

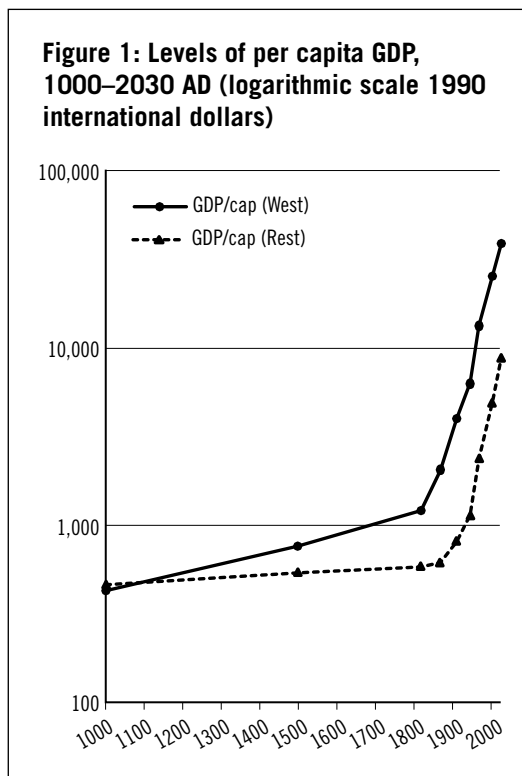
The West and the Rest in the World Economy: 1000–2030

Maddisonian and Malthusian interpretations

Angus Maddison

Changes in the momentum of growth over the long term

From the year 1000 AD to 1820, world economic growth was predominantly extensive. Most of the GDP increase went to accommodate a four-fold increase in population. The advance in per capita income was a slow crawl – the world average increased by less than half over a period of eight centuries (see Table 1). However, there was a significant divergence between the growth momentum of the West (Western Europe, United States, Canada, Australia and New Zealand) and the Rest (of the world). Between 1000 and 1820, per capita income in the West rose almost threefold, and only a quarter in the Rest. In



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Table 1: Levels of per capita GDP, 1–2030 AD
(1990 international Geary-Khamis dollars)

	1	1000	1500	1820	1950	1973	2006	2030
Western Europe	576	427	772	1,202	4,578	11,417	2,332	31,389
US	400	400	400	1,257	9,561	16,689	31,049	45,774
Other Western offshoots*	400	400	400	761	7,424	13,399	24,168	36,025
West	569	426	754	1,202	6,304	13,392	25,399	39,065
China	450	466	600	600	448	838	6,048	15,763
India	450	450	550	533	619	853	2,637	7,089
Japan	400	425	500	669	1,921	11,434	22,471	30,072
Other Asia	421	520	565	578	924	2,046	4,855	8,292
Latin America	400	400	416	691	2,503	4,513	6,485	8,648
Eastern Europe & Former USSR	406	400	498	686	2,602	5,731	7,023	11,214
Africa	472	428	416	421	890	1,410	1,710	2,027
Rest	453	457	537	581	1,127	2,379	4,910	8,845
World	467	453	567	667	2,111	4,091	7,285	11,814
Inter-regional Spread	1.4:1	1.3:1	1.9:1	3:1	21.3:1	19.9:1	18.2:1	22.6:1
West–Rest Spread	1.3:1	0.9:1	1.4:1	2.1:1	5.6:1	5.6:1	5.2:1	4.4:1

* Australia, Canada and New Zealand.

Source: www.ggdc.net/Maddison, and Maddison (2007a), p. 382.

1000, the West had a lower per capita income than the Rest, but by 1820 the Western average was more than twice that in the Rest. Since 1820, world development has been much more dynamic, but Western momentum was more rapid than that of the Rest. By 2006, the Western average had risen 21 fold, the rest only 8 fold. A 5-fold gap had emerged between the per capita income of the two groups. The per capita income spread within the West was very much smaller (2:1) than in the Rest, where the difference between Hong Kong and Burundi was 62:1 (see Table 2).

Why the West grew faster than the Rest before 1820

The greater dynamism of Western Europe than Asia from 1000 to 1820 was due to five major changes which had no counterpart elsewhere.

1. In the eleventh and twelfth centuries, important urban trading centres emerged, in Flanders and Northern Italy, with autonomous property

Table 2: Per capita income divergence within the world economy in 2006

Region	% of world GDP	Highest	1990 PPP dollars	Lowest	1990 PPP dollars	Range
Western Europe	17.9	Norway	27,384	Portugal	14,210	1.9:1
Western offshoots*	22.5	US	31,049	New Zealand	18,293	1.7:1
Asia	42.5	Hong Kong	29,486	Afghanistan	771	38:1
Latin America	7.7	Trinidad & Tobago	22,606	Haiti	697	32:1
Africa	3.3	Equatorial Guinea	16,952	Burundi**	475	36:1
Eastern Europe	2.0	Slovenia	16,364	Serbia	3,104	5.3:1
Former USSR	4.2	Estonia	19,411	Tajikistan	1,305	15:1
World	100.0	US	31,049	Burundi**	475	65:1

* US, Australia, Canada and New Zealand; ** I have ignored the estimate of US\$230 for Zaire as it is subject to a wide margin of error aggravated by war conditions. The next lowest country was Burundi.

Source: www.gdpc.net/Maddison

rights. This fostered entrepreneurship and abrogated feudal constraints on the purchase and sale of property. The development of accountancy helped make contracts enforceable. New financial and banking institutions provided access to credit and insurance, facilitated risk assessment and large scale business organisation throughout Western Europe. These features of early merchant capitalism spread elsewhere, particularly in the Netherlands and the United Kingdom. They became a standard feature of modern capitalism. Between 1000 and 1800, the number of European cities with a population of more than 10,000 rose from 4 to 364, i.e. from 0% to 10% of the population (see de Vries 1984).

2. The introduction of printed books in the fifteenth century, the Renaissance and the development of Baconian, Galileian and Newtonian science, systematic experimentation, and the spread of university education and creation of academies of science unleashed a Promethean advance of secular knowledge which was a fundamental prerequisite for later technological development. The first European university, Bologna, was founded in 1080; by 1800, 184 had been created (de Ridder-Symoens 1996).

3. The influence of the Christian church meant that marriage became very different from what it had been in the Roman empire. It was monogamous, with a ban on concubinage, adoption and divorce, with strong discouragement of remarriage of widows or widowers. Inheritance was limited to close family members and widespread adoption of primogeniture broke down loyalties to clan, tribe or caste, promoted individualism and accumulation, and reinforced the sense of belonging to a nation-state. This contrasted with the polygamy of the Islamic world and the extended family systems of India and China.
4. Advances in maritime technology and navigation techniques revolutionised European knowledge of world geography. The discovery of the Americas, new routes around Africa to Asia, and Magellan's circumnavigation of the globe led to the development of merchant capitalism and colonialism with global horizons. The economy of the Americas was transformed, and repopulated by slaves and European settlers. There were also substantial profits from trade with Asia.
5. A fifth distinctive feature was the emergence of nation-states in close propinquity, with significant trading relations and relatively easy intellectual interchange in spite of linguistic differences. This benign fragmentation stimulated competition and innovation. Migration to or refuge in a different culture and environment were options open to adventurous and innovative minds. This was the reason why the pace of economic advance was fairly congruent within Western Europe.

The experience of Western Europe in the centuries before 1820 was a long and necessary apprenticeship for the faster growth which followed. The absence of such experience elsewhere is the major reason why growth performance elsewhere was so much slower.

This first phase of sustained but quite modest growth accelerated after the Napoleonic wars. From 1820 onwards there was a very marked improvement of capitalist performance, which characterised Western Europe and Western offshoots.

There are two old-fashioned notions which should be rejected: i) that the merchant capitalist epoch ended with an 'industrial revolution' around 1760, and ii) that the acceleration was characterised by staggered

‘take-offs’ at significant intervals. Crafts (1983) showed much more modest British growth in 1760–1820 than Deane and Cole (1964) whose work was thought to have justified the industrial revolution hypothesis. Rostow (1962) postulated a spread in ‘take-off’ dates from 1783 in the UK, 1830 in France, 1843 in the US, 1850 in Germany, 1868 in Sweden and 1896 in Canada, but his chronology was unsubstantiated. The acceleration of growth after 1820 was quite general and reasonably synchronous in the West (see the detailed evidence in Maddison 1982 and 1991).

Why the divergence between the West and Rest continued in the capitalist era from 1820 to 1950

After 1820, economic growth accelerated in Western Europe for three reasons: leading countries had acquired most of the institutional and intellectual attributes of a modern capitalist state and had ceased to follow ‘beggar-your-neighbour’ policies, and there was a faster pace of technical change.

Railways and steam shipping were particularly important in creating new elements of dynamism. Tables 3a and 3b show the proximate driving forces which emerged in five successive phases of capitalist development in the UK, the US and Japan (the only Asian country to develop an early catch-up strategy). Accelerated GDP growth and success in exploiting new technology needed great increases in the education level of the labour force, even greater increases in the capital stock, and a rapid expansion of international trade. These characteristics were missing in most of Asia until after the second world war.

West European countries had lost most of their American colonies by 1820, but augmented their imperialist ambitions in Asia and subsequently in Africa. Merchant capitalist policies had generally been ‘beggar-your-neighbour’, but imperialism became much more collusive in the nineteenth century (especially so in China). Generally, the imperialist powers avoided conflict with each other. From 1820 to the outbreak of the second world war, Western powers regarded colonialism as a significant contribution to their prosperity, but nationalist politicians in the colonised countries, notably in China, India and Indonesia, rightly considered colonial policy a major barrier to their economic performance.

Table 3a: Determinants of growth: UK, US and Japan, 1820–2003

	UK	US	Japan	UK	US	Japan
	Gross stock of machinery and equipment per capita (1990 US\$)			Gross stock of non-residential structures per capita (1990 US\$)		
1820	92	87	n.a.	1,074	1,094	n.a.
1870	334	489	94 ^a	2,509	3,686	593 ^a
1913	878	2,749	329	3,215	14,696	852
1950	2,122	6,110	1,381	3,412	17,211	1,929
1973	6,203	10,762	6,431	9,585	24,366	12,778
2003	14,291	32,240	31,232	22,957	35,687	52,589
	Primary energy consumption per capita (tons of oil equivalent)			Average years of education per person employed*		
1820	0.61	2.49	0.20	2.00	1.75	1.50
1870	2.21	2.45	0.20	4.44	3.92	1.50
1913	3.24	4.47	0.42	8.82	7.86	5.36
1950	3.14	5.68	0.54	10.60	11.27	9.11
1973	3.93	8.19	2.98	11.66	14.58	12.09
2003	3.86	7.86	4.05	15.79	20.77	16.78
	Land area per capita (hectares)			Exports per capita (1990 US\$)		
1820	1.48	48.1	1.23	53	25	0
1870	1.00	23.4	1.11	390	62	2
1913	0.69	9.6	0.74	862	197	33
1950	0.48	6.2	0.44	781	283	42
1973	0.43	4.4	0.35	1,684	824	875
2003	0.41	3.2	0.30	5,342	2,762	3,152
	Annual hours worked per head of population			GDP per hour worked (1990 US\$)		
1820	1,153	968	1,598	1.49	1.30	0.42
1870	1,251	1,084	1,598	2.55	2.25	0.46
1913	1,181	1,036	1,290	4.31	5.12	1.08
1950	904	756	925	7.93	12.65	2.08
1973	750	704	988	15.97	23.72	11.57
2003	694	746	853	30.69	38.92	24.86

^a 1890; * equivalent years of primary education.
Source: Maddison (2007a), pp. 305–6.

Table 3b: Capital/output ratios, labour and total factor productivity: UK, US and Japan, 1820–2003

	UK	US	Japan	UK	US	Japan
	Capital–output ratio machinery & equipment/GDP			Capital–output ratio non-residential structures/GDP		
1820	0.05	0.07	n.a.	0.63	0.87	n.a.
1870	0.11	0.20	0.10 ^a	0.79	1.51	0.59 ^a
1913	0.18	0.52	0.24	0.65	2.77	0.61
1950	0.31	0.64	0.72	0.49	1.80	1.00
1973	0.52	0.64	0.93	0.80	1.46	1.12
2003	0.67	1.11	1.47	1.08	1.23	2.48
	Labour productivity (annual average compound growth rates)			Total factor productivity (annual average compound growth rates)		
1820–1870	1.10	1.10	0.18	0.15	–0.15	n.a.
1870–1913	1.22	1.93	2.00	0.31	0.36	–0.21 ^b
1913–1950	1.66	2.47	1.79	0.81	1.62	0.20
1950–1973	3.09	2.77	7.75	1.48	1.75	5.12
1973–2003	2.20	1.66	2.58	0.91	0.65	0.63

^a 1890; ^b 1890–1913

Source: Maddison (2007a), pp. 305–6.

Western Europe's postwar golden age

From 1950 to 1973, West European per capita GDP grew 4% per year, three times as fast as in any earlier phase of development. There was a potential for catch up due to prewar stagnation and wartime destruction. The East–West split reinforced harmony of interests between the capitalist economies. The policy conflicts of interwar years did not recur. The US played a generous and effective role from 1948, providing a substantial flow of Marshall aid, fostering liberal trading policies, creating a functioning international order with explicit and rational codes of behaviour and institutions for cooperation. West European governments gave much greater emphasis to economic growth objectives than ever in the past, and were meticulous in measuring performance. They promoted high levels of demand and employment and openness to international trade. The productivity gaps within the Western world were significantly reduced. After

1973, average per capita growth in Western Europe was similar to that in the US; the catch up phase had ended in most countries. Most of the slow-down was warranted as Western Europe was operating much closer to the frontier of technology. The success of growth policies reduced the appeal of imperialism. Prewar policies of colonial tutelege were abandoned and emphasis switched to stimulating development by providing financial aid.

Can one characterise modern Western growth as industrialisation?

There is a tendency to equate Western economic growth as a process of industrialisation. This is an error (see Table 4a).

The share of industrial employment rose fairly steadily in Western countries from 1700 to the end of the 1960s and has declined significantly since then. At no time has industrial employment been more than half of total employment. The fastest rise has been in the service sector, and the biggest decline has been in agriculture. There is little difference now in the shares of industrial employment and value added, which means there is not a wide variation in inter-sector productivity. The situation is very different in China where the share of employment in industry is not too different

Table 4a: Structure of employment 1700–2006 (% of total)

		Agriculture	Industry	Services
1700	Netherlands	40	33	27
	UK	56	22	22
	US	n.a.	n.a.	n.a.
1820	Netherlands	42	28	30
	UK	37	33	30
	US	70	15	15
1950	Netherlands	14	40	46
	UK	5	47	48
	US	13	33	54
1970	Netherlands	7	38	55
	UK	3	44	53
	US	4	31	65
2006	Netherlands	3	21	76
	UK	1	22	77
	US	3	21	76
	China 2002	52	20	28

Sources: Maddison (2007a), p. 76 updated. Agriculture includes forestry and fishing; industry includes mining, manufacturing, electricity, gas, water and construction; services is a residual including all other activity, private and governmental (including military). Chinese estimates are from Maddison and Wu (2008), pp. 33 and 37–38.

from the situation in the West. However, the share of Chinese industry in value added is hugely different from that in the West (Table 4b). In 2003 it was 57% of GDP, far higher than ever in Western experience. The higher relative level of industrial productivity is due to official policy in prioritising industrial development in many ways.

Table 4b: Structure of value added (% of total)

		Agriculture	Industry	Services
2006	Netherlands	2	24	74
	UK	1	23	76
	US	1	23	76
	China 2003	16	57	27

End of colonialism in Asia, beginning of indigenous catch up policies

Colonialism in most of Asia had ended by 1950 and countries were free to follow indigenous policies to promote economic growth. However, East Asian per capita income was well below prewar levels and the Korean war was a further impediment to recovery. Japan’s empire was liquidated and five million refugees were repatriated. Its GDP was below prewar levels until 1955.

In spite of these unfavourable omens, several east Asian countries had an unparalleled surge of growth from 1952 to 1978. Per capita GDP rose faster than in Western Europe – 6.7% per year in Japan, 6.6% in Taiwan, 6.3% in South Korea, 5.4% in Hong Kong and 4.8% in Singapore. They started from a low level, and rapid catch up was achieved by large increases in capital stock, improvements in educational level and rapid growth in exports (see the comparative growth accounts for China, Japan, the US and South Korea in Table 5).

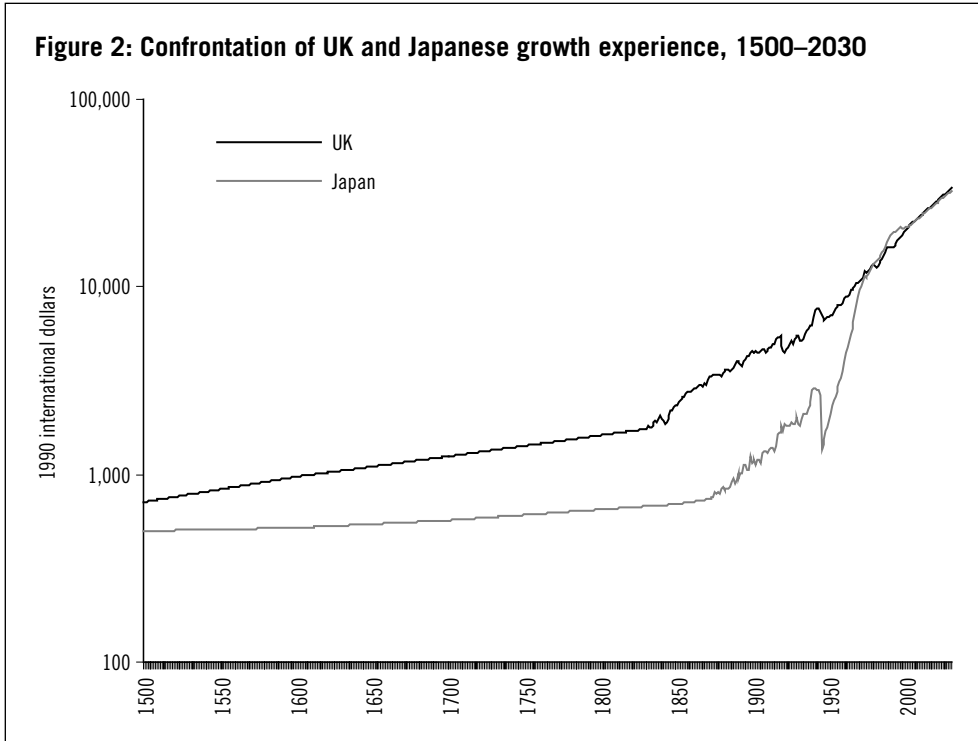
Japan was the most successful because it could switch all of its already highly educated labour force to peacetime pursuits and its international interaction benefited from its early emergence as an ally of the US. South Korea and Taiwan also benefited in their reconstruction and rapid development from being US allies and recipients of US aid. Growth slowed a little after 1978 in most of these countries, but in Japan there was a

Table 5 Basic growth accounts, China, Japan, South Korea and the US, 1952–2003 (annual average compound growth rates)

	China		Japan	
	1952–78	1978–2003	1952–78	1978–2003
Population	2.02	1.20	1.10	0.41
GDP	4.39	7.85	7.86	2.53
Per capita GDP	2.33	6.57	6.69	2.11
Labour input	2.57	1.89	1.12	0.07
Education	4.49	2.63	1.19	1.12
Quality adjusted labour input	4.87	3.23	1.72	0.63
Non-residential capital	7.72	7.73	9.57	5.03
Labour productivity	1.78	5.85	6.67	2.46
Capital productivity	-3.09	0.11	-1.56	-2.39
Capital per person engaged	5.02	5.73	7.97	4.38
Total factor productivity	-1.37	2.95	3.32	0.36
Export volume	2.6	14.42	13.17	4.09
	US		South Korea	
	1952–78	1978–2003	1952–78	1978–2003
Population	1.34	1.07	2.21	1.06
GDP	3.61	2.94	8.63	6.68
Per capita GDP	2.24	1.85	6.28	5.56
Labour input	1.12	1.10	3.40	1.75
Education	1.12	1.20	3.13	3.13
Quality adjusted labour input	1.69	1.61	5.02	2.15
Non-residential capital	3.39	3.23	10.89	10.24
Labour productivity	2.47	1.82	5.05	4.85
Capital productivity	0.22	-0.38	-2.05	-3.22
Capital per person engaged	1.85	1.81	8.77	8.05
Total factor productivity	1.28	0.69	1.48	0.93
Export volume	5.19	5.91	26.1	11.2

Source: Maddison (2007b), p. 68.

particularly sharp deceleration. Japan operated nearer to the technological frontier, and government policy had pushed investment to a point of diminishing returns (see the Japanese capital output ratios in Table 3b; see also Figure 2 which compares British and Japanese growth experience).



The Asian surge spreads to China and India

In 1952–78, per capita GDP growth in China and India was well below the Asian average. In both cases, domestic policies bore some of the responsibility.

In China, the establishment of the People’s Republic brought a sharp change in the political elite and mode of governance (bigger than the Meiji shake-up in nineteenth century Japan). The degree of central control was much greater than under the Ch’ing dynasty or the Kuomintang. Landlords, and national and foreign capitalist interests were eliminated by expropriation of private property and there were minimal links to the world economy. The political changes had substantial costs. China’s version of communism involved risky experimentation on a grand scale. Self-inflicted wounds brought the economic and political system close to collapse during the Great Leap Forward (1958–60), and again in the Cultural Revolution (1966–76) when education and the political system

were deeply shaken. Allocation of resources was extremely inefficient. From 1952 to 1973 the US applied a comprehensive embargo on trade, travel and financial transactions, and from 1960 onwards the USSR did the same. China grew more slowly than other communist economies and somewhat less than the world average. Nevertheless, economic performance was a great improvement over that of the past. GDP trebled, per capita real product rose by more than 80%. After 1978, Chinese economic performance surged at a similar pace to that attained earlier in Japan, and this surge is likely to last much longer, as China operates much further from the technological frontier.

In India, from 1952 to 1978, per capita GDP grew by 1.7% per year, faster than in colonial times, but below potential, because Nehruvian policies involved high levels of public investment in heavy industry and detailed controls on the private sector. The Gandhian heritage placed great emphasis on self-sufficiency. These policies were modified somewhat and per capita growth rose to 2.6% a year in 1978–90. Policy became substantially more liberal while Manmohan Singh was minister of finance from 1991 to 1996. He has been Prime Minister since 2004 and has given a further boost to expansionist policies. He greatly reduced the degree to which economic activity was constrained by official permits and encouraged the inflow of foreign investment. As a result, per capita GDP rose by an average of 3.9% per year from 1990 to 2003 and accelerated to 6.5% in 2003–06, coming close to the growth performance of China.

It seems clear that the catch up surge in Asia's two biggest economies is likely to continue, as it is based on high levels of investment in physical and human capital, increased exposure to world trade, receipt of foreign investment and accelerated transfer of technology. In India the period of super-growth has been much shorter than in China; its levels of education are lower; its infrastructure of roads, railways, ports and electricity is weaker; labour market flexibility is less because of government regulations and caste barriers; and its exports are only one-eighth of the Chinese. However, Indian per capita GDP is only half of that of China, so its catch up potential seems very promising. Table 6 shows the impressive rise in Asia's share of world income and its likely continuance to 2030 and beyond.

Table 6: Shares of world GDP, 1820–2030

	1820	1950	1973	2003	2030
Western Europe	23.0	26.2	25.6	19.2	13.0
US	1.8	27.3	22.1	20.7	17.3
Other Western offshoots*	0.1	3.4	3.3	3.1	2.5
West	25.0	56.8	50.9	40.4	32.8
China	32.9	4.6	4.6	16.8	23.8
India	16.0	4.2	3.1	6.1	10.4
Japan	3.0	3.0	7.8	6.1	3.6
Other Asia**	7.4	6.8	8.7	13.6	15.4
Latin America	2.1	7.8	8.7	7.7	6.3
Eastern Europe & former USSR	9.0	13.1	13.8	6.1	4.7
Africa	4.5	3.8	3.4	3.2	3.0
Rest	75.0	43.2	49.1	59.6	67.2
Asia as % of world	59.3	14.9	24.2	42.6	53.3

* Australia, Canada and New Zealand; ** includes Bangladesh & Pakistan from 1950
Source: Maddison (2007a)

The prospects for the world economy to 2030

As there has been such a striking divergence in the pace and pattern of growth in different regions of the world in the past 30 years, it is worth considering the changes which seem likely in the next quarter century. Futurology is a more speculative business than history. Hard evidence is lacking and we have to project trends from the past which seem plausible but may well be reversed by unforeseeable events.

My projections have two components: growth of population and per capita GDP. The GDP projection is derivative. I assumed that world development will not be interrupted by major military conflicts in addition to those already under way.

Projections of population

Table 7 shows the population growth from 1 AD and projections to 2030. For 1950 onwards the estimates are from the International Programs Department, US Bureau of the Census (www.census.gov/ipc).

The Western share of world population dropped sharply after 1950. The composition of the population changed a good deal over time. From 1000

Table 7: Population of the world and major regions, 1–2030 AD (millions)

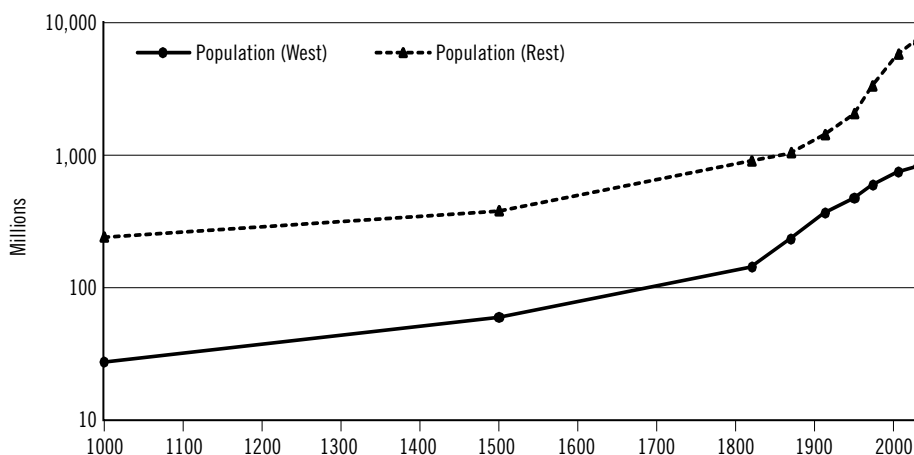
	1	1000	1500	1820	1950	1973	2006	2030
Western Europe	25.1	25.6	57.3	133.0	305	359	397	400
US	0.7	1.3	2.0	10.0	152	212	298	364
Other Western offshoots*	0.4	0.6	0.8	1.3	24	39	57	67
West	26.2	27.4	60.1	144.3	481	609	753	831
China	59.6	59.0	103	381	547	882	1,311	1,458
India	75.0	75.0	110	209	359	580	1,095	1,421
Japan	3.0	5.2	15.4	31	84	109	127	116
Other Asia	31.8	43.4	55.4	89	393	678	1,329	1,795
Latin America	5.6	11.4	17.5	21.6	166	308	562	702
Eastern Europe & former USSR	8.7	13.6	30.5	91.2	268	360	409	402
Africa	17.0	32.3	46.6	74.2	228	390	911	1,449
Rest	199.7	239.8	378.3	898	2,045	3,307	5,744	7,343
World	225.8	267.2	438.4	1,042	2,526	3,916	6,497	8,175
West as % share of world	11.6	10.3	13.7	13.8	19.0	15.5	11.6	10.2

* Australia, Canada and New Zealand.

Source: www.ggdc.net/Maddison and Maddison (2007a).

to 1820, life expectation in the West rose from 24 years at birth to 36; it rose to 46 by 1900, to 67 by 1950, and to 79 in 2006. In the Rest it lagged behind, remaining at 24 from 1000 to 1820, rising to 26 by 1900, 44 by 1950 and 64 in 2006. There was also an earlier and greater increase in the level of education in the West.

Figure 3: World population growth, 1000–2030 AD (logarithmic vertical scale)



Population growth in the West was slower than in the Rest from 1900 onwards. Figure 4 shows the relative movements in greater detail from 1913 to 2006. It is clear that the deceleration was sharper in Western Europe than in the Western offshoots.

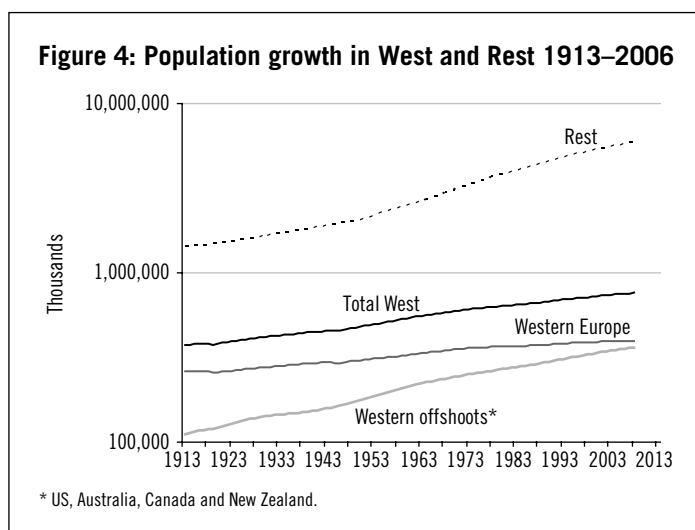
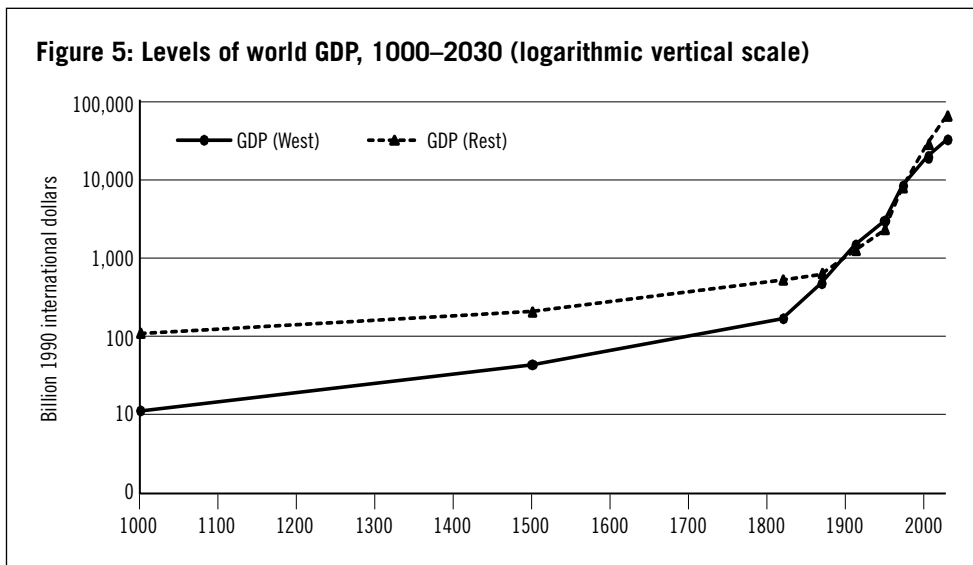


Table 8: Levels of GDP, world and major regions 1–2030 AD (billion 1990 international Geary Khamis PPP dollars)

	1	1000	1500	1820	1950	1973	2006	2030
Western Europe	14.43	10.93	44.18	159.85	1,396	4,097	8,473	12,556
US	0.27	0.52	0.80	12.55	1,456	3,537	9,266	16,662
Other Western offshoots*	0.18	0.23	0.32	0.95	180	522	1,388	2,414
West	14.88	11.67	45.30	173.35	3,032	8,155	19,127	31,632
China	26.82	26.55	61.80	228.60	245	739	7,928	22,983
India	33.75	33.75	60.50	111.42	222	495	2,888	10,074
Japan	1.20	3.19	7.70	20.74	161	1,243	2,864	3,488
Other Asia	14.97	21.38	31.32	51.72	363	1,387	6,450	14,884
Latin America	2.24	4.56	7.29	14.92	416	1,389	3,644	6,074
Eastern Europe & former USSR	3.52	5.44	15.15	62.58	696	1,487	2,870	4,508
Africa	8.03	13.84	19.38	31.27	203	550	1,557	2,937
Rest	90.53	108.71	203.14	521.25	2,305	7,868	28,202	64,948
World	105.40	120.38	248.45	694.60	5,337	16,023	47,329	96,580

* Australia, Canada and New Zealand.

Source: www.ggdc.net/Maddison and Maddison (2007a), p. 379.



Assumptions underlying the projections to 2030

For population the US Bureau of the Census has made individual projections for 224 countries (see www.ggdc.net/Maddison to which Table 7 refers). My projections of per capita GDP (see Table 9b) are much more aggregative. They cover major regions, and the five countries with the biggest shares of world GDP. They are not the result of an econometric exercise, but are based on an analysis of changes in the momentum of growth in different parts of the world economy and my assessment of the likelihood of their continuation or change. They were conceived as likely continuation or deviation from the momentum of growth in 1990–2003.

The West

For the advanced capitalist group, i.e. Western Europe, the US, the other Western offshoots and Japan, their aggregate per capita GDP is assumed to advance at the same pace as in 1990–2003. This does not mean that all component countries will have the same growth rate. The rapid and widespread catch up on US per capita income levels in the golden age (1950–73) had ended for most countries by the 1990s. France, Germany, Italy and Japan advanced more slowly than the US in 1990–2003, but Ireland made a remarkable bound forward, while Australia, Spain and the UK had

Table 9a: Comparative GDP performance of China, Russia, Japan, India and the US, 1990–2030

	(GDP levels in billion 1990 PPP dollars)					(China as percentage of)			
	Russia	Japan	China	US	India	Russia	Japan	US	India
1990	1,151	2,321	2,124	5,803	1,098	185	92	37	199
1991	1,093	2,399	2,264	5,792	1,112	207	94	39	204
1992	935	2,422	2,484	5,985	1,169	266	103	42	212
1993	854	2,428	2,724	6,146	1,238	319	112	44	220
1994	745	2,455	2,997	6,396	1,328	402	122	47	226
1995	715	2,504	3,450	6,558	1,426	483	138	53	242
1996	689	2,590	3,521	6,804	1,537	511	136	52	229
1997	699	2,636	3,707	7,110	1,611	530	141	52	230
2006	1,113	2,864	7,928	9,266	2,888	712	277	86	275
2015	1,300	3,116	12,271	11,467	4,665	944	394	107	263
2030	2,017	3,488	22,983	16,662	10,074	1,139	659	138	228

Source: 1990–2006 from www.gdpc.net/Maddison; 2015 and 2030 projections derived from Maddison (2007b).

Table 9b: Comparative per capita GDP performance of China, Russia, Japan, India and the US, 1990–2030

	(Per capita GDP levels in 1990 PPP dollars)					(China as percentage of)			
	Russia	Japan	China	US	India	Russia	Japan	US	India
1990	7,779	18,789	1,871	23,201	1,309	24	10	8	143
1991	7,373	19,355	1,967	22,849	1,299	27	10	9	151
1992	6,300	19,482	2,132	23,298	1,341	34	11	9	159
1993	5,752	19,478	2,312	23,616	1,390	40	12	10	166
1994	5,020	19,637	2,515	24,279	1,463	50	13	10	172
1995	4,813	19,979	2,863	24,603	1,538	59	14	12	186
1996	4,645	20,616	2,892	25,230	1,630	62	14	11	177
1997	4,717	20,929	3,013	26,052	1,680	64	14	12	179
2006	7,786	22,471	6,048	31,049	2,637	78	27	19	229
2015	9,554	24,775	8,807	35,547	3,663	88	36	25	240
2030	16,007	30,072	15,763	45,774	7,089	98	52	34	222

Source: 1990–2006 from www.gdpc.net/Maddison; 2015 and 2030 projections derived from Maddison (2007a).

a respectable degree of catch up. Labour input per head of population is generally lower in Western Europe than in the US, so the gap in performance is smaller in terms of productivity than in per capita GDP. This is due in part to shorter working hours and longer holidays, but in France, Germany and Italy unemployment rates were much higher than in the US and UK from 1990 to 2006. This contrasts with the situation in the golden age, when European unemployment rates were much lower than in the US. With more flexible labour market policies there would be some scope for better European performance (see van Ark 2006 and Gordon 2006).

Asia

In the past three decades, the biggest change in the structure of the world economy has been the increased share of Asia, which is likely to continue. China has been the most dynamic of the Asian economies, but growth will probably decelerate for several reasons. In the reform period, the emphasis on population control and changes in age structure made it possible to raise the activity rate to a degree that cannot be repeated. Because of the low starting point, the average educational level of the labour force was multiplied by a factor of six from 1952 to 2003. China has suffered environmental deterioration in its push for rapid growth. In future it will have to devote greater resources to mitigate this damage.

Income growth has lagged in rural areas and there has been a neglect of rural educational and health facilities. Bigger resources will be needed to compensate for this. Some slowdown can also be expected as Chinese wages rise and the average technological level gets closer to the frontier in the advanced countries. I assumed that per capita income will grow at an average rate of 4.5% per year between 2003 and 2030, but that the rate of advance will taper off. Specifically, I assume a rate of 5.6% per year to 2010, 4.6% between 2010 and 2020, and a little more than 3.6% per year from 2020 to 2030. By then, it will have reached the same per capita level as Western Europe in 1990. As it approaches this level, technical advance will be more costly as imitation is replaced by innovation. Even on my rather conservative assumptions, China would again become the world's biggest economy by 2015, the US would be number two and India number three. The average per capita income level in China would still be a good

deal lower than in the US, Western Europe and Japan, but it would be well above the world average.

Conclusions on the Malthusian interpretation of world development

In a recent issue of *World Economics*, Brian Snowdon (2008) reviewed Oded Galor's 'unified' theory of economic growth (see Galor 2005). I was surprised that Galor had drawn extensively on my database to illustrate an interpretation of world economic history so different from mine.

Galor assumes that within in the past 10,000 years, there was no growth in per capita income in the first 9,750 years. A 'Malthusian regime dominated...all of human history until we come to the Industrial Revolution'. 'The Malthusian regime describes a world in low-level equilibrium in terms of income per capita. Technological progress took place, but very slowly. The growth of total output was matched by population growth so that per capita income fluctuated around a low stable level, with no significant progress in average living standards.'

This was followed by a 'post-Malthusian' regime, when technical progress accelerated and there was the beginning of growth in per capita income. This was followed by a demographic transition which engendered a 'modern regime' where growth is faster and sustained. In this regime, parents invest in human capital, substituting quality for quantity of their offspring. Thus the Malthusian constraint eventually 'generates the necessary evolutionary pressure for the ultimate take-off'.

Galor's main interest is in his theory, which is both Malthusian and Darwinian. In his 'single dynamical system', 'steady-state equilibria are altered qualitatively in the process of development due to latent state variables that evolve behind the scene' and allow the economy to escape from the Malthusian equilibrium and 'gravitate towards a sustained growth regime'. As an example of masked behind-the-scene processes he refers to population growth and 'evolution of the distribution of genetic characteristics' which are causal elements in his schema.

Galor is an econometrician, whose theory is not derived from his own detailed measurement of change. His evidence is illustrative. In Galor (2005) it consists of 42 figures and 13 pages of algebra. He presents no tables. Twenty-one of his graphs are attributed to Maddison, but in all except two cases, these graphs are not mine, but are derived from tables

in Maddison (2001). The trouble with these 19 graphs is that they have an arithmetic vertical scale, and are misleading when presenting rates of change over 2000 years. I use a vertical logarithmic scale to illustrate proportionate change in per capita income. My graph (left of Figure 6) shows a significant but slow rise in Western per capita income between 1000 and 1820 AD. His graph (right of Figure 6) is shaped like a half-opened jackknife with a sharp and sudden jump from flat to sharply vertical. Hence he makes no acknowledgement of the significant divergence between the momentum of growth in the West and the Rest in 1000–1820, and attaches far too much importance to the stereotyped and poorly documented notion of an industrial revolution as a turning point in world growth.

As I explained at the beginning of this paper, I consider the achievement of the West between 1000 and 1820 to have been a long and necessary apprenticeship to modern economic growth, and am very sceptical of sudden take-off theories. This is not my only disagreement with Galor's theory, which attributes too much importance to population change and recent Darwinian modifications in human intelligence.

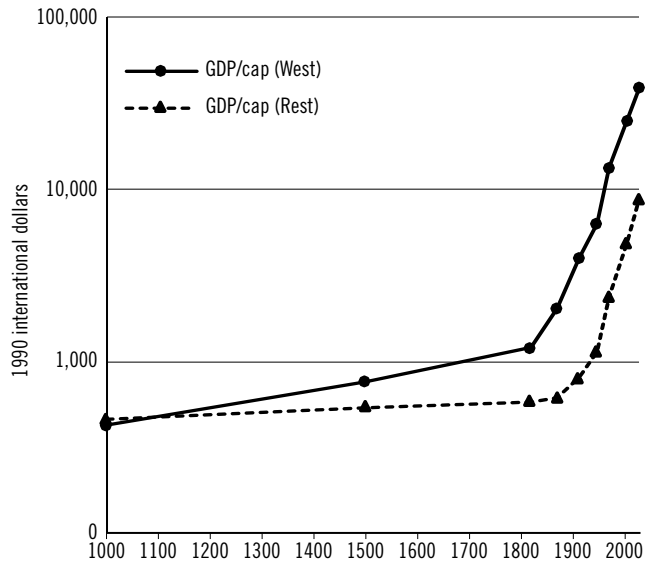
I think Galor's theory of growth could be improved if he looked more carefully at my quantitative estimates and used graphs with a logarithmic rather than an arithmetic scale.

I think he should consider the work of Adam Smith on the period 1500 to the latter part of the eighteenth century. Smith (1776/1776) had a fairly euphoric view of this period and had scrutinised world economic performance more carefully than the lugubrious Malthus. He argued that the discovery of the Americas and southern route to Asia had opened up new and significant opportunities for economies of scale and specialisation in Western Europe through international trade. He did not quantify growth performance explicitly, but arrayed countries in descending order of achievement. For him, the Netherlands, France and the American colonies had shown a better growth performance than China, Bengal and Africa. For him policies and institutions were a major reason for inter-country variance in performance.

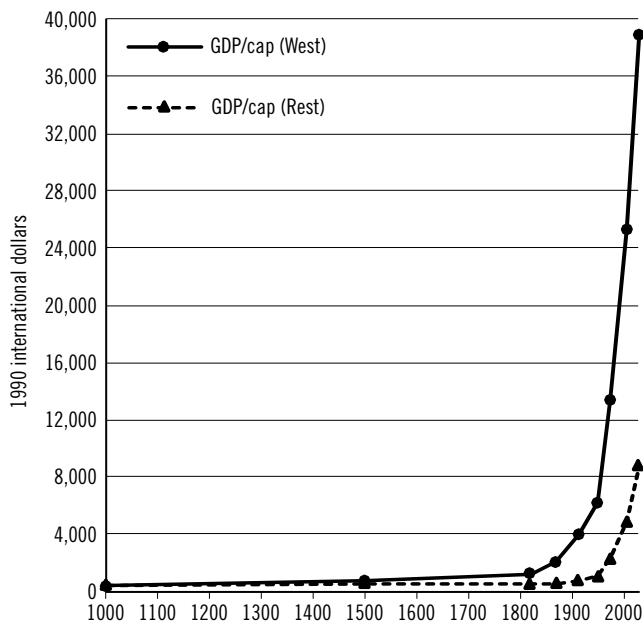
Galor is a subtle theorist, and more open-minded than economists like Bradford DeLong (2000) and Gregory Clark (2007) who are more dogmatic Malthusians who are more casual about the evidence of long term stagnation before 1800. He should modify his position in line with the evidence I have provided.

Figure 6: Confrontation of Maddison and Galor style of interpreting per capita growth, 1000–2030 AD

(a) Logarithmic scale



(b) Arithmetic scale



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Table A1: Percentage distribution of Gross Domestic Product at current prices, 1950–2006

	1950			2006		
	Agriculture	Industry	Services	Agriculture	Industry	Services
Austria	17.8	49.6	32.6	1.7	30.7	67.6
Denmark	21.0	36.0	43.0	0.9	24.2	74.9
Finland	25.9	40.3	33.8	2.5	32.3	65.1
France	14.7	47.3	38.0	2.0	20.8	77.2
Germany	10.4	49.8	39.8	0.9	29.4	69.7
Italy	25.3	33.3	41.4	2.0	27.4	73.7
Japan	25.7	29.7	44.6	1.4	28.7	69.9
Netherlands	14.2	39.8	46.0	2.2*	24.1*	73.7*
Norway	15.1	31.7	53.2	1.5	45.1	53.4
Sweden	10.7	43.3	46.0	1.3	28.5	70.2
UK	5.8	45.5	48.7	0.9	22.9	76.2
US	7.0	38.8	54.2	1.2*	22.8*	76.0*
Average	16.1	40.4	43.4	1.5	28.1	70.4

* 2005

Sources: Maddison. 'Economic Growth and Structural Change in the Advanced Countries' in Leveson, L. & J. W. Wheeler (eds), *Western Economies in Transition*, Boulder, Colorado: Westview Press, and London: Croom Helm, pp. 41–60; OECD, *National Accounts of OECD Countries, 1950–1968*, and *National Accounts of OECD Countries*, volume 1, *Main Aggregates, 1995–2006*, Paris, 2008. Agriculture includes farming, forestry and fisheries; industry includes manufacturing, mining, construction, utilities and energy production; services are a residual covering all other economic activity, private and governmental, including military.

Table A2: Structure of employment: percentage share of agriculture (I), industry (II), services (III)

	1870			1950			2003		
	I	II	III	I	II	III	I	II	III
Australia	30.0	38.0	32.0	14.6	36.5	48.9	4.0	21.0	75.0
Austria	65.0	19.2	15.8	34.0	35.4	30.6	5.6	29.4	65.0
Belgium	43.0	37.6	19.4	10.1	46.8	43.1	2.3	25.1	72.6
Canada	53.0	30.0	17.0	21.8	36.0	42.2	2.8	22.4	74.8
Denmark	51.7	n.a.	n.a.	25.1	33.3	41.6	3.0	23.8	73.2
Finland	71.2*	9.7	19.1	46.0	27.7	26.3	5.0	26.0	69.0
France	49.2	27.8	23.0	28.3	34.9	36.8	3.2	23.9	72.9
Germany	49.5	28.7	21.8	22.2	43.0	34.8	2.5	31.7	65.8
Italy	62.0	23.0	15.0	54.4	28.6	26.0	4.9	31.7	63.4
Japan	72.6**	n.a.	n.a.	48.3	22.6	29.1	4.6	28.8	66.6
Netherlands	37.0	29.0	34.0	13.9	40.2	45.9	3.0	20.2	76.8
Norway	53.0	20.0	27.0	29.8	33.2	37.0	3.7	21.4	74.9
Sweden	53.9***	n.a.	n.a.	20.3	40.8	38.9	2.1	22.7	75.2
Switzerland	49.8	n.a.	n.a.	16.5	46.4	37.1	4.1	23.9	72.0
UK	22.7	42.3	35.0	5.1	46.5	48.4	1.2	23.5	75.3
US	50.0	24.4	25.6	13.0	33.3	53.7	2.5	21.4	76.1
Average	51.0			24.7	36.6	38.7	3.4	24.8	71.8
	48.8****	27.5****	23.7****						

*1880

**1872

*** assumes that half the living-in rural domestic workers were engaged in agriculture

**** excludes Denmark, Japan, Sweden and Switzerland

Last column, Netherlands and US, are for 2002

Sources: 1870 from P. Bairoch and Associates (1968) *The Working Population and its Structure*, Université Libre de Bruxelles; ILO *Yearbooks*, national sources, and OECD, *Labour Force Statistics*, various issues. Sector coverage as in Table A1.

