	115.4	169.7	162.9	117.0	118.3
1935	131.6	83.8	125.4	124.4	173.5	166.8	113.2	127.2
1936	137.1	86.3	126.3	129.9	177.8	178.5	114.5	138.4
1937	143.7	90.9	128.0	142.9	182.1	196.1	120.8	153.4
1938	145.2	102.5	125.1	144.1	186.5	197.5	120.8	169.1
1939	146.2	116.2		154.8	195.4	192.1	125.8	182.7
1940	155.7	113.2		176.6	168.0	169.2	103.8	184.0
1941	173.2	121.3		202.0	151.4	179.5	82.3	195.7
1942	193.1	115.2		239.5	154.8	187.7	73.6	198.4
1943	199.9	118.0		249.2	171.9	204.6	69.8	202.3
1944	193.0	121.0		259.0	189.9	200.8	61.0	207.5
1945	183.4	50.0		253.2	175.6	171.1	66.2	145.3
1946	176.8	58.4		246.4	203.0	193.3	100.6	83.0
1947	181.1	64.4		256.9	214.4	206.1	109.5	101.9
1948	192.8	82.0	132.9	263.3	221.5	219.5	125.8	120.8
1949	205.4	97.5	138.3	269.8	231.5	228.8	134.5	140.7

a) estimates adjusted to exclude the impact of frontier changes.

Table 9 (Fortsetzung)

1913 = 100

Italy	Japan	Netherlands	Norway	Sweden	Switzerland	U.K.	U.S.A.
99.0	97.0	99.1	102.2	100.2		101.0	92.3
110.8	106.1	100.8	106.6	98.5		109.1	94.9
122.5	122.4	105.3	110.0	104.0		111.5	108.0
126.5	126.7	97.7	100.0	92.5		112.5	105.3
127.5	124.0	92.5	96.3	92.0		113.2	114.8
107.8	140.9	115.7	112.6	96.5		100.9	115.8
100.0	132.2	118.3	119.7	102.8		94.8	114.7
98.0	146.9	122.7	109.8	105.9		87.1	112.1
103.9	146.3	127.5	122.6	111.8		91.6	118.3
109.8	146.3	131.9	125.3	116.9		94.5	133.9
111.8	151.2	136.3	124.7	119.3	119.2	98.4	138.0
119.6	156.7	142.8	132.4	130.4	127.8	103.2	141.2
120.6	158.1	146.2	135.3	138.7	134.2	99.4	150.4
117.6	160.6	154.2	140.5	144.9	141.5	107.4	151.9
126.5	172.8	158.5	145.1	145.3	149.3	108.7	153.6
130.4	178.9	166.5	158.6	156.5	154.5	111.9	163.0
123.5	166.1	168.2	170.3	165.5	153.6	111.1	147.4
122.5	171.6	162.6	157.1	153.9	147.2	105.4	136.1
125.5	173.2	157.0	167.6	150.2	142.2	106.2	117.4
125.5	180.5	152.9	171.6	153.7	149.2	109.3	115.0
125.5	199.9	154.3	177.1	163.3	149.5	116.5	123.9
137.3	204.7	158.3	184.7	172.7	148.9	121.0	134.6
137.3	211.2	161.3	196.0	183.7	149.4	126.5	153.3
146.1	261.2	170.0	203.0	186.6	156.5	130.9	160.7
148.0	270.0	171.6	208.1	192.7	162.6	132.5	153.6
158.8	272.3	178.2	218.0	199.4	162.3	133.8	165.6
159.8	256.0	160.0	198.6	190.7	164.0	147.2	178.4
157.8	260.1	162.8	203.4	190.6	162.9	160.6	207.5
155.9	263.5	148.7	195.5	196.6	158.8	164.6	239.5
141.2	262.8	144.6	191.6	199.9	157.4	168.2	276.0
114.7	254.0	97.7	181.6	207.2	161.2	161.6	295.5
89.8		99.1	203.5	220.6		154.5	291.1
117.6		173.2	225.3	232.1		147.8	247.9
138.2	152.8	200.0	251.1	241.6		145.6	243.5
146.1	171.0	221.4	271.1	251.5	204.1	150.2	253.3
156.9	179.0	235.5	276.4	264.9	196.1	155.8	254.7

Table 10: Movement in GDP, Annual Data 1950–79[a]

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany
1950	219.6	109.6	145.9	290.2	248.2	243.0	144.6	161.0
1951	229.0	117.1	154.2	303.2	246.4	265.6	153.0	177.8
1952	231.1	117.2	153.0	329.6	250.7	274.8	158.2	193.5
1953	238.3	122.3	157.9	345.9	265.2	275.1	162.1	209.5
1954	253.1	134.8	164.4	342.1	274.4	300.0	168.9	225.6
1955	266.9	149.7	172.2	374.7	273.4	322.7	176.8	252.8
1956	276.0	160.0	177.2	406.9	278.9	329.1	187.3	270.9
1957	281.6	169.8	180.5	417.3	291.0	334.1	198.5	286.1
1958	295.1	176.0	180.3	426.2	299.1	333.8	204.3	296.3
1959	313.8	181.0	186.0	443.1	319.7	358.0	210.8	318.2
1960	327.4	195.9	196.0	455.6	338.6	393.6	225.9	346.5
1961	334.8	206.8	205.9	469.5	360.2	423.4	238.3	364.2
1962	348.2	212.2	216.8	501.3	380.7	434.5	254.3	380.2
1963	372.3	221.0	226.3	529.1	383.1	449.2	267.8	391.6
1964	398.8	234.7	242.1	562.9	418.6	472.9	285.3	417.8
1965	416.6	241.5	251.1	601.0	437.7	497.9	298.9	441.4
1966	434.0	255.2	258.7	643.3	449.7	508.4	314.5	452.4
1967	455.7	262.8	269.0	665.4	470.3	520.1	329.3	451.6
1968	485.7	274.6	280.4	702.6	490.3	533.3	343.3	480.0
1969	522.0	291.8	298.9	739.2	524.1	584.6	367.3	517.6
1970	550.8	312.6	317.8	758.3	537.8	630.8	388.3	548.6
1971	577.4	330.2	330.1	811.2	550.9	642.4	409.3	566.3
1972	600.7	350.1	347.7	858.8	580.7	690.9	433.5	587.0
1973	628.0	368.5	369.3	923.2	611.2	736.0	456.8	615.8
1974	648.9	384.3	385.8	955.9	605.8	759.4	471.6	619.1
1975	662.9	377.8	378.4	966.6	602.1	763.8	472.4	607.7
1976	682.1	399.6	398.4	1,022.7	649.9	767.7	496.9	639.0
1977	693.8	417.0	401.5	1,047.6	661.6	768.5	510.8	658.4
1978	708.6	421.3	413.4	1,085.6	670.0	786.0	529.2	680.2
1979	730.2	442.6	423.2	1,117.3	693.6	842.8	545.9	711.4

a) Estimates adjusted to exclude the impact of frontier changes.

Table 10 (Fortsetzung)

1913 = 100

Italy	Japan	Netherlands	Norway	Sweden	Switzerland	U.K.	U.S.A.
169.6	194.8	243.0	291.5	279.3	209.5	160.8	276.8
182.5	219.1	247.3	305.0	287.7	226.5	166.6	299.6
190.6	244.5	252.1	315.9	292.6	228.4	166.2	310.6
204.9	262.5	272.8	331.7	302.1	236.5	173.8	322.6
212.4	277.4	291.1	344.5	320.1	249.7	180.5	318.6
226.5	301.1	311.5	351.8	329.8	266.6	186.5	339.8
237.1	323.8	325.4	369.8	340.7	284.2	189.4	346.9
249.7	347.5	335.1	378.3	348.8	295.5	193.1	353.0
261.8	367.8	331.8	383.3	357.0	289.2	193.4	352.0
278.9	401.3	347.4	394.4	375.6	307.5	201.1	373.0
296.5	453.9	378.8	413.0	389.9	329.0	211.6	380.1
320.8	520.0	390.4	433.9	412.2	355.7	218.6	390.0
340.7	556.7	405.9	454.3	429.9	372.7	220.7	412.3
359.9	615.2	420.6	471.5	452.3	390.9	229.3	428.8
369.9	696.4	455.4	495.1	483.6	411.4	241.3	451.3
382.0	732.2	479.3	521.3	503.5	424.5	246.9	478.5
404.9	811.8	492.5	541.0	514.7	435.0	251.9	507.7
433.9	912.8	518.5	574.9	533.1	448.3	258.4	521.5
462.3	1,041.2	551.8	587.9	552.5	464.3	269.1	545.4
490.5	1,167.9	587.2	614.4	578.8	490.5	273.1	560.8
516.6	1,304.8	626.6	626.6	610.4	521.8	279.1	559.7
525.1	1,371.4	653.4	655.3	616.5	543.1	286.7	578.0
541.9	1,499.5	675.7	689.2	629.2	560.4	292.9	610.3
580.0	1,633.7	714.2	717.5	653.3	577.5	314.9	644.0
604.0	1,628.1	739.5	744.9	680.0	585.9	311.2	639.2
582.1	1,650.4	731.8	786.2	697.0	543.2	308.8	633.6
616.2	1,757.1	770.8	839.8	708.1	535.6	321.6	667.4
627.9	1,851.9	789.1	869.8	691.2	548.6	324.8	703.6
644.1	1,960.7	808.6	898.3	700.6	550.4	336.5	735.9
676.0	2,076.4	826.3	926.6	728.8	562.6	339.6	756.2

Annex

The annex indicates the sources I used to measure GDP growth. It is intended to provide some indication of the wealth of the present literature in this field, and of the gaps that remain to be filled.

Australia: 1861–1901, GDP from N. G. Butlin, *Australian Domestic Product, Investment and Foreign Borrowing 1861–1938/39,* Cambridge 1962, pp. 33–4. 1901–51, GDP at 1966/67 prices from M. W. Butlin, *A Preliminary Annual Database 1900/01 to 1973/74,* Discussion Paper 7701, Reserve Bank of Australia, May 1977. All figures adjusted to a calendar year basis.

Austria: 1830–1913 from A. Kausel, *Österreichs Volkseinkommen 1830 bis 1913,* in: Geschichte und Ergebnisse der zentralen amtlichen Statistik in Österreich 1829–1979, Beiträge zur österreichischen Statistik, Heft 550, 1979. 1913–50 gross national product from A. Kausel, N. Nemeth and H. Seidel, *Österreichs Volkseinkommen, 1913–63,* in: Monatsberichte des Österreichischen Institutes für Wirtschaftsforschung, 14th Sonderheft, Vienna, August 1965. 1937–45 from F. Butschek, *Die Österreichische Wirtschaft 1938 bis 1945,* Stuttgart, 1979, p. 65. The figures are corrected for territorial change which has been large (in 1911–13 present day Austria represented only 37.4 per cent of the total output of the Austrian part of the Austro-Hungarian Empire). They refer to the product generated within the present boundaries of Austria.

Belgium: 1846–1913 gross domestic product derived from movements in agricultural and industrial output from J. Gadisseur, *Contribution à l'Etude de la Production Agricole en Belgique de 1846 à 1913,* in: Revue Belge d'Histoire Contemporaine, IV (1973), 1–2, and service output which was assumed to move with employment in services (derived for census years from P. Bairoch, *La Population Active et sa Structure,* Brussels 1968, pp. 87–88). 1913 weights derived from Carbonnelle. 1913–50 gross domestic product estimates derived from C. Carbonnelle, *Recherches Sur l'Evolution de la Production en Belgique de 1900 à 1957,* in: Cahiers Economiques de Bruxelles, No. 3, April 1959, p. 353. Carbonnelle gives G.D.P. figures for only a few benchmark years but gives a commodity production series for many more years. Interpolations were made for the service sector to arrive at a figure for G.D.P. for all the years for which Carbonnelle shows total commodity production. Figures corrected to exclude the effect of the cession by Germany of Eupen and Malmedy in 1925, which added 0.81 per cent to population and was assumed to have added the same proportion to output.

Canada: Gross national product (expenditure) from O. J. Firestone, *Canada's Economic Development 1867–1953,* London 1958, p. 276 for 1867–1926; 1926 to 1950 from *National Income and Expenditure Accounts 1926–1974,* Vol. I, Statistics Canada, 1976. Figures adjusted to offset the acquisition of Newfoundland in 1949 which added 1.3 per cent to G.N.P. and 2.6 to population.

Denmark: 1820–1950 G.D.P. at factor cost (1929 prices) from S. A. Hansen, *Økonomisk vaekst i Danmark,* Vol. II, Institute of Economic History, Copenhagen 1974, pp. 229–32 (figures from 1921 onwards adjusted to offset the acquisition of North Schleswig, which added 5.3 per cent to the population, and 4.5 per cent to G.D.P.).

Finland: 1860–1950 GDP from O. E. Niitamo, *National Accounting and National Statistical Service on the Threshold of the 1980's,* in: Finnish Journal of Business Economics, I, (1980).

France: For the eighteenth century J. Marczewski has presented rough estimates of economic growth based partly on the work of his colleague J. C. Toutain, who showed a 60 per cent increase in agricultural output between the first and eighth decade. Toutain's estimates have been criticised by M. Morineau, *Les Faux-Semblants d'un Demarrage Economique,* Paris 1971 who rejects all evidence of French progress rather in the style of a prosecution attorney. E. Le Roy Ladurie presents a more balanced criticism and also presents an alternative estimate to Toutain which I have used. The sources to 1820 were therefore: 1701–10 to 1820 movement in industry and 1781–90 to 1820 movement in agriculture from J. Marczewski, *Some Aspects of the Economic Growth of France, 1660–1958,* in: Economic Development and Cultural Change, April 1961, p. 375; 1701–10 to 1781–90 agricultural output increase assumed to be 32.5 per cent, the mid point of the range suggested by E. Le Roy Ladurie, *Le Territoire de l'Historien,* Vol. I, Paris 1973, p. 279. 1701–10 to 1781–90 output in services assumed to move parallel with population. 1781–90 to 1820 output in services from J. Marczewski, *The Take-Off Hypothesis and French Experience,* in: W. W. Rostow (ed.), The Economics of the Take-Off into Sustained Growth, New York 1965, p. 136. 1820–96 gross domestic product derived from separate indicators of industrial, agricultural, building, and service output. Industrial production, agriculture and building from M. Levy-Leboyer, *La Croissance Economique en France au XIXe Siecle,* in: Annales, July-August 1968, p. 802 bis. Service output interpolated from J. Marczewski, Take-Off, p. 136. 1896–1950 GDP and 1896 sector weights from J. J. Carre, P. Dubois and E. Malinvaud, *La Croissance Française,* Paris 1972, pp. 35 and 637. Interpolation between 1913 and 1920 based on figures for industrial and agricultural output shown in J. Dessirier, *Indices Compares de la Production Industrielle et Production Agricole en Divers Pays de 1870 a 1928,* in: Bulletin de la Statistique Generale de la France, Etudes Speciales, October-December 1928; service output was assumed stable in this period, and weights for the three sectors were derived from Carre, Dubois and Malinvaud, Croissance. Interpolation between 1939 and 1946 was based on A. Sauvy's report on national income to the Conseil Economique, *Journal Officiel,* 7th April, 1954. (Sauvy's estimates for this period seem reasonable when checked against estimates of wartime agricultural and industrial output. See M. Cepede, *Agriculture et Alimentation en France Durant la IIe Guerre Mondiale,* Paris 1961 and *Annuaire de Statistique Industrielle 1938–1947,* Ministere de l'Industrie et du Commerce, Paris, 1948.) The figures from 1918 onwards were adjusted downwards by 4.6 per cent to offset the impact of the return of Alsace Lorraine, figures for 1861–70 multiplied by 95.92 to offset for inclusion of Alsace Lorraine, and 1860 and earlier by 97.65 to offset both the impact of acquisition of Nice and Savoy in 1861 and the Alsace-Lorraine component.

Germany: 1816–50 GDP estimated from Prussian data in R. H. Tilly, *Capital Formation in Germany in the Nineteenth Century,* in: P. Mathias and M. M. Postan (eds.), Cambridge Economic History of Europe, Vol. VII, Part I, pp. 395, 420 and 441. Using 1850 weights for agriculture, industry and services from Hoffmann, p. 454, Prus-

sian per capita output in agriculture and industry were multiplied by population in Germany as a whole. Output in services was assumed to move with population. 1850–1925 net domestic product (value added by industry) at factor cost from W. G. Hoffmann, F. Grumbach and H. Hesse, *Das Wachstum der deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts,* Berlin 1965, pp. 454–5. This source gives no figures for 1914–24, but starts again in 1925. The pattern of movement in individual years 1914–24 was derived from annual indices of industrial and agricultural output in Dessirier, using Hoffmann's weights for these sectors and adjusting them to fit his sectoral output benchmarks for 1913 and 1925. Service output was interpolated between Hoffmann's 1913 and 1925 figures for this sector. 1925–39 GDP from *Bevölkerung und Wirtschaft 1872–1972,* Statistical Office, Wiesbaden 1972, p. 250. 1939–44 GNP from E. F. Denison and W. C. Haraldson, *The Gross National Product of Germany 1936–1944, Special Paper 1* (mimeographed), in: J. K. Galbraith (ed.), The Effects of Strategic Bombing on the German War Economy, U.S. Strategic Bombing Survey 1945. 1946 from *Wirtschaftsproblemen der Besatzungszonen,* Berlin 1948, p. 135; 1945 was assumed to lie midway between 1944 and 1946. 1947–50 from *Statistics of National Product and Expenditure No. 2, 1938 and 1947 to 1955,* O.E.E.C., Paris 1957, p. 63. The estimates are fully corrected for territorial change which was extremely complicated in Germany. It can be summarised in simplified form as follows (in terms of ratio of old to new territory 1870 96.15 per cent; 1918 108.39 per cent; 1946 155.35 per cent. (See A. Maddison, Phases of Capitalist Development, in: Banca Nazionale del Lavoro Quarterly Review, June 1977, p. 133–4 for full detail.)

Italy: 1861–1950 gross domestic product at 1938 prices from P. Ercolani, *Documentazione statistica di base,* in: G. Fua (ed.), La Sviluppo Economico in Italia, vol. III, pp. 410–12, Milan 1975. The figures refer to output in the present territory of Italy ("confini attuali", see p. 388). Figures in an earlier official study, *Annali di Statistica,* Serie VIII, vol. 9, Instituto Centrale di Statistica, Rome 1957 show a gain in output due to territorial change of 3.2 per cent after the first world war and a loss of 1.5 per cent after the second world war (corresponding population changes were a gain of 4.1 per cent and a loss of 1.4 per cent respectively).

Japan: 1885–1930, gross domestic product at 1934–36 prices from K. Ohkawa, N. Takamatsu and Y. Yamamoto, *National Income,* Vol. I of *Estimates of Long-Term Economic Statistics o Japan since 1868,* Toyo Keizai Shinposha, Tokyo 1974, p. 227. Rough estimate for 1870 was derived by assuming that per capita product rose by 1 per cent a year from 1870 to 1885. This is smaller than the later period, but 1870–85 saw major upheavals in which economic growth was probably slow. 1930–42, gross national product at 1934–36 prices from *National Income White Paper* (in Japanese), 1963 edition, p. 178 adjusted (from 1946 to a calendar year basis. 1952 onwards from *National Accounts of OECD Countries 1950–78,* Vol. I, pp. 28–9. In the above sources, Okinawa is included up to 1945, and excluded from 1946 to 1972. An upward adjustment of 0.66 per cent was made for 1946 to offset the impact of territorial change, and 1973 was adjusted down by 0.92 per cent of offset the impact of Okinawa's return.

Netherlands: For 1700 it was assumed that Dutch GDP per head was a little more than 50 per cent higher than that of the U.K. This rough assumption is based on comparative evidence of economic structure and relative levels of international trade, investment and government finance in the two countries as shown mainly in Jan de Vries, *The Dutch Rural Economy in the Golden Age, 1500–1700,* Yale 1974, and P. Deane and W. A. Cole, *British Economic Growth 1688–1959,* Cambridge 1964. In 1700 about two thirds of the U.K. labour force was in agriculture, and in the Netherlands the proportion was about one third. I assume productivity was higher in industry and services than in agriculture in both countries and the evidence suggests strongly that Dutch productivity was higher in each sector. Dutch agriculture was more specialised with a large internal trade carried by canal, exports of dairy products, a quarter of its grain was imported from Eastern Europe and cattle were imported on a large scale from Denmark. Its industry was highly diversified with a great deal of international trade, and the Dutch performing sophisticated finishing processes (bleaching, printing, dyeing) for English woollens and German linens. Activity in international banking, insurance, shipping, warehousing was on a much larger scale per capita than in the U.K. At the end of the seventeenth century the Dutch merchant fleet was about 50 per cent larger than the British but population was a fifth of that in the U.K. (See R. Davis, *The Rise of the English Shipping Industriy,* London 1962, p. 27 for the size of British fleets and W. Vogel, *Zur Grösse der europäischen Handelsflotten im 15., 16. und 17. Jahrhundert,* in: Festschrift D. Schäfer, Forschungen und Versuche zur Geschichte des Mittelalters und der Neuzeit, Jena, 1915, p. 331, for Dutch shipping.) Gregory King estimated Dutch per capita income as only 4 per cent higher than that of England in 1695 (see G. E. Barnett, *Two Tracts by Gregory King,* Baltimore 1936, p. 55) but he overestimated Dutch population by 18 per cent. Assuming that this error was independent of his output estimate (which is not clear) this would raise King's differential to about 23 per cent in favour of the Netherlands as against England. Our own estimates for the U.K. (see below) imply that U.K. per capita income in 1700 was about 4.5 per cent lower than that in England and Wales. Adjusting King again for this would produce a differential of 29 per cent in favour of the Netherlands as against the U.K. However, King estimates English consumption levels to be one third higher than the Netherlands (even after adjusting for his population error). This seems implausible. Hence, the evidence of Gregory King, though it points to a lower Dutch advantage than I suggest is not too persuasive. (H. C. Bos, *Economic Growth of the Netherlands,* IARIW Portoroz 1959 (mimeographed) presented a rough estimate of Dutch per capita income in 1688 compared with 1910 which is not different from my estimate, though the approach is quite different.)

In the eighteenth century the Dutch economy stagnated. The process is described in detail without any aggregate quantification by Johan de Vries, *De economische Achteruitgang der Republiek in de Achttiende Eeuw,* Leiden 1968. From 1700 to 1760 I have assumed that Dutch per capita GDP fell by 10 per cent and then stagnated. Per capita GNP probably did not decline because of the increase in foreign investment and the receipts from it. These receipts, and GDP, were quite adversely affected during the Napoleonic wars and French occupation. I have not made any direct estimate of 1820–70 growth, but this emerges as a by-product from the above and from estimates backcast from 1970 to 1870 from the following sources. 1870–1900 GDP from

S. Kuznets, *Economic Growth of Nations,* Harvard 1971, pp. 12 and 16. 1900–17, 1921–39, and 1948–50 net domestic product and 1917–20 national income at constant market prices derived from *1899–1959 Zestig Jaren Statistiek in Tijdreeksen,* Centraal Bureau voor de Statistiek, Zeist 1959, p. 102. 1939–47 real product in international units interpolated from C. Clark, *Conditions of Economic Progress,* 3rd ed., London 1957, p. 166–7.

Norway: Gross domestic product at market prices. 1865–1950 from *National Accounts 1865–1960,* Central Bureau of Statistics, Oslo 1965, pp. 348–59 (gross fixed investment was adjusted downwards by a third to eliminate repairs and maintenance). 1939–44 movement in national income (exluding shipping and whaling operations carried out from Allied bases 1940–44) from O. Aukrust and P. J. Bjerve, *Hva Krigen Kostet Norge,* Oslo 1945, p. 45. 1945 assumed to be midway between 1944 and 1946.

Sweden: 1861–1950 gross domestic-product from O. Krantz and C. A. Nilsson, *Swedish National Product 1861–1970: New Aspects on Methods and Measurement,* Kristianstad 1975, p. 171.

Switzerland: 1890–1944 real product in international units from C. Clark, *Conditions of Economic Progress,* 3rd edition, London 1957, pp. 188–9. The link 1938–48 is from *Europe and the World Economy,* OEEC, Paris 1960. 1948–76 from *Séries Revisées de la Comptabilité Nationale Suisse 1948–1970,* Federal Statistical Office, Berne 1977, pp. 26–7. The rough estimate for 1870 was derived by backward extrapolation of the 1890–1913 movement in output per head. There is a graphical indication of the growth of Swiss real product in F. Kneschaurek, *Probleme der langfristigen Marktprognose,* in: Aussenwirtschaft, December 1959, p. 336 for 1900–65. This shows faster growth than C. Clark to 1938. U. Zwingli and E. Ducret, *Das Sozialprodukt als Wertmesser des langfristigen Wirtschaftswachstums,* in: Schweizerische Zeitschrift für Volkswirtschaft und Statistik, March-June 1964, shows slower growth for 1910–38 than C. Clark.

U.K.: 1700–1800 England and Wales from P. Deane and W. A. Cole, *British Economic Growth 1688–1959,* Cambridge 1964, p. 78 (excluding government) and 1801–1831 for Great Britain from p. 282. The Deane and Cole estimates were adjusted to a U.K. basis, assuming Irish output per head in 1830 to be half of that in Great Britain (as Deane herself hypothesises in the source mentioned below) and to have been stagnant from 1800–1830, assuming that Scottish and Irish output per head in 1800 were threequarters of that in England and Wales in 1800, and that output per head increases by a quarter in these two areas from 1700 to 1800 (as compared with a growth of 47 per cent in England and Wales). 1830–1855 gross national product at factor cost from P. Deane, *New Estimates of Gross National Product for the United Kingdom 1830–1914,* in: The Review of Income and Wealth, June 1968, p. 106, linked to 1855–1950 gross domestic product at factor cost (compromise estimate) from C. H. Feinstein, *National Income Expenditure and Output of the United Kingdom 1855–1965,* Cambridge 1972, pp. T 18–20. Figures from 1920 onwards are increased by 3.8 per cent to offset the exclusion of output in the area which became the Irish Republic.

U.S.A.: G.D.P., 1820–40 at 1840 prices derived from P. A. David, *The Growth of Real Product in the United States before 1840: New Evidence, Controlled Conjectures,* in: Journal of Economic History, June 1967. The method assumes that 1820–40 agricultural output moved parallel with total population, derives the agricultural productivity movement from this and further assumes that agricultural and non-agricultural productivity grew at the same pace. Agricultural productivity in 1840 is taken as 51 per cent of non-agricultural. 1840–1889 movement of G.N.P. in 1860 prices (The movement in our estimates for the U.S.A. between 1840 and 1889 is very similar to those of T. S. Berry, *Revised Annual Estimates of American Gross National Product: Preliminary Annual Estimates of Four Major Components of Demand,* Virginia 1978, which is not surprising as they are both benchmarked on Gallman. Before 1840 Berry's estimates show even faster growth than David's.) derived from R. E. Gallman, *Gross National Product in the United States 1834–1909,* in: Output, Employment and Productivity in the United States after 1800, N.B.E.R., New York 1966, p. 26. Gallman does not actually give figures for 1840, 1850, 1860, 1870 and 1889. These were extrapolated from neighbouring years. The movement in individual years 1870–1889 was derived by using the index of output in mining manufacturing and construction in W. A. Lewis, *Growth and Fluctuations 1870–1913,* London 1978, p. 273, the index of farm production from F. Strauss and L. H. Bean, *Gross Farm Income and Indices of Farm Production and Prices in the United States 1869–1937,* Technical Bulletin 703, U.S. Dept. of Agriculture, Washington 1940, p. 126, table 61 (Laspeyre's index), and interpolating the movement in services from the residual derived from Gallman. 1889 weights (agriculture 28.1, industry 26.7, other 45.2 per cent) at 1929 prices were derived from *The National Income and Product Accounts of the United States, 1929–1974,* p. 186, and the 1889–1929 product movement by sector as shown in Kendrick, pp. 302–3 as cited below. 1889–1929, gross domestic product from J. W. Kendrick, *Productivity Trends in the United States,* National Bureau of Economic Research, Princeton 1961, p. 298–9. 1929–79 GDP from *The National Income and Product Accounts of the United States: An introduction to the Revised Estimates for 1929–80,* in: Survey of Current Business, December 1980, Figures corrected to exclude the impact of the accession of Alaska and Hawaii in 1960. These two states added 0.5 per cent to total product, but part was already included and the explicit addition was only 0.2 per cent, see *Survey of Current Business,* July 1962, p. 5.