

Macromasurement Before and After Colin Clark *

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by

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National accounts are an indispensable tool for assessing the growth potential and performance of contemporary economies. They are fundamental in international comparison of development levels. They have become an important tool of analysis for quantitative economic historians. They are sometimes considered too “modern” to be applicable to the distant past. In fact, national accounting, international income comparisons, and historical demography originated in the seventeenth century, when “the art of reasoning by figures on things relating to government” was called Political Arithmetick.

The 17th Century Political Arithmetic

The pioneer was **William Petty** (1623-87), a major figure in the scientific revolution of the seventeenth century. He was research assistant to the philosopher Thomas Hobbes in Paris in the 1640s, Professor of Anatomy in Oxford and organiser of the cadastral survey of Ireland after the Cromwellian conquest in the 1650s, one of the founders of the Royal Society in the 1660s, inventor, cartographer, economist, entrepreneur and founder of a wealthy dynasty. *Verbum Sapienti* (1665) presented his estimates of population, income, expenditure, stock of land, other physical assets and human capital in an integrated set of accounts for England and Wales. They were intended to provide a quantitative framework for effective implementation of fiscal policy and mobilisation of resources in time of war (the second Anglo-Dutch war of 1664-7). In fact, these accounts (see Table 1) are a precursor of the growth accounts developed in the 1960s by Ed Denison (1962, 1967, 1993).

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Political Arithmetick (1676) was a comparative study of the economic performance of the Netherlands and France, using key indicators to demonstrate Dutch superiority. The French population was ten times the Dutch, but the Dutch merchant fleet was nine times as big, its foreign trade four times as big, its interest rate half the French level, its foreign assets large, those of France negligible. The Dutch economy was highly specialised, importing a large part of its food, hiring mercenaries to fight its wars, concentrating its labour force in high productivity sectors. High density of urban settlement, good ports and internal waterways reduced transport and infrastructure costs, cheapened government services and reduced the need for inventories. Property rights were clear and transfers facilitated by maintenance of registers. An efficient legal system and sound banking favoured economic enterprise. Taxes were high but levied on expenditure rather than income. This encouraged savings, frugality and hard work. The Dutch were a model of economic efficiency with obvious lessons for English policy, whereas popular notions of French power were greatly exaggerated.

Both these works were circulated in manuscript in Petty's lifetime, and published posthumously, in 1690 and 1691. Their publication sparked renewed interest in political arithmetic.

The second major contribution came from **Gregory King** (1648-1712), in reaction to Charles Davenant's (1694), *Essay upon Ways and Means of Supplying the War* (war of the League of Augsburg, 1688-97). **Davenant** (1656-1714) had literary talent as a clear expositor of economic issues (his father was poet laureate, and he was reputed by some to be the grandson of William Shakespeare). As former commissioner of excise when tax collection was taken out of the hands of tax farmers, he was able to present a first consolidated and transparent picture of the government's actual and potential revenues and expenditure. King was impressed by the possibilities of using fiscal information for macroeconomic analysis. He established a close relationship with Davenant who quoted his work in detail and called him "that wonderful genius and master in the art of computing". Publications on sensitive matters of public policy required an official license, and exposed the author to sanctions of official disapproval. King preferred to avoid this risk, circulated copies of his manuscript accounts for comment to Davenant, **Robert Harley** (1661-1724) and others, but did not publish them. Unlike Davenant who was a well connected member of parliament, King was a cautious public servant in course of moving from the antiquated world of heraldry to more lucrative employment as Commissioner of Public Accounts. Harley was later Chancellor of the Exchequer and effectively Prime Minister under Queen Anne.

King's work in this field was intense from 1695 to 1700. His *Natural and Political Observations and Conclusions on the State and Condition of England* (1696) presented his results in highly concentrated

form, but his 300 page *Notebook* (published in facsimile form by Laslett, 1973) provides an understanding of his meticulous procedures and the sophistication of his analysis. King's *Observations* was first published in complete form by George Chalmers in 1802 as an annex to his book on the *Comparative Strength of Great Britain*. This sparked the interest of **Patrick Colquhoun** (1745-1820) who exploited new sources of information (the first two censuses and the first income tax accounts) to replicate King's income account, and a more comprehensive production account showing value added for 1812. However, King's *Notebook* did not surface until 1917, and was first explored by David Glass in 1965. It is a treasure trove which deserves to be mined more thoroughly by quantitative historians.

The modern standardised system of national accounts provides a coherent macroeconomic framework covering the whole economy, which can be crosschecked in three ways. From the income side, it is the total of wages, rents and profits. It is also the sum of final expenditures by consumers, investors and government. From the production side, it is the sum of value added in different sectors-agriculture, industry and services, net of duplication. The framework can be expanded to include measures of labour input and capital stock, labour and total factor productivity.

King had four dimensions to his accounts which anticipated this modern system of interrelated balances: a) the best-known is his income account which depicts the 1688 social hierarchy, showing 26 types of household, their number, average size, income and expenditure, savings or dependency on social transfers, and type of economic activity. In constructing it, King drew on 30 years experience in the Herald's office, making visitations to various parts of England to examine credentials of succession to aristocratic titles, the status and social standing of people who accounted for about two-thirds of national income. As a commissioner for the graduated poll tax on births, deaths, and marriage which came into force in 1695, he had access to a great deal of new information on the structure of incomes. The hearth tax was a further guide to the number of households and their average size; b) his second account showed the structure of demand - government spending and consumer expenditure by type of product (43 items, see Table 2) - based on information derived from land and excise taxes for food, drink and tobacco, and a special survey he made for clothing and textiles. In *Observations* this account is very summary, but it is clear from the *Notebook* that his aggregate was the fruit of detailed estimation, and contains enough information to provide an approximation to the modern notion of gross domestic product. Table 2 shows my version of King's account which I augmented from his *Notebook* to correspond to the modern concept of gross domestic expenditure. Colin Clark (1937, p. 219) also augmented King's account using detail available on consumption items and the total from King's income account in *Observations*. His total is

smaller than mine (£49 instead of £54 million), because he shows taxation and saving instead of government expenditure and capital formation, and he did not know the existence of King's *Notebook*; c) King's supply side account, showing production, was incomplete. It showed value added in farming (crops and livestock) and forestry. His *Notebook* provides detailed quantification of many other items—textiles, value added in the paper industry, a breakdown of material inputs and labour costs in construction and shipbuilding. It shows expenditure on furniture, ceramics, pottery, glass, tools and transport equipment which can be converted into production estimates, with adjustment to deduct material inputs, transport and distributive margins; d) a fourth dimension was his consolidated wealth and income account for 1688. This resembled Petty's account for 1665 (see right panel of Table 1), showing property and labour income, the capitalised value of physical assets and of human capital. Their methods for capitalising physical assets were similar, but quite different for labour. Petty capitalised the value of labour income at the same rate as physical assets (16.7 years purchase). King assessed the market value of the whole population as if they were slaves or horses, differentiating in detail by age and sex. Thus he attributed a positive value to the potential labour income of young children as "the prospect of future usefulness has an intrinsic value in like manner as an estate in reversion after a determinate term of years". His procedure is shown in his *Notebook*, pp. 244-5 and 248.

King had a fifth account which compared levels of per capita consumption, public expenditure and revenue in England, France and Holland in 1688 and in 1695 in order to demonstrate differences in capacity to mobilise resources for war. It also contained a forecast of English national income to 1698. The estimates for France and the Netherlands were in most respects very rough, and he did not discuss the problem of measuring changes in the volume of output over time or adjusting for differences in the purchasing power of currency in making international comparisons.

Political arithmeticians as pioneers of demography

The first serious demographer was **John Graunt** (1620-74), a close friend of Petty. Graunt's *Observations on the Bills of Mortality* published in 1662 involved a meticulous assemblage and adjustment of a very large weekly and annual database on burials and christenings in London for 1603 onwards. For 20 years he had data on causes of death, broken down by 81 categories. He had access to returns of a partial census for 1631 which provided a benchmark for his growth estimates.

Graunt distinguished the regular pattern of chronic ailments from epidemics. Plague was endemic but recurred at irregular intervals. The worst year was 1603, when it caused 82 percent of deaths. He had no direct information on age at death, but constructed a rough proxy by grouping illnesses which affected

infants and children, and those associated with old age. He constructed a crude survival table which showed 36 percent mortality for those aged 0-6, with only 3 per cent surviving beyond age 66. This was the ancestor of life tables, and attracted wide interest in England, France and Holland where life annuities and tontines (a lottery on life expectation invented by Lorenzo Tonti in 1652) were part of the public debt. **Edmond Halley** (1656-1742) improved on Graunt's crude analysis of life expectation and articulated the fundamental mathematical principles of life insurance in (1693) "Degrees of Mortality of Mankind; with an Attempt to ascertain the Price of Annuities", *Philosophical Transactions of the Royal Society*.

In confronting data on London burials and christenings, Graunt found that burials were bigger. By comparison of the average discrepancy between births and deaths, he concluded that there was net immigration from small towns and rural areas of about 6,000 persons a year. As a crosscheck, he analysed annual data for Romsey, a town near Southampton. Over 90 years there was a net increase of 1,059 persons, of which 300 remained in Romsey, 400 emigrated to the Americas and 300-400 emigrated to London. In the third edition, in 1665, Graunt extended the analysis of country towns to Tiverton in Devon and Cranbrook in Kent, which confirmed the Romsey/London differentials.

As births were rising substantially over time, it was clear that the population was growing, and the growth of the housing stock corroborated this. Using inferences about age structure and likely fertility in conjunction with his other material, he suggested that London had grown two and a half fold in the previous 56 years.

Graunt concluded that the population of England and Wales was 14 times as big as that of London. His multiplier was derived from several indicators, i.e. London's share of the tax burden; cartographic analysis of the area of different parts of the country, likely density of settlement, the average size of parishes.

Prior to Graunt, nobody had thought of using the mortality bills to reconstruct the demography of London. His meticulous inspection of data, adjustments for coverage, the caution and modesty with which he explained his carefully structured inferences and techniques of analysis are the foundation of modern historical demography, and he clearly belonged to the pantheon of seventeenth century science.

Gregory King made a significant improvement on Graunt's estimate of the population of England and Wales. He had much more information for areas outside London. He had the hearth tax returns on the number of houses (1 million rural and 300,000 urban). From Davenant (1694) he had evidence from the chimney tax on house occupancy. He organised mini-censuses for Lichfield, Harfield and Buckfastleigh as a crosscheck on household size. His estimate of family size was smaller than Graunt's. He found an

average household of 4.23 persons, but this included domestic servants, apprentices and unmarried farm labourers who lived in. Deducting these the average family size was 3.8 persons.

King's estimate of the population of England and Wales in 1695 was 5.5 million, significantly lower than Graunt's 6.4 million, but virtually identical with the estimate of Wrigley *et al.* (1997) in their detailed reconstitution of English demographic history 1580-1837 using the sophisticated techniques and massive computing power of modern demography.

King also made an estimate of world population in 1695, based on a calculation of the surface area of the globe, the proportion of land in the total and the likely density of settlement on different types of land (see Table 6). His world total in the *Notebook* was 626 million, much closer to my 604 million for 1700 than Petty's estimate of 320 million in his day or Riccioli's (1672) estimate of 1 billion.

The 18th Century Onwards

From the beginning of the eighteenth century to the 1930s, there were about thirty attempts to measure national income in Britain. There were significant differences in their coverage and methodology. Most concentrated on the income dimension without crosschecks from the expenditure or production side. Most were spot estimates for a given point of time and it was difficult to link them to measure economic growth, as there was only a limited and belated effort to develop appropriate price deflators (see Colin Clark, 1937). Nevertheless, these estimates are still very useful to quantitative economic historians. Thanks to detailed scrutiny by Phyllis Deane (1955-7) they provided a starting point and inspiration for pioneering studies of British economic growth by Deane and Cole (1964), Feinstein (1972), Matthews, Feinstein and Odling-Smee (1982) and Crafts (1985). The retrospective estimates of this new generation of quantitative historians are generally based on the modern international standardised system of national accounts.

Between 1800 and the first world war, the statistical basis for macroeconomic measurement improved a good deal in Europe, North America and the Antipodes. Population censuses provided a much better basis for demographic analysis. Statistical offices collected data on trade, transport, fiscal and monetary matters, employment, wages and prices. There was an increasing array of information on commodity output in agriculture, mining and manufacturing. Index number techniques were developed which would have made it possible to measure temporal change and inter-spatial variance of complex aggregates.

Although there was a proliferation of national income estimates, there was little improvement in their quality or comparability. They generally concentrated on the income dimension with no crosschecks on the expenditure and production side. They provided little help for serious analysis of economic growth, and there were significant differences in their coverage and methodology.

Michael Mulhall (1836-1900) made the first serious contribution to international comparison of levels of performance. Mulhall was Irish, educated in Rome, and spent his early working life as a journalist in Argentina. He published four major books between 1880 and 1896, drawing on census, trade, and commercial information to demonstrate developments in the world economy. His *Industry and Wealth of Nations* (1896) was devoted entirely to providing consistent comparisons of national output and wealth. He made his own intertemporal estimates of national output on a standardised basis in nominal terms (see Table 5). He gave detailed sources and a mass of carefully structured statistical material in comparative form for 22 countries representing about 60 per cent of world product in 1894-5. He referred to other national income estimates where available, but used his own standard rules of thumb to assess value added for all countries. He also provided standard guidelines for his measures of national wealth. His methods were simple and described transparently. To determine total value added, he divided each national economy into 9 sectors, estimated gross output in each sector, and to avoid double counting, deducted inputs as specified in Table 4.

His coverage of Europe and Western offshoots was pretty comprehensive, but for the rest of the world was confined to Argentina and South Africa. He provided current price estimates of the level in income in eight countries at dates ranging from 1812 to 1895. His cross-country comparison for 1894-5 was at current prices (in £ sterling) using exchange rates.

Mulhall had a powerful influence on Timothy Coghlan (1855-1926), the government statistician for New South Wales who made the first official estimates of national income for the *Seven Colonies of Australasia* which were published regularly from 1886-1905.

Colin Clark (1905-89)

Apprenticeship and Career Objectives

Colin Clark is a leading figure in the history of macroeconomic measurement. His hero was William Petty, the founder of the discipline. Like Petty, he began as a scientist, was self-taught in economics, had the same restless energy and creative imagination, self-confidence and showmanship. Like Petty his brilliance and originality were clear at an early age. He also had multiple ambitions as a

scholar, politician and public servant. As a student in Petty's old college in Oxford (1924-8), he took his degree in chemistry which included a year's research in physics. He was active in the Labour Club, became a Fabian socialist, and was active in labour politics, seeking election as a Labour member of parliament in the general elections of 1929, 1931 and 1935. He lost the elections, but was able to operate in the corridors of power in Labour administrations in Whitehall in 1930-31 and in Queensland in 1938-52. By the 1950s, his political views had completely changed. Petty also switched his political allegiance, being a high level public servant and member of parliament under Cromwell, and later a confidante of Charles II.

Clark's father James (1855-1927) was born near Aberdeen and emigrated to Australia in 1878, he was one of the first settlers in Townsville (in Northern Queensland) and later a businessman in Brisbane. He became prosperous exporting wool and meat to Japan. Later he moved to South Africa where he married Marion Jolly (1880-1942). They returned to London in 1905, and moved in 1910 to farm near Plymouth. Colin Clark was the first of their four children.

In Oxford, his two mentors in economics were **G. D. H. Cole** (1889-1959), a leading Labour intellectual, who was later professor of Social and Political Theory in Oxford, and **Lionel Robbins** (1898-1984), who had been a socialist and whose views were changing in the direction that Clark took later. In his autobiography (1971, p. 119), Robbins recollected Clark's regular attendance at the meetings of the Adam Smith discussion society, where "Colin Clark, then a chemistry scholar at Brasenose, somewhat disillusioned with his subject, would appear with large sheaves of statistical matter, worked up in his spare time, to illuminate and bring down to earth the theoretical discussions of his fellow members".

Clark's first job, in October 1928, on Robbins' recommendation, was as research assistant to **Allyn Young** (1876-1929), an American economist who had just left Harvard for a special chair created for him at the London School of Economics. Their association was brief as Young died of influenza in early March 1929. Clark also interacted briefly with Young's pupil, George Jones (1902-1929), who was killed in a motor accident in Rouen. Clark edited Jones' comparison of US and UK industrial size and efficiency (*Increasing Return*), and saw it to publication in 1933. Their influence on Clark's analytical approach and vocabulary was profound. Young (1928) thought increasing returns (economies of scale) were the main cause of higher labour productivity in the USA than the UK. Clark persisted in emphasising the importance of "increasing returns" rather than investment as a causal

factor in economic growth. He also measured economic “progress” in terms of national income per hour worked rather than per head of population.

However, Clark was not, at least in retrospect, an unconditional disciple of Young. In a letter of December 1972, he wrote: “One of Young’s ideas which certainly startled his audiences, was that what Britain needed was a population of 100 million; this would facilitate the sub-division of processes and raise productivity almost to an American scale. I regard it as a characteristic Americanism on Young’s part that he always thought of the internal market, and that it did not occur to him that a country could obtain economies of scale by working for a world export market”. He considered Jones’ analysis more subtle, as it differentiated scale economies at the firm and industry level (see Clark, 1977).

From March 1929 to March 1930, he worked on the *New Survey of London Life and Labour*, as assistant to William Beveridge, and then in Liverpool on the *Social Survey of Merseyside*, as deputy to Alexander Carr-Saunders.

In March, 1930 he was appointed (at Cole’s suggestion) as statistical assistant to the National Economic Advisory Council, newly created by the 1929-31 Labour administration. It was the first time a British government had created a body to provide it with professional advice on economic policy. The Council was presided by Prime Minister Ramsey MacDonald. It and its committees included several cabinet ministers, businessmen, a trade unionist (Ernest Bevin), an economic historian (R. H. Tawney) and economists (including G. D. H. Cole, Hugh Dalton, Maynard Keynes, A. C. Pigou and Lionel Robbins). Its work is described in detail in Howson and Winch (1977) who include a statistical memo written by Clark (pp.232-243). The government dithered in the face of the world economic crisis. The chancellor, Snowden, favoured the notoriously deflationary views of Montagu Norman (governor of the Bank of England, 1920-44). The Prime Minister favoured protection rather than devaluation. Forty years later, in the *Brisbane Courier Mail* (6/10/1971) Clark said “In that government the Prime Minister ought to have been in a mental hospital, the chancellor of the Exchequer was physically incapacitated and the Minister in charge of economic policy was a crook”. The only politician on the Council Clark respected was Ernest Bevin. In September 1931, MacDonald ditched his own party to form a National (coalition) government with the Conservative Party. Clark left the Council at that time to fight the October election as a Labour candidate for Wavertree in Liverpool. The results were devastating for his Party, whose representation fell from 287 to 49 seats (see Cole and Postgate, 1938, pp. 573-587).

In the Council, Clark had interacted closely with **Maynard Keynes** (1883-1946) and **A. C. Pigou** (1877-1959). They arranged for him to be appointed to a lectureship in statistics in Cambridge where he worked from 1931 to 1937 under the aegis of G. Udney Yule, the professor of statistics. He also acted as Keynes' statistical researcher. Clark had dining rights in Caius, but was not a fellow of the college. He had to augment his income by supervising students sent to him by Dennis Robertson and Joan Robinson and by economic journalism (*Trends*, a monthly set of economic indicators issued as a supplement to *Industry Illustrated*). His political prospects in England must have seemed pretty grim, his academic position was not well-paid, the excitement of working with Keynes had probably waned after the appearance of the *General Theory*, and there seemed little prospect then that his work on national income would have any impact on official statistics (see Patinkin, 1976, on Keynes' failure to press this issue), so he was looking for greener pastures.

In 1937-8, he took leave of absence in Australia and New Zealand to pursue his work on national income and to look for job possibilities with a Labour administration. He prepared the ground carefully with visiting university appointments in Melbourne and Perth, well-publicised lectures in Adelaide, Brisbane and New Zealand, and introductions to some leading political figures. In February 1938, James Brigden the economic advisor and highest-paid civil servant to the Queensland government, resigned at short notice. Forgan-Smith (a Scottish painter and decorator, who had emigrated to Australia in 1911, and was Premier 1932-42) offered the job to Colin Clark on the recommendation of Hugh Dalton and he took it up in May. When Clark resigned from Cambridge in 1938, he was replaced by David Champernowne, and Erwin Rothbarth took over his role as research assistant to Keynes.

Clark occupied a very influential position under three successive Labour Premiers of Queensland with whom he interacted closely (Forgan-Smith to 1942, Cooper to 1946, Hanlon to January 1952), but resigned in March after a few weeks under Premier Gair, with whom he had major policy differences. He was the economic and financial advisor, state statistician, and supervisor of major public works projects (the new campus of the University of Queensland, the Somerset dam, and the Storey Bridge). Queensland was the second biggest of the six states of the Australian Commonwealth. Its land area was 173 million hectares and population under a million in 1938. With abundant land and mineral resources, its long term development problems and opportunities were very different from those in the UK, which had half a hectare per head and a population of 47.5 million. The balance of political forces was also congenial to Clark. The Labour party was in power in Queensland

for 39 of the 42 years between 1915 and 1957. Catholics played a major role in the party and higher ranks of government and Clark was a recent convert. Clark's enthusiasm for Australia was expressed in a letter to Keynes in November 1941: "When you leave England for Australia you get a strange feeling you have somehow jumped ten years into the future, and when you come to Queensland you jump ten years further. Queensland is a predominantly rural and small enterprise economy, with a very equalitarian distribution of income and property, very generous social services, compulsory Trade Unionism, and all matters of wages hours and working conditions judicially controlled by the Arbitration court, which now has such prestige that both sides always accept its decision."

The immediate policy concern in 1938-9 was with measures to promote recovery from depression. Clark and Forgan-Smith favoured Keynesian expansionary stimuli, and were at odds with commonwealth policy-makers in Canberra (see Clark, 1958a, pp. 220-226 for a detailed analysis of commonwealth policy in the depression and the political background). The policy issues changed with the outbreak of war, and the vulnerability of sparsely settled Queensland to Japanese invasion strengthened Clark's enthusiasm for measures to disperse population and promote its growth.

In addition to these tasks, Clark was very active as a journalist, writing many articles on policy issues for the official monthly bulletin, *Economic News*, intended to explain government policy and influence public opinion. He produced annual estimates of the state's national income and interstate trade in the *Queensland Yearbook*. In 1942 he published *The Economics of 1960*, forecasting world population, product and terms of trade for agricultural and manufactured products for the next two decades. In 1947 he spent a month advising the newly independent governments of Sri Lanka and India. Between 1949 and 1952, he published a monthly *Review of Economic Progress* in preparation for the second edition of *Conditions of Economic Progress*.

In the course of his years in Queensland, Clark developed distinctive views as a rural utopian and social engineer. He argued that economics had a moral dimension. He emphasised the virtues of early marriage, large families and self-reliance, opposed the growth of taxation and the welfare state (see his 1945 article on the dangers of expanding taxation beyond 25% of national income). He advocated development of family or co-operative enterprise in rural areas and small towns, stressing the problems of transport congestion and diseconomies of life in large cities. He favoured a decentralised population based on primary and tertiary industries. He supported development of mining and coal exports from north Queensland, but opposed measures to provide tariff protection for manufacturing and subsidies to urban transportation. Putting his principles in action at the personal

level, he purchased a 10 acre plot in Kenmore, near Brisbane, in 1949, and developed it as a family farm, tending dairy cows, raising pigs and growing sugar cane with help from his wife and several of his 8 sons.

He was also deeply interested in interpreting Australia's social and political history. He felt that "Australian Catholicism had very little to offer in the way of social thought until comparatively recent years...many people who were actively Catholic in their private life, nevertheless filled their minds with Marxian ideas" (1958a, p.168). His analysis helped fill this gap and foreshadowed the programme of the Catholic Social Studies Movement led by his friend "Ben" Santamaria (1915-1998) and Archbishop Mannix (1864-1963). Clark felt that this "small body of zealous men saved the Australian Labour Party from becoming Communist-dominated" by its action in forcing a split in the Party in 1954-5. Clark, 1958a, pp.179, 230-245 contains a detailed analysis of these events, a harsh critique of the Labour leader, Evatt and a more muted complaint that his predecessor, Chifley, was "like many Irishmen outside Ireland, erratic in his religious practice and far too willing to condone Communist activities".

After his resignation as a public servant, Clark started to carve out an independent career in journalism and as a consultant. He did this with some success in 1952. He wrote more than 20 newspaper articles, made an advisory trip to Pakistan, and spent the latter half of the year consulting in Chicago and New York.

In 1953, he became Director of the Institute of Agricultural Economics in Oxford and stayed until 1969. There he published a third edition of *Conditions of Economic Progress* in 1957, then switched his interests. His analysis of socioeconomic problems and political forces in Australia appeared in 1958, *The Economics of Subsistence Agriculture* (with Margaret Haswell) in four editions between 1964 and 1970, and his strongly anti-Malthusian *Population and Land Use* in 1967. He articulated his libertarian views on the appropriate economic policy for advanced capitalist economies in two booklets *Welfare and Taxation*, 1954 and *Growthmanship*, 1962, and wrote many provocative and polemical book reviews in the Catholic weekly, *The Tablet*, between 1953 and 1968. He became a professorial fellow of Brasenose College in 1961, and in 1964 a member of the Commission on Population, Family and Birth which advised Pope Pius VI in drafting the Encyclical *Humanae Vitae* (1968), which rejected contraception, sterilisation and abortion.

Clark made it clear in an interview published in the Brisbane *Courier Mail* (9/1/1962), that he was impatient to return to Australia, and had made several unsuccessful attempts to find an academic

post. In 1969, he became a research fellow at Mannix (Dominican) College and Monash University in Melbourne. In 1978, he returned to his farm in Kenmore, and became an active “research consultant” in the Economics Faculty of the University of Queensland. The University gave him an honorary doctorate, and named the Faculty building after him on his death in 1989. In these last two decades in Australia, his main activity was journalism. He wrote about 400 articles on current events and policy options in Australia and elsewhere in the world. More than half appeared in monthly columns for the *Courier Mail* and the *Sydney Morning Herald*.

Main Contributions to Macroeconomics

(1) National Income Analysis and Measurement

In the 1930s, he worked on the definition and measurement of inter-temporal change in aggregate economic activity at the national level, in two pioneering books on the UK (1932 and 1937), with John Crawford on Australia (1938), and on Russia (1939). The estimates in the first two and the last have long been superseded. This is not quite the case for Australia (see Maddison, 2003, pp. 71-75).

His 1932 book helped Keynes to quantify his macroeconomic ideas (in moving from the *Treatise on Money* to the *General Theory*). When Keynes read it he wrote “My dear Colin, I think it is excellent. An enormous step forward. You have quite convinced me that gross output, gross investment, gross savings, etc. is the natural way to work and not the net, and I have been re-writing my definitions and equations on these lines”. Clark replied “Dear Maynard, This is really rather fascinating. It certainly beats physics” (see Keynes, vol. XXIX, pp. 58-9).

National Income and Outlay (1937) was a more ambitious and much more comprehensive study. It measured aggregate economic activity in three dimensions: income, expenditure, and production. Estimates were presented at current and constant market prices. He called his aggregate “national income”. It included depreciation and was what we now call GNP (gross national product). He suggested that a measure of “progress” should allow for inequality in the distribution of income and instability over time. However, he did not operationalise this complex concept. His primary indicator was a measure of productive power-income per head of the working population.

His basic calculations were for the years 1924, and 1929-36. He also provided quarterly figures for 1929 to mid-1936 (he was the first to do this). There was an analysis of income distribution and redistribution through taxation and transfer payments, industrial structure and sectoral value added,

cyclical movements in prices and production, the impact of changes in the terms of trade and income from abroad, and an estimate of the Keynesian “multiplier”.

His historical chapter explained in detail the derivation of English national income for 1688 by Gregory King (see King’s *Observations*, 1696), and his methods for estimating demographic change. He augmented King’s estimate to include the income of domestic servants (p. 219), whom King treated as members of their employer’s family, and made detailed estimates of price change to link 1688 with 1913. His analysis included a brief survey of English attempts to measure national income since Gregory King. Table 2 shows King’s estimate for 1688 with my adjustment. My aggregate is £54 million instead of Clark’s £49. I show government expenditure and capital formation instead of taxation and saving. However, his estimate would have been different had he known the existence of King’s *Notebook*.

Clark’s accomplishment was a major advance on Bowley & Stamp (1927). Their scope was confined to earnings and taxes in 1924. They concluded that home-produced real income per head was very nearly the same then as in 1911, and that there had been a 5 to 10 per cent fall when allowance was made for loss of foreign income.

The 1937 book demonstrated the importance of national accounts as a tool of economic policy and was useful to Keynes’ (1940) in formulating his proposals for wartime finance. It was the precursor of the official British national accounts, created by Meade and Stone in 1941. Clark’s depth of perspective, back to 1688, was influential in creating the Cambridge tradition of research on historical national accounts (see the work of Phyllis Deane and Charles Feinstein) in the Department of Applied Economics. The founder of the Department was **Richard Stone** (1913-91) whose lifelong devotion and massive contribution to macromasurement sprang from his early contact with Clark.

(2) International Comparisons in Space and Time

Clark’s *Conditions of Economic Progress* (1940) was his most important contribution to macromasurement. It was the first study to present comparable estimates of levels of real income across countries adjusted for differences in the purchasing power of currencies. These were linked to inter-temporal measures of GNP in real terms of the type he had previously produced. This created a framework for comparative analysis of performance in space and time which was to revolutionise the possibilities for comparative economic history, and analysis of problems of growth and development. Its value was greatly enhanced by his boldness and energy in filling “empty economic boxes”. He produced this monumental work single-handed, without research assistance in an era of slide rules and

adding machines. He adopted a maximalist approach to quantification, using more-or-less respectable estimates of income **level** for 30 countries and scraps of information on real wages for another 23.

He was the first to quantify the wide inter-country spread in real income per capita. Table 7 shows a range of 18:1 between the USA and East Africa. Since then the range of countries covered in such comparisons has been greatly extended and their quality has been improved by increased sophistication of measurement techniques, and a very large investment in collection of carefully structured evidence.

He also presented inter-temporal measures of economic **growth** in real terms. He used the estimates he had made for Australia, Russia and the UK and those of Kuznets for the USA. For the other countries he was in large degree dependent on other people's estimates. Given the limited range of research available at the time, and the absence of an international standardised system on the coverage and methodology of national accounts which Richard Stone produced in 1952, these intertemporal measures were weak. In several cases he had to make crude links between different and not always comparable "spot" estimates, and rely on some dubious deflators. He adjusted their coverage (by adding an imputation, where necessary, for direct consumption of farm produce) to conform to the criteria developed in his 1937 book. In 1940 he presented inter-temporal estimates for 16 countries. In later editions he was able to extend the coverage (28 countries in 1951, and 35 in 1957, see Table 12), and, exploiting the burgeoning literature on economic growth, improve their quality. Since Clark wrote, there has been an enormous increase in the number of countries for which inter-temporal estimates of real GDP growth are available, and virtually all his estimates have now been superseded. In Maddison (2003), I had estimates back to 1500 for 26 countries and from 1950 onwards for 179 countries.

In the 1940 edition, p. 56, Clark presented an estimate of world income level, the sum of his estimates for 50 countries for 1925-34. One might have expected him to provide a similar estimate in the two following editions, but he didn't.

He explained his approach and objectives in a pugnacious and iconoclastic introduction; "There is room for two or three economic theorists in each generation, not more. Only men of transcendental powers of reasoning can be candidates for these positions. The rest of us should be economic scientists, content steadily to lay stone on stone in building the structure of organised knowledge". The scientific approach he defined as "careful systematisation of all observed facts, the framing of hypotheses from

these facts, prediction of fresh conclusions on the basis of these hypotheses, and the testing of these conclusions against further observed facts”.

This manifesto echoed Petty’s preface to *Political Arithmetick*, written in 1676 and first published in 1690. Petty, a methodological disciple of Francis Bacon, said “instead of using only comparative and superlative words and intellectual arguments, I express myself in terms of number, weight and measure; use only arguments of sense, and consider only such causes as have visible foundations in nature, leaving those that depend upon the mutable minds, opinions, appetites, and passions of particular men to the consideration of others” (Hull, 1899, vol. 1, p. 244).

In the 1951 edition of his book, he apologised for his “unnecessarily violent language” in 1940. In penitent mood, he quoted St. Thomas Aquinas, and added a homily stressing the primacy of ethics over economics.

The 1940 book contained a very useful 28 page Summary and Conclusions. Unfortunately it had no counterpart in later editions.

a) Clark’s *International Unit*

He made several innovations in 1940. The most important was his “international unit” (IU), a measure of the purchasing power of national currencies in 1925-34 at 1925-34 prices. The term purchasing power parity (PPP) was first used by Gustav Cassel (1918), and Irving Fisher (1922) first presented his ideal (superlative) index number, but Clark was the first to marry and operationalise the two concepts. He used Fisher’s geometric index, with the USA as the reference country. Each of the other countries was linked to the USA in a series of binary comparisons of consumer expenditure, e.g. in a German/US comparison, the cost of the German consumption basket was measured at US prices and the US basket at German prices. The fact that his 1940 benchmark straddled a decade in which there were huge changes in prices and production was a significant weakness.

In the second and third editions (1951 and 1957), he switched to a 1929 benchmark and explained his binary procedure more carefully and clearly. Cassel had argued (on the basis of evidence for a few European countries) that exchange rates and PPPs tended to converge, which is certainly not the case if one looks at a wider range of income divergence. Clark did not compare his PPPs with exchange rates, but I have done this in Table 8 which shows the exchange rate deviation index (ERDI). One can see that the purchasing power of the currency in 1929 was greatest relative to the exchange rate in Czechoslovakia, Spain and Greece, and below the exchange rate in Australia, Norway, South

Africa and Switzerland. The range of variation went from .87 to 2.2. Later studies which cover a much wider range of real per capita GDP than Clark was able to do, show a wider spread. Kravis, Heston and Summers, 1982, pp. 12 show a 1975 ERDI varying from .79 in Denmark to 3.65 in Sri Lanka. Generally the highest ERDI were found in the poorer countries.

His price comparisons were derived from a survey made by the Ford Motor Company, together with his own estimates for luxury items, and ILO material on rents in different countries. In 1940, he did not show the structure of expenditure and derivation of his PPPs, but he did show these details in the 1951 edition (p.26) and in 1957 (p. 31). His method was similar to that in the OEEC comparisons of Gilbert and Kravis (1954), but his sources were much rougher. They knew much more about the structure of expenditure and used a carefully designed sample that also included investment and government spending.

OEEC comparisons of real expenditure levels and purchasing power covered only 8 of its member countries. Irving Kravis, Alan Heston and Robert Summers set up their International Comparisons Project (ICP) in 1968 and published three studies in 1975, 1978 and 1982. They made major methodological innovations (notably the introduction of the multilateral Geary-Khamis index), and expanded coverage to 34 countries in Europe, Africa, the Americas and Asia. ICP work was continued by the United Nations Statistical Office in 1980 and 1985 comparisons for 82 countries. UNSO then abandoned this work, but there are regional comparisons for Asian, African, and Middle Eastern countries by UN agencies for 1993, and OECD (2002) published 1999 level comparisons for 43 countries, including Eastern Europe and successor states of the USSR. This latest OECD exercise involved collection of prices for 2,740 items. For countries not covered in these studies the Penn World Tables (PWT) of Summers and Heston provide short-cut estimates based on limited information, which make it possible to get very full coverage of world income. In Maddison (2003) I used ICP estimates for 70 countries representing 93.8 per cent of world GDP and PWT estimates for 5.6 per cent (84 countries). For the remaining 0.6 percent (48 countries), I made proxy estimates.

Table compares his implicit per capita estimates to mine for 1925-34, using 1990 Geary-Khamis dollars as my international unit. My estimates of the relative standing of countries vis-a-vis the USA are generally higher than Clark's. Table 10 compares the 1929 ranking of per capita income in IUs in his 1957 edition, with my results for that year. My estimates are again generally higher than his, though the average differential is smaller.

In the 3rd edition Clark made a major innovation. He concluded that his “international unit” worked “reasonably satisfactorily in comparing economically advanced countries”, but “as we go down to lower real incomes, either examining the poor communities of the present day, or going backward in time, we find that the IU becomes less satisfactory as a unit,” because the price and consumption structure varied widely between rich and poor countries. He therefore introduced a new concept: the “**Oriental Unit**”.

The USA was the reference country for the IU in all his binary comparisons. For the OU, it was India. Measurement conventions for the OU were different: a) food products were valued at the farm-gate (excluding distributive margins which were included in the IU procedure); b) all government expenditure was omitted because he felt it did not contribute to welfare in poor countries, but was destined to maintain law and order and the corrupt interests of ruling elites; c) rent and imputed rent was hard to assess in most low-income countries, so it was assumed to add 6 per cent to income; d) labour productivity in personal and professional services was assumed to be the same in all countries.

He was able to construct detailed OU estimates for 26 countries (pp. 58-9), mostly for 1938 and 1950. Except for India most of these were higher-income countries for which he had made IU estimates. He made proxy OU measures for other countries using “scraps of statistical information which are the only indication we have of the level of economic development in such countries” (p, 22). This cocktail had been devised by the American agricultural economist, Merrill K. Bennett (1951) as a rough measure of variance in living standards. He used an unweighted arithmetic average of 19 per capita indicators, intended to show the ranking of countries rather than degrees of distance between them. Clark constructed a modified version using 16 indicators, all expressed relative to India. The 16 indicators were amalgamated using a partially weighted geometric average (with no differentiation in weights between countries).

Clark “calibrated” his detailed OU estimates for 26 countries against his variant of the Bennett index (p.65), and extrapolated the relationship to derive a per capita income ranking for 102 other countries, classified into 9 per capita income ranges (in Table XIX of Clark, 1957). His description of the procedure for estimating the Oriental Unit occupied a lot of space (pp. 19-24 & 50-70), but was difficult to follow. As he had no estimate of the absolute level of income in OUs, the figures were not additive, and could not be aggregated to make a world total. He did not make a direct confrontation of his estimates of per capita income in IUs and OUs for the countries where he had a direct measure of both. Table 11 makes such a comparison, but the nature of the relationship is not clear.

The OU experiment was not therefore very successful, but Clark foreshadowed some important issues which arose in the Kravis, Heston & Summers (1982) estimates. They also dropped distributive margins, and their treatment of “measurement-resistant” services was similar (see Clark’s comment on their manuscript to which they responded on pp.139-140, and my comment on KHS in Maddison,1983, p. 36).

b) Clark’s Denominator

A second distinctive feature of Clark’s approach was his denominator. He did not divide income by population. Instead he measured income per “occupied” person, further adjusted for hours worked, wherever possible.

As he wrote the first edition between 1935 and 1938 in an era of massive unemployment and there had been a big fall in working hours in the UK after the first world war, he felt that the per capita income measure used by Bowley and Stamp (1927) gave a misleading picture of economic performance and potential. He also felt the need to adjust for inter-country variance in census conventions. “In France, Germany and Russia for instance, all adult family members of peasant households were regarded as being engaged in agriculture, while in the USA and Canada only women in actual receipt of wages are so regarded” (p.33). He therefore adjusted census measures of the occupied population to eliminate unemployment and to exclude all females recorded as engaged in agriculture. He estimated intercensal movement in the occupied population by interpolation.

His stress on labour productivity eventually sparked off a vast research effort on international comparisons in this field, starting with Laszlo Rostas (1948). Measures of labour input became much more accurate (see Maddison, 1980a). International comparison of performance levels was based on real product PPPs rather than Clark’s expenditure PPPs (see Maddison and van Ark, 2000, for the history of these endeavours). This type of analysis was extended in the 1960s by Kendrick and Denison to cover total factor productivity

Although there were good reasons for what Clark did, there were large risks of error in international comparison of employment and working hours for 1925-34, and even bigger problems in carrying such adjustments back to the first half of the nineteenth century. He should have shown per capita estimates as well, which he eventually did in the 1957 edition.

Throughout the three editions, he continued to assume that the long-term trend in hours was consistently downwards. Since then, several authors-Boserup (1965) and Hayami (1977) for Asia, de

Vries (1994) and Voth (1998) for Western Europe-have argued that there was an intensification of labour input per person and per family before the nineteenth century.

c) *Clark's Three Sector Analysis*

A third distinctive feature of *Conditions*, was the analysis of comparative performance in three sectors: primary, secondary and tertiary. The latter term was borrowed from the New Zealander A. G. B. Fisher, who used it in a different sense. In the third edition Clark he dropped “tertiary” and referred to the “service” sector. In fact the service sector is a miscellaneous residual and the three-way breakdown is a convenient proxy for more disaggregated analysis of growth dynamics and the locus of technical progress (which Clark did not analyse).

He initiated the discussion (p. 176) by quoting what he called Petty's Law “There is much more to be gained by manufacture than husbandry, and by merchandise than manufacture....Now here we may take notice that as trades and curious arts increase; so the trade of husbandry will decrease, or else the wages of husbandmen must rise and consequently, the rents of lands must fall.” He did not identify the exact source and said it was written in 1691. In fact he was quoting Petty's description of the situation in the Dutch economy in *Political Arithmetick* (Hull, vol. 1,1899, pp. 256 and 267, written in 1676). Clark asserted that different levels of economic advancement were very closely associated with the proportions in which the working population is distributed and gives for 33 countries comparing the level of aggregate performance shown in Table 7 with the sector structure of the labour force (p. 179).

Clark continued to stress and sacralise the significance of the three-sector breakdown and structural change in interpreting economic growth. He gave extensive consideration to increasing returns in the secondary sector, echoing the views of his early mentor, Allyn Young, and, like him, discounted the importance of investment in economic growth. In the 3^d edition p. 490-1, he asserted, echoing Ricardo, that “agricultural processes, with one or two exceptions, must be carried out under a Law of Diminishing Returns. The essential nature of manufacture is.....that in most cases it is carried out under a Law of Increasing Returns”. His deep attachment to these views was also clear in his 1942 book on *The Economics of 1960*. They led him to predict a very favourable long-run movement in the terms of trade for primary producers.

His analysis of sector performance was, in fact, rather a mess. The estimates for the three sectors were not components of his national income aggregates. Estimates for output in each sector were derived from miscellaneous sources. They can not be added to reconcile with his totals for

national income. They should measure value added in each sector. Otherwise a three-sector total will involve duplication. However, his estimates for agriculture clearly refer to gross output (see Maddison and van Ooststroom, 1993, and Maddison and Prasada Rao, 1996, on techniques of measuring agricultural value added in comparable international units).

Furthermore, his international units were not congruent and comparable between sectors. In the 3rd edition, his international unit for national income is in 1929 prices, on pp. 254-8 he shows agricultural output at the farm gate valued in an international unit of 1925-34, and in oriental units valued relative to the purchasing power of the Indian rupee in 1948-9, and the derivation of these sectoral IUs and OUs is very fuzzy. In Clark and Haswell (1970), the agricultural IUs and OUs were dropped in favour of wheat units (following the practice of FAO).

In his lecture, "Development Economics: The Early Years", 1984, p. 70, he acknowledged the modest results of his three sector analysis: "That agriculture should show a decline in its relative importance in employment and in national product, with manufacturing showing first a rise and then a decline in favor of services, was a generalization made as long ago as the seventeenth century by Sir William Petty. This was a principal subject of observation, with extensive studies of the available material, current and historical, in *Conditions of Economic Progress*. I was unable to give full analytical explanations, which indeed even now partly escape us. We have to deal with the interactions of both income and price elasticities of demand for the products of the three sectors, and the labour required per unit of output of each."

The changes in demand structure over the past three centuries can be seen very clearly in our Table 3, which shows the fall in relative importance of expenditure on food and the expansion in the role of non-domestic services. Table 13 shows the massive change in employment structure, with the huge fall in the share of agriculture, the rise in the share of services, the rise of manufacturing employment to a peak around 1950 in these advanced capitalist countries, and a sharp fall since then (see also Maddison, 1980b, on the role of structural change in economic growth). The huge fall in agriculture happened earlier in the UK because of its move to free trade and food imports in 1848. In the USA the accelerated decline in agriculture came later and reflects the great acceleration of technical progress and productivity in farming since 1940, which Clark did not foresee at the time he wrote *Conditions* and the *Economics of 1960*.

There is an almost universal tendency to characterise the acceleration of economic growth in the past two centuries as a process of industrialisation, and to classify the richest countries as

industrialised. There is an even stronger tendency to describe the transition to what Kuznets called “modern economic growth” as an industrial revolution. Clark was not guilty of this, in spite of his neo-Ricardian belief that manufacturing was the main locus of technical change. In Clark (1953), he said “The growth of English industry was a gradual process, starting in the sixteenth, not in the eighteenth century. People like to talk about “The Industrial Revolution”, but there is no evidence to justify applying so strong a word as “revolution” to any period in the eighteenth century or the nineteenth; all the changes came comparatively gradually”.

Clark’s causal analysis of the economic growth process, and the reasons for the wide gap between the per capita incomes of different countries would have been improved if he had placed less emphasis on structural change, spent more effort explaining why the pace of growth has changed over time and investigating more closely the characteristics that differentiated rich and poor countries. In November 1947, he had a memorable conversation with Mahatma Gandhi a few weeks before he was assassinated. Clark (1969) reported it as follows: “Do you know what is the matter with the Indian people, Mr. Clark?” “No Mahatma,” I replied. “They’re idle. They won’t work....You may see a man sitting under a tree who says that he is engaged in religious meditation. But all that he is really doing is avoiding work.” Clark recounted this brief conversation quite often, but never tried to explain the origins of Indian poverty, and his main recommendation for its alleviation were to abandon the five year plans and to improve the institutional framework for a market economy (see Clark, 1962, pp. 28-29).

He was also fairly cavalier in explaining how the rich countries became prosperous and the role of technical progress and investment in this process. In 1940. in his chapter on “the role of capital in economic progress”, he started by stressing the difficulties of measuring capital, and “much preferred to keep clear of this problem”. In fact, he relied heavily on the capital-output ratios of Paul Douglas, and continued to do so in the 1951 and 1957 editions. In the latter, he said the general impression had been that the capital-output ratio was about 4 in most countries, but further examination of the rather shaky evidence shows that, “in a number of advanced countries, capital stock equivalent to 3 or 2.5 years’ national product will suffice” (2). He concluded that “the more thoughtful workers in this field are coming to agree that while the availability of capital may still be an important factor, many factors, some of them of a very intangible nature, constitute the real determinants of economic progress” (see pp. 569 and 580).

d) The Very Long-Run

A fourth distinguishing feature of *Conditions*, was his interest in very long-run comparison. In the 1940 edition, pp. 164-170, there was a tantalisingly brief comparison of real wages of building workers in Greece in 328 BC with those of similar workers in England in 1925-34, and a comparison of the wages of carpenters and agricultural workers in England since the early 15th century. In the second edition, comparisons with the ancient world were enlarged into an exciting Excursus of 28 pages, and again augmented in the third edition. His continuing interest is also evident in his voluminous correspondence with economic historians and the topics he discussed in his book reviews in *The Tablet*. However, really long-term comparisons were not an integral part of his macromeasurement. Their main importance was an implicit challenge to subsequent generations of researchers to stretch macromeasurement back to the ancient world by gathering more evidence than he had to hand. Without his boldness and assiduity in piecing together scraps of evidence, it seems doubtful that Raymond Goldsmith would have written his article on the national product of the Roman empire (1985) and his book on *Premodern Financial Systems* (1987), or that I would have written *The World Economy: A Millennial Perspective* (2001).

(3) *The History of Agricultural Development*

The Economics of Subsistence Agriculture (written with Margaret Haswell) was the most impressive of Clark's books after 1957. It is a comprehensive survey of the economics of food production over the past 9,000 years, its adaptation to variations in climate and soil conditions, changes in the intensity of with which land and labour were used in different parts of the world as technology and consumption levels changed. The chapter on "pre-agricultural man" suggests that land requirements of hunter-gatherer economies varied from 10 square km. per head in well-watered grasslands to 140 in the Eskimo territory of northern Canada. Even where there was an abundance of livestock, hunters had to track and work hard to kill them, compete with other predators and inevitably waste a lot of what they caught because of lack of storage facilities. The introduction of crop production and pastoralism had a huge impact in raising density of settlement and production of a surplus which permitted the development of urban civilisation in Mesopotamia, The Indus valley and Egypt. In sub-Saharan Africa, the transition from shifting to settled cultivation was slower because of poorer soils, and the difficulty of raising livestock for traction, transport or food because of the tsetse fly.

There is an interesting chapter on the history of transport, which emphasises its key role in agricultural development. It assesses the impact of successive reductions in the cost of moving a ton km. of grain by head portage, wheelbarrow, pack animal, waggon, boat, steamboat, railway, and motor vehicle, which have transformed the possibilities for specialisation and trade in agriculture. In mid-nineteenth century Ghana, there was no possibility of exporting maize though its domestic price was only one fifteenth of that in the world market. Interspatial differentials in food prices were greatly reduced as transport costs fell.

The book concludes with a survey of policy options for trade aid and development. The main recommendation is that advanced countries should cease to subsidise their farmers and remove tariffs and other restrictions on imports from the poorer countries. Policies for food aid are damaging to the farmers of recipient countries and are bolstered “by the belief, now shown to be entirely erroneous, that two-thirds of the world are starving”.

(4) Population Growth and its Impact

Clark's *Population Growth and Land Use* (1967) is a comparative historical analysis of characteristics of population growth and its economic and social consequences. It surveyed long-term determinants in fecundity, birth and death rates, survival patterns and life expectation, and had a useful chapter on world population growth by regions from the first century to 1800.

The main policy message was that early marriage, high fertility, and rapid population growth almost always have a positive impact on economic growth and living standards. He cited several authors in support of this proposition: a) Allyn Young, who argued that population growth induces economies of scale; b) Everett Hagen's view that “an erroneously-judged investment, in rapidly growing economies, stands a good chance of being able to be put to an alternative use” whereas in a stationary economy, it is more likely to be a dead loss; c) Alfred Sauvy's judgement that per capita overhead costs of government and public services are less when population is growing; d) Verdoorn's “law” associating rapid productivity advance with rapid production growth.

He asserted that population growth has “a positive effect on savings” (p. 267); “the necessary conditions for a free market usually cannot be attained in sparsely populated countries” (p. 274); demographic stagnation led to the fall of the Roman Empire. He attacked Malthusian fears of population pressure, and denounced the FAO as an “institution devoted to proving that there is not enough food in the world”. He suggested (p. 124), that the world had “10.7 billion hectares of standard

land equivalent” which could feed 47 billion people at US levels of per capita consumption and 157 billion at Japanese levels.

His major reservation was that rapid population growth could lead to “undue concentration in a few limited areas and depopulation of remoter areas”. In sharp contrast to his generally unconstrained enthusiasm for market forces, he proposed “a system of taxes on employment in the former and subsidies in the latter”.

In an earlier (1958b) essay, he was more specific in his utopian proposals for population dispersal: “For economic, social and political reasons alike we should take... communities sized about 150,000 as our objective. A community of this size is large enough to give its inhabitants, and those of the neighbouring rural areas, a full range of economic and administrative services. But we should not allow our community to become any larger if we want its citizens to retain civic pride in their local affairs, if we want its traffic to remain reasonably free of congestion, and if we want to prevent local administration from becoming both expensive and bureaucratic.”

Conclusions

Colin Clark and his contemporary **Simon Kuznets** (1901-85) made an immense contribution to the development of national income analysis. Kuznets’ influence was greater, because he worked twice as long in this field, and was not distracted by ambitions in the field of politics and controversies on public policy. He had a greater influence as a university teacher (between 1930 and 1971) and did more to interact with his colleagues (in the NBER), encouraged young scholars in many countries in the International Association for Research in Income and Wealth, and helped attract financial support from the Social Science Research Council. Kuznets was a more subtle analyst of intertemporal and cyclical characteristics, phases and long waves in economic development and their causality. Kuznets also did much more than Clark to use quantitative evidence to interpret the causes of accelerated economic growth in the past two centuries.

Clark was the pioneer of international comparison of levels of income. The successive versions of *Conditions of Economic Progress* were the main vehicle for his innovatory ideas and outlet for his colossal energy. Kuznets did virtually nothing in this field. He did not strive to create world aggregates and his interspatial analysis was based substantially on exchange rate conversions, with only brief speculation on what differences purchasing power converters might make.

Nearly all of Clark's 1940-57 estimates have now been superseded, but his work is still of substantial interest, because he made an exhaustive survey of the work of virtually all the economists and statisticians who had published in his field in the nineteenth and twentieth centuries and had extensive correspondence with the statisticians of his day who were engaged in such work. He never hesitated to adjust these estimates to conform to his own ideas about the appropriate coverage of the accounts or methods of treatment of particular items. His boldness in making adjustments, inferences and conjectures to fill empty economic boxes was frowned upon by many critics, but was useful in provoking others to look for firmer evidence to test his hypotheses.

His continuous stress on the long tradition of national accounting since the 17th century and on the importance and feasibility of very long term comparisons were important in inspiring later generations working on the really long term.

Clark's early interaction with Keynes was important in demonstrating the usefulness of national accounts as a tool of policy analysis in times of peace and war. Clark's pupil **Richard Stone** (1913-1991) played a major role in standardising international practice in compiling national accounts. He was largely responsible for devising the standardised system for OEEC countries and the United Nations. He founded the Department of Applied Economics in Cambridge where he fostered the creation of detailed historical accounts for the UK. He played a major role in transmitting the national accounting approach throughout Europe in the training programmes he ran in Cambridge for national accountants from OEEC countries. He also produced guidelines for OEEC and OECD on *Quantity and Price Indexes* (1956), *Input-Output and National Accounts* (1961) and *Demographic Accounting and Model Building* (1971). His *magnum opus* was his posthumously published (1997) *Some British Empiricists in the Social Sciences, 1650-1900*. Stone (1988) wrote "Colin is one of the key links in the long thin chain of political arithmeticians that stretches back to William Petty, and his work was the main inspiration for mine. Indeed I owe him more than inspiration. He was my teacher in Cambridge and we became close friends. When in 1937 he left England for Australia he passed on to me the running of a little monthly called *Trends*. I continued in his footsteps and it was in this way that I sharpened my claws as a national accountant."

Kuznets' pupils, **Milton Gilbert** (1909-79) and **Irving Kravis** (1916-92) constructed the first official measures of the purchasing power parity of currencies, published by OEEC in 1954. Kravis greatly expanded the scope of the PPP measures by starting the International Comparison Project (ICP) in 1968, and in 1978, together with his colleagues Alan Heston and Robert Summers inaugurated the Penn World

Tables (PWT) to fill gaps in ICP coverage. The style in which their estimates were constructed and presented was very different from that of Colin Clark and much closer to that of Kuznets.

Kuznets was a fastidious analyst, very cautious in interpreting economic growth, rigorous and well-organised in presenting evidence transparently, very sensitive to the quality of evidence and the multilayered complexity of causality. He was willing to make carefully articulated conjectures, e.g. on the likely rate of growth of per capita product in Western Europe from 1500 to 1750 (1973, pp. 138-141), but he had no time for the type of proxy measures (Bennett index and real wage indicators) which Clark used. His basic quantitative studies were produced in the National Bureau of Economic Research in New York, where he worked with a team of gifted colleagues, e. g. **Raymond Goldsmith** (1905-88), and **Moses Abramovitz** (1912-2000). His work received careful scrutiny and comment from them before publication. Most of his detailed procedures were described in Statistical Appendices, which meant that his main text was more easily digestible.

Colin Clark was a loner, bubbling with ideas and handling a vast amount of material in *Conditions of Economic Progress*. He presented the reader with a mass of primary material whose analytic relevance was frequently difficult to perceive. He had hundreds of tables, but in the first two editions, none of them were numbered, many had no title and countries were not listed in alphabetical order. His explanatory text was often abruptly interrupted by detailed description of procedures which read like rough drafts. His bibliographical references were frequently inadequate often omitting dates or titles. This was not true of his work in the 1930s on national income, and was less extreme in his work after 1957. The disorderly presentation of his *magnum opus* and the difficulty in digesting it is a major reason why his distinguished role in the history of macromasurement is sometimes underestimated. As a journalist he had a lively style, and some of his shorter academic pieces contain clearer analytical statements than his major books. If he had concentrated his efforts and been less impatient to cover so many problems his impact would probably been greater.

Notes

- (1) I am grateful to Prasada Rao for help and encouragement, to Karen Borchardt and Rose Wade for facilitating access to the Colin Clark archive in the Fryer Library of the University of Queensland, and to Oliver Clark for providing details of the Clark family history.
- (2) Erwin Rothbarth (1941) commented as follows on Clark's obsession with capital-output ratios: "There is no reason at all to assume that production in the USA moved along one production function in the period 1899-1923 as assumed by Professor Douglas."

Table 1

**Consolidated Wealth and Income Accounts for England & Wales:
Petty's Estimates for 1665 and King's for 1688**
(£ million in current values)

Petty - 1665			King - 1688	
	Property Income	Capitalised Value of Physical assets	Property Income	Capitalised Value of Physical assets
Land	8.0	144.0 (18.0)	10.0	180.0 (18)
Housing	2.5	30.0 (12.0)	2.0	36.0 (18)
Other	4.5	76.0 (16.9)	1.0	86.0 (86)
Property	15.0	250.0 (16.7)	13.0	320.0 (24.6)
	Labour Income	Capitalised Value of Labour Force	Mixed Income (Trade, Arts & Labour)	Capitalised Value of Population
Labour	25.0	417.0 (16.7)	30.5	330.0 (11)
Aggregate	40.0	667.0 (16.7)	43.5	650.0 (14.9)

Source: Petty, *Verbum Sapienti*, 1665, (Hull's ed., vol.1, pp.104-110). Figures in brackets refer to number of years' purchase. Petty made a second estimate (for 1676) in *Political Arithmetick*, 1676, (Hull's ed., vol.1, p.267 in which property income was assessed at 16 million, labour income at 26 million, but physical assets and the labour force were capitalised at 20 years purchase. King's consolidated account as stated above is from *Observations*, 1696, pp.30-32.

Table 2: Gross Domestic Expenditure in England & Wales in 1688
(£000's at market prices)

Food	13,900	Education & Health	1,150
Bread, Biscuits & Pastry	4,300	Schooling	250
Beef, Mutton & Pork	3,300	Paper, Books & Ink	500
Fish, Poultry & Eggs	1,700	Medical	400a
Dairy Products	2,300		
Fruits & Vegetables	1,200	Personal & Professional	
Salt, Spices, Oil, &		Services	3,100
Sweetmeats	1,100	Domestic Servants	1,600a
		Recreation	500
Beverages & Tobacco	7,350	Legal, Financial, Hair-	
Beer & Ale	5,800	dressing, Inns & Taverns	1,000a
Wine & Brandy	1,300		
Tobacco, Pipes & Snuff	250a	Passenger Transport	430
		Passenger Transport by Road	280a
Clothing	10,393	Passenger Transport by Water	150a
Male Outerwear	2,390		
Shirts, Cravats, & Ruffles	1,300	Government, Religion	
Male Underwear	100	& Defence	4,844
Male Accessories	85	Military Pay	1,530a
Female Outerwear	904	Ecclesiastical Remuneration	514a
Female Underwear	1,400	Civil Government Pay	1,800a
Nightgowns & Aprons	500	Commodities	1,000a
Female Accessories	335		
Hats, Caps & Wigs	568	Gross Capital Formation	3,675
Gloves, Mittens & Muffs	410	Structures	975a
Handkerchiefs	200	Transport Equipment	700a
Stockings & Socks	1,011	Other Equipment	2,000
Footwear	1,190		
		Gross Domestic Expenditure	54,042
Household Operation	9,200		
Rent & Imputed Rent	2,200a	Gregory King's Total	41,643b
Fire, Candles & Soap	2,000	Additional Items	12,399a
Beds & Bedding	1,500		
Sheets & Table Linen	1,500		
Brass & Pewterware	1,000		
Wood & Glassware	1,000		

a) indicates items I added from *Notebook* b) total of items shown in *Observations*.

Source: Gregory King's *Notebook* in Laslett (1973) and *Observations* in Barnett (1936).

Table 3
Structure of British Gross Domestic Expenditure, 1688 and 1996
(percent of total)

	1688 England & Wales	1996 UK
Food	25.7	6.5
Beverages and Tobacco	13.6	5.9
Clothing & Footwear	19.2	3.7
Light, Fuel and Power	3.7	2.2
Furniture, Furnishings & Household Equip.	9.3	4.0
Personal Services	3.0	1.2
Total: Items 1-6	74.5	23.5
Rent & Imputed Rent	4.1	10.0
Education	1.4	5.4
Health	0.7	6.7
Recreation & Entertainment	0.9	5.7
Transport & Communication	0.8	10.6
Other	1.9	11.5
Total: Items 7-12	9.8	49.9
Total Private Consumption (Total Items 1-12)	84.2	73.4
Government Consumption (except education & health)	9.0	10.9
Gross Capital Formation	6.8	15.8
Total Gross Domestic Expenditure	100.0	100.0
Level of Per Capita GDP (in 1990 international dollars)	1,411	17,891

Source: 1688 from Table 2; 1996 from OECD, **National Accounts 1984-1996**, Vol.2, Paris 1998.

Table 4 Mulhall's 1896 Guidelines for Estimating Value Added by Sector of Economic Activity

Economic Sector	Value Added
Agriculture:	60 percent of gross product
Manufacturing:	50 percent of gross product
Minerals, forestry and fisheries:	100 percent of gross product
Commerce:	10 percent of aggregate domestic sales
Transport:	10.5 percent of aggregate domestic sales
House-rent:	6 percent of the value of the housing stock
Domestic servants:	Two-thirds of house rent
Public service:	50 percent of tax revenue
Professional services:	10 per cent of the sum of 8 items above

Table 5: Confrontation of Mulhall (1896) and Maddison (2003) Estimates of Relative Levels of GDP per Capita in 1894-5 (UK=100)

	Mulhall	Maddison		Mulhall	Maddison
Austria-Hungary	46.4	49.8	Portugal	37.8	26.2
Belgium	78.6	84.2	Spain	43.1	41.6
Denmark	75.8	64.5			
France	86.7	63.8	Russia	26.4	28.5
Germany	68.6	63.1	USA	122.2	80.5
Italy	38.9	38.3	Canada	100.0	58.8
Netherlands	71.7	79.5	Argentina	66.6	57.7
Norway	50.0	44.5	Australia	142.2	91.5
Sweden	61.1	52.7			
Switzerland	64.7	77.2			
UK	100.0	100.0			

Source: Mulhall (1896), p.391. His figures refer to 1894 except for the UK which is for 1895 (see pp. 51 and 95). For Australia, his estimate appears to include New Zealand (see p.346) and p. 51 shows an income estimate about 10% lower. My estimates refer to the same years and are from Maddison (2003). His estimates are converted to sterling at official exchange rates, except for some sectors, e.g. agriculture, where he seems to have used UK or world prices to revalue quantities. To some degree therefore he was making a PPP comparison, though he does not mention the concept. Mulhall gave no estimates for world income. The fourth edition of his *Dictionary of Statistics* (1899), pp. 320-322, contained relatives which differed from those above. They referred to 1881 for the UK, 1888 for France, and 1889 for Germany. For Australia the per capita relative to the UK was 119.3, and was derived from Coghlan, but the year was not specified. Mark Thomas (1995), made a detailed comparison of 1891 income levels in Australia (average of NSW and Victoria) and the UK. His geometric average, at prices of both countries, shows Australian per capita income 19 % higher. This is very close to my 1891 estimate (Australia 17.4% higher) derived as described in Appendix 1. 1891 was a peak year for Australia with a per capita level not regained until 1908.

Table 6
Estimates of World Population Around 1700 by
Riccioli, Gregory King, Maddison, McEvedy and Colin Clark
(million)

	Riccioli 1672	King 1695	Maddison 1700	McEvedy & Jones 1700	Clark 1700
Europe	100	115	127	120	106
Asia	500	340	400	415	420
Africa	100	70	61	61	100
America	200	90	14	13	13
Oceania	100	11	2	2	2
Total	1,000	626	604	611	641

Source: Riccioli (1672), pp.677-81; King, *Notebook*, pp.1 and 2. Maddison (2003), pp. 258. McEvedy and Jones (1978); Colin Clark (1967) p.64. The last region is called *terrae australis* by Riccioli. King stated in his reply to Harley that "By the unknown parts of the world, I mean only the *terra australis incognita*, and the North parts of Asia and America which have never yet been coasted about". Modern estimates refer to Australia, New Zealand, Melanesia and Polynesia. Riccioli and King used a similar method. For Europe they had detailed estimates, King for 17 countries, Riccioli for 6 countries and four groups of countries. For Asia more guesswork was involved, but there and in other continents they estimated land area and made assumptions about population density which were inferred to some extent from the range of variation in Europe.

**Table 7: Clark's (1940) Ranking (53 countries)
of Real Income per Person Occupied, 1925-34**
(international units with purchasing power of US \$1)

USA	1,381	Japan	353
Canada	1,337	Poland	352
New Zealand	1,202	Martinique*	350
UK	1,069	Latvia	345
Switzerland	1,018	Italy	343
Argentina*	1,000	Estonia	341
Australia	980	Yugoslavia	330
Netherlands	855	Egypt*	325
Ireland	707	USSR	320
France	684	Algiers*	300
Denmark	680	South Africa	276
Sweden	653	Bulgaria	259
Uruguay*	650	Romania	243
Germany	646	Spa Morocco*	220
Belgium	600	Lithuania	207
Spain*	550	Syria*	200
Chile*	550	Brit. India*	200
Norway	539	Gold Coast*	180
Austria	511	Rhodesia*	160
Czechoslovakia	455	Tanganyika*	140
Brazil*	435	Fr. W. Africa*	130
Greece	397	Turkey*	130
Finland	380	China*	110
Philippines*	375	Ceylon*	100
Mexico*	360	Malaya*	90
Palestine*	360	East Africa*	75
Hungary	359		

Sources: The best evidence is for the 30 countries shown on p. 41. The derivation of the estimates is shown on p. 40, but for Austria, Bulgaria, Ireland and USSR, the results are different from those shown on p.41, and for Japan the derivation is not shown. For the 23 asterisked countries the estimates are rough proxies, see pp.42 and 52. Except for British India, Japan and China, they are derived from partial information on wages.

Table 8 Exchange Rate/PPP Deviation: 25 Countries in 1929
(US cents per unit of national currency & ER/PPP Ratio)

	Ex. Rate	PPP	PPP/E.R. Ratio
Australia	485.688	424.240	0.873
Austria	14.058	17.650	1.575
Belgium	2.783	4.134	1.486
Canada	99.247	112.662	1.135
Czechoslovakia	2.961	6.515	2.200
Denmark	26.680	31.385	1.176
Finland	2.517	3.095	1.230
France	3.916	5.357	1.368
Germany	23.809	26.190	1.100
Greece	1.293	2.403	1.858
Hungary	17.441	18.290	1.049
Ireland	485.688	561.690	1.156
Italy	5.233	5.563	1.063
Netherlands	40.162	54.220	1.350
New Zealand	485.688	503.250	1.036
Norway	26.683	24.890	0.933
Poland	11.194	17.530	1.566
South Africa	485.688	479.400	0.987
Spain	14.683	30.840	2.100
Sweden	26.284	26.840	1.002
Switzerland	19.279	18.510	0.960
Turkey	48.411	66.670	1.377
UK	485.688	570.300	1.174
USA	100.000	100.000	1.000
Yugoslavia	1.759	1.948	1.107

Source: Exchange rate from *Banking and Monetary Statistics*, Federal Reserve Bank, PPPs from Clark (1951), p.26. Third column is the exchange rate deviation index (ERDI).

Table 9 Comparison of Colin Clark's (1940) Estimates of "National Income" Levels for 30 Countries & Maddison's (2003) Estimates of GDP Levels for 1925-1934 in international units

	Clark(1940) Nat Income million I.U.	Clark's implicit per capita N.Inc I. Us	Col.2 with USA=100	Maddison (2003) GDP mill 1990 intGK \$	Maddison per capita GDP 1990 int GK \$	Col. 5 with USA=100	Col. 6/3
Australia	2,543	399	73.6	32,415	5,019	84.2	114.3
Austria	1,613	242	44.6	22,103	3,314	55.6	124.5
Belgium	2,033	253	46.7	38,842	4,832	81.0	173.6
Bulgaria	524	87	16.1	7,623	1,269	21.3	132.6
Canada	5,084	494	91.1	44,787	4,347	72.9	80.0
Czechoslovakia	2,680	193	35.6	38,091	2,736	45.9	128.9
Denmark	1,008	285	52.6	17,734	5,006	84.0	159.7
Estonia	142						
Finland	473	138	25.5	9,001	2,619	43.9	172.5
France	12,480	302	55.7	177,404	4,287	71.9	129.0
Germany	17,580	271	50.0	243,983	3,762	63.1	126.2
Greece	922	145	26.8	14,403	2,272	38.1	142.4
Hungary	1,205	177	32.7	19,975	2,318	38.9	119.0
Ireland	829	281	51.8	8,208	2,780	46.6	89.9
Italy	5,320	131	24.2	119,207	2,935	49.2	203.6
Latvia	249						
Lithuania	190						
Netherlands	2,624	335	61.8	41,443	5,289	88.7	143.5
New Zealand	691	468	86.3	7,142	4,839	81.2	94.0
Norway	607	216	39.9	9,519	3,387	56.8	142.5
Poland	3,428	122	22.5	51,620	1,796	30.1	133.8
Portugal	839	124	22.9	10,787	1,595	26.7	116.9
Romania	1,471	104	19.2	17,028	1,204	20.2	105.2
Sweden	1,731	282	52.0	22,537	3,676	61.6	118.5
Switzerland	1,917	476	87.8	23,877	5,923	99.3	113.1
South Africa	883						
U. K.	21,854	477	88.0	242,385	5,287	88.7	100.7
USA	66,203	542	100.0	727,803	5,963	100.0	100.0
USSR	14,710	87	16.1	231,886	1,370	23.0	143.1
Yugoslavia	1,352	95	17.5	17,650	1,239	20.8	118.5

Source: Clark's "national income" is equivalent to GNP at market prices, adjusted by his PPP converter. For real income per head his denominator refers to persons employed and not to population. Here, I have divided his national income in international units by my estimate of population for the average of these years. Col. 1 from Clark 1940); col. 2 = col. 1 divided by population from Maddison (2003). Cols. 4 & 5 from Maddison (2003). The figures for Greece are an average of 1924, 1929 & 1934; for USSR, they refer to 1928. For Poland, Clark's estimate is for 1925-34, mine for 1929-34.

Table 10: Clark's (1957) Ranking of 25 countries: 1929 National Income Per Head of Population in 1929 International Units & Maddison (2003) GDP Per Head in 1929 in 1990 International Geary-Khamis dollars

	Clark in	Col. 2 with	Maddison in	Col. 3 with	Col 4/ 2
	1929 I U	US=100	1990 int \$	US=100	
USA	725	100.0	6,899	100.0	100.0
Canada	588	81.1	5,065	73.4	90.5
New Zealand	613	84.6	5,262	76.3	90.2
UK	543	74.9	5,503	79.8	106.5
Denmark	529	73.0	5,075	73.6	100.8
Australia	479	66.1	5,263	76.3	115.5
Netherlands	434	59.9	5,689	82.5	137.8
Switzerland	430	59.3	6,332	91.8	154.7
France	385	53.1	4,710	68.3	128.6
Sweden	353	48.7	3,869	56.1	115.2
Norway	344	47.4	3,472	50.3	106.1
Ireland	326	45.0	2,824	40.9	91.0
Germany	317	43.7	4,051	58.7	134.3
Czechoslovakia	231	31.9	3,042	44.1	138.4
Japan	223	30.8	2,026	29.4	95.5
Austria	220	30.3	3,699	53.6	176.7
Finland	214	29.5	2,717	39.4	133.4
Greece	193	26.6	2,342	33.9	127.5
Italy	189	26.1	3,093	44.8	172.0
Chile	173	23.9	3,396	49.2	206.3
South Africa	160	22.1	1,778	25.8	116.8
Poland	148	20.4	2,117	30.7	150.3
Hungary	144	19.9	2,476	35.9	180.7
Bulgaria	137	18.9	1,180	17.1	90.5
Brazil	108	14.9	1,137	16.5	110.6

Source: Col. 1 from Clark (1957), pp.75-218; Col 3 from Maddison (2003)

In the 3rd edition, Clark showed 1929 I.U. PPPs for 34 countries (p.31 for 30 countries, p. 104 for Brazil, Bulgaria, p. 105, Chile p. 112 and Japan p. 160). He used these for 25 countries shown above in chapter III to link his GNP level to his time series for GNP growth (pp. 75-218). However he did not show income or per capita income in 1929 for Belgium, Cuba, the Dominican Republic, Ecuador, Estonia, Guatemala, Spain, Turkey and Yugoslavia.

Table 11: Comparison of Clark's (1957) Estimates of Income Per Head of Population: 1950 in International & Oriental Units

	Oriental units 1950 in 1950 rupees	Col. 1 with USA=100	Int. units 1950 in 1929 dollars	Col. 3 with USA=100
Canada	3,562	78.4	810	76.1
Ceylon	400	8.8	n.a.	n.a.
Chile	817	18.0	266	25.0
Colombia	765	16.8	118	11.1
Denmark	3,065	67.5	634	59.6
Finland	1,778	39.1	340	32.0
France	1,793	39.5	480	45.1
Germany	1,571	34.6	360	33.8
Greece	681	15.0	162	15.2
India	192	4.2	n.a.	n.a.
Ireland	1,420	31.3	441	41.4
Italy	834	18.4	243	22.8
Japan	375	8.3	194	18.2
Netherlands	1,861	41.0	505	47.5
Norway	2,984	65.7	463	43.5
Turkey	404	8.9	n.a.	n.a.
South Africa	914	20.1	284	26.7
UK	2,267	49.9	599	56.3
USA	4,543	100.0	1,064	100.0

Source: 1st col. from, pp.58-59; 3rd col. from pp.107-193 of Clark (1957)

**Table 12 Coverage of Clark's Estimates of Growth of Real Income
in international units**

	1st edition (16 countries)	2nd edition (28 countries)	3rd edition (35 countries)
Argentina		1935-45**	1916-51
Australia	1886/7-1937/8	1886-1947/8	1901/3-52/3
Austria		1911/13-1926	1859-1952
Belgium		1846-1947	1846-1952
Brazil		1928-46**	1926-52
Bulgaria			1913-50
Canada	1903-36	1903-47	1870-1952
Chile			1929-50
Colombia			1939-50
Cuba			1929-51
Czechoslovakia		1913-47**	1913-50
Denmark	1913-33	1913-47	1870-1951
Finland		1913-38	1913-51
France	1850/9-1937	1789-1938	1810-1952
Germany	1854-1938	1805-1944	1900-53
Greece		1891-1929**	1891-1952
Hungary		1900-44	1911/13-1947/8
India	1867/8-1936	1867/8-1944/5	1868-1931/2
Ireland		1926-44	1883-1951
Italy	1893 & 1901	1893-1947	1901-53
Japan	1887-1936	1887-1944	1913-52
Netherlands	1913-34	1900-38	1900-52
New Zealand	1901/3-1937/8	1901-47/8	1901-47/8
Norway	1913-37	1891-1947	1891-1952
Peru			1942-51
Poland		1913-38	1913-48
Portugal			1914-41
P. Rico			1939-50
Russia	1870-1937	1913-40	1913-53
Spain		1906-45	1906-51
Sweden	1861/9-1936	1861/9-1947	1861-1952
Switzerland	1924-34	1890-1943	1890-1951
South Africa		1911/2-1946**	1911/2-1952
U. K.	1688-1937	1688-1937	1688-1952
USA	1850-1937	1800-1947	1850-1952

Source: Most of these are for income per person or per hour worked, estimates of real income are usually, but not always shown.

1st col. from (1940), pp. 78-175. 2nd col. from (1951), pp.38-162,

3rd col. (1957), pp. 88-196.

Table 13
Structure of Employment in the Netherlands, United Kingdom
and United States, 1700-1998
(per cent of total employment)

		Netherlands	United Kingdom	United States
1700	Agriculture	40	56	n.a.
	Industry	33	22	n.a.
	Services	27	22	n.a.
1820	Agriculture	42	37	70
	Industry	28	33	15
	Services	30	30	15
1890	Agriculture	36	16	38
	Industry	32	43	24
	Services	32	41	38
1950	Agriculture	14	5	13
	Industry	40	47	33
	Services	46	48	54
1998	Agriculture	3	2	3
	Industry	22	26	23
	Services	75	72	74

Source: Maddison (1991), p.32 for 1700; Maddison (1995) p.253 for the United Kingdom and the United States 1820-90; Netherlands 1820 and 1890 from Smits, Horlings and van Zanden (2000), pp.115-6. 1950 from Maddison (1991), p.248. 1998 from OECD, *Labour Force Statistics 1978-1998*. Agriculture includes forestry and fishing; industry includes mining, manufacturing, electricity, gas, water and construction; services is a residual covering all other activity, private and governmental (including military).

Appendix 1 Estimates of Australian Economic Growth: 1500-2001

Australia has experienced much more rapid growth since 1820 than Western Europe or the rest of the world. Between 1820 and 2001 its population increased 9-fold, compared with less than 3-fold in Western Europe. Their GDP increased 2,250-fold compared with 47-fold in Western Europe. Average per capita GDP (in terms of 1990 international dollars) rose from \$518 to \$21,883; Western Europe's from \$1,204 to \$19,256.

The disparity was due partly to huge differences in natural resource endowment. In 1820, land per head of population in France, Germany and the UK averaged 1.5 hectares compared to 2,316 hectares in Australia. Australian growth was facilitated by large-scale immigration, foreign investment and distance from foreign wars. It inherited institutional arrangements and traditions favourable to growth: political stability, a fair degree of social mobility, relatively high levels of education, secure property rights, and a willingness to use market forces.

Table A-1 Population and GDP of Australia, 1700-1870

	Population (000s)			GDP (million 1990 internat. \$)			GDP per capita (int \$)		
	European	Aboriginal	Total	European	Aboriginal	Total	European	Aboriginal	Average ¹
1700	0	450	450	0	180	180		400	400
1820	34	300	334	53	120	173	1,559	400	518
1830	70	260	330	176	104	280	2,514	400	848
1840	190	230	420	485	92	577	2,553	400	1,374
1850	405	200	605	1,115	80	1,195	2,951	400	1,975
1860	1,146	180	1,326	3,766	72	3,838	3,349	400	2,894
1870	1,620	155	1,775	5,748	62	5,810	3,548	400	3,273

In the past, most measures of Australian performance concentrated on the economy created by European settlement, and disregarded the fact that it displaced, damaged, or destroyed a significant part of the indigenous economy where output and population contracted. In the 1980s Noel Butlin made a major innovation in proposing a “multicultural” estimate. In 1983 he published a masterpiece of demographic modelling (*Our Original Aggression*, Allen & Unwin, Sydney and London) analysing the impact of white settlement on the Aboriginal population and its economy, with detailed specification of the different vectors of mortality. This was similar in intent to studies by Borah and others on the impact of European conquest on the Americas, but Butlin was much more rigorous. His analysis of Aboriginal history was enlarged in *Economics and the Dreamtime: A Hypothetical History*, Cambridge University Press, 1993. A further posthumous work *Forming A Colonial Economy: Australia 1810-1850.*, Cambridge University Press, appeared in 1994. Here, I have included a crude measure of the indigenous economy to 1870, with a total for “multicultural” GDP. For the indigenous sector the population figures are rough and the per capita GDP estimates are stylised. I have followed Butlin's lead with some modification. His estimate of the pre-contact population is much higher than is conventional (1.1 million instead of 300,000). His analysis of the destructive impact of white settlement makes it difficult to accept the conventional estimate, but his depopulation coefficient seems exaggerated. As a compromise, I assumed a pre-contact population of 450,000, 1820-70 from L. R. Smith, *The Aboriginal Population of Australia*, ANU, Canberra, 1980, p. 210.

Australia has a distinguished record of national income measurement. It was the first country with official estimates.. They were started in 1886 by Timothy Coghlan (1857-1926), government statistician for New South Wales who published estimates of the *Wealth and Progress of New South Wales* as well as a *Statistical Abstract for the Seven Colonies of Australasia* covering New Zealand and the six colonies

which became the constituent states of Australia. Publication was discontinued in 1905 when he accepted a diplomatic post as agent general for New South Wales in London, and official national accounts did not reappear on a regular basis until 1946. Bryan Haig is the custodian of the Coghlan archive, and has written an as yet unpublished memoir on Coghlan's work "The First Official National Accounting Estimates" (see also Heinz Arndt, "A Pioneer of National Income Estimates", *Economic Journal*, December, 1949)

In 1938, Colin Clark (1905-89) and John Crawford (1910-84) published estimates of income and product for the 1920s and 30s, annual estimates of real income for 1914-39, and rough estimates of productivity for some years back to 1886 (see their *National Income of Australia*, Angus and Robertson, Sydney, 1938). Clark used this material in the first edition of *Conditions of Economic Progress*, 1940, pp.84-5, improved on it in the 1951 edition, pp. 140-1, and modified his estimates showing faster growth of real product for 1914-38 in the 1957 edition, pp. 90-7 (see Table A-3). In fact, I have used Bryan Haig's estimates for 1914-38, but Colin Clark's(1957) estimates seem quite respectable. If one were to use the Clark estimates, it would reduce the level of GDP for all earlier years by a sixth, and make the international standing of Australia less exceptional.

Noel Butlin (1921-91) published a continuous stream of studies on the quantitative economic history of Australia from 1946 onwards (see Graeme Snooks, "Life and Work of Nøel George Butlin", *Australian Economic History Review*, September 1991). He was an admirer of Kuznets and much of his work is in the Kuznetsian tradition with meticulous indication of sources and transparent explanation of methodology. His first major book (1962) provided annual estimates of GDP, GNP, net domestic and net national product from 1861 to 1938/9. It showed nominal and real value added by industry of origin at factor cost and market prices, together with very detailed estimates of capital formation and the balance of payments on current and capital account. It contained more than 200 pages describing his sources and estimating procedures, and 274 tables.

As Butlin's work covered the whole span of Australian history, I relied heavily on his estimates in Maddison (1995 and 2001). 1820 to 1828 GDP movement was derived from N.G. Butlin, "Our 200 Years", *Queensland Calendar*, 1988. 1828-60 annual GDP volume movement by eight industries of origin at 1848-50 prices from N.G. Butlin, "Contours of the Australian Economy 1788-1860", *Australian Economic History Review*, Sept. 1986, pp. 96-147. Annual GDP movement 1861-1938/9, by 13 industries of origin in 1910/11 prices from N.G. Butlin, *Australian Domestic Product, Investment and Foreign Borrowing 1861-1938/39*, Cambridge, 1962, pp. 460-1; amended as indicated in N.G. Butlin, *Investment in Australian Economic Development 1861-1900*, Cambridge, 1964, p. 453, with revised deflator for 1911-1938/9 shown in M.W. Butlin, *A Preliminary Annual Database 1900/01 to 1973/74*, Discussion Paper 7701, Reserve Bank of Australia, May 1977, p.41. 1938/9-1950 real expenditure aggregates in 1966/7 prices from M.W. Butlin, p.85. 1860-1 link derived by using the GDP deflator in W. Vamplew (ed.), *Australians: Historical Statistics*, Fairfax, Broadway, 1987, p. 219. 1950 onwards from OECD sources. Where necessary, GDP figures were adjusted to a calendar year basis. Population 1788-1949 from Butlin (1988), adjusted to a calendar year basis from 1870.

Recently, Bryan Haig rejected Butlin's estimates *en bloc* (see his "New Estimates of Australian GDP: 1861-1948/49" *Australian Economic History Review*, March 2001, pp. 1-34). He argues that Butlin's approach (deflation of nominal estimates of value added by price indices) is "unworkable" because of the weakness of existing price indices, and the inherent difficulty of improving them; Butlin "relied on existing series of wholesale prices, wage rates and retail price indices", and "no useful research has been undertaken by academics on Australian price indices since Butlin produced his estimates". Butlin did not take his price indices from the shelf, but constructed ten special deflators for sectors of GDP, and eight for components of capital investment. His deflators are imperfect but improvable. Australian academics have not abandoned the field (see Ian McLean and S. J. Woodland "Consumer Prices in

Australia, 1850-1914” *Working Paper 92-4*, Economics Dept, University of Adelaide, 1992), and Australia seems better endowed with historical price statistics than many other countries (see Shergold’s chapter in Vamplew,1987).

Haig’s second fundamental objection is that Butlin’s results are “unreasonable” as they show contours of development which conflict with traditional views and generated a new interpretation of Australian economic history. I see no harm in this. It is up to those who disagree with Butlin to prove him wrong.

Table A-2 Alternative Measures of Australian Sector Growth and Structure, 1861-1938/9

	Annual Growth %		1891 level: million		Annual Growth %		1938/9 level:million	
	1861-1911		1891 pounds		1911/12-1938/9		1938/9 pounds	
	Butlin	Haig	Butlin	Haig	Butlin	Haig	Butlin	Haig
Pastoral	4.81	4.30	29.5	28.7	1.39	0.96	74.5	63.2
Agriculture	3.39	3.81	10.5	15.3	1.13	2.38	41.7	41.2
Dairy	3.69	3.96	9.7	6.8	3.54	2.64	49.3	40.8
Mining	1.83	1.98	11.3	12.0	-2.21	-0.60	27.9	27.1
Manufacturing	6.13	3.72	21.3	29.5	2.01	2.43	157.0	198.0
Construction	3.01	2.37	28.4	15.1	0.34	2.27	56.2	65.0
Water Transport	4.56	n.a.	3.6	n.a.	-0.41	n.a.	7.9	n.a.
Public Undertakings	5.88	n.a.	6.8	n.a.	1.06	n.a.	45.5	n.a.
Public services	1.99	n.a.	8.5	n.a.	2.62	n.a.	40.7	n.a.
Finance	1.55	n.a.	6.7	n.a.	2.73	n.a.	21.1	n.a.
Distribution	4.33	n.a.	23.9	n.a.	2.40	n.a.	159.8	n.a.
Other services	3.16	n.a.	22.5	n.a.	0.89	n.a.	91.0	n.a.
Total Services	3.63	3.33	72.0	52.0	1.77	2.35	366.0	291.0
Imputed Rent	3.34	3.27	21.9	18.3	2.20	2.19	72.0	60.0
Unallocated	4.91	n.a.	1.8	0.0	2.93	n.a.	-4.1	0.0
GDP	3.67	3.34	202.8	177.8	1.58	2.09	840.5	797.0
GDP New South Wales	n.a.	4.00	n.a.	57.3				
GDP Victoria	n.a.	2.06	n.a.	53.3				

Source: Columns 1 & 5 from Butlin, pp.160-1. Butlin shows fiscal years (beginning July 1st) from 1901/2 onwards, Haig from 1911/2 onwards. 1911 calendar year for Butlin derived by averaging his estimates for 1910/11 and 1911/12. Columns 2 & 6 from Haig, pp.28-34. Columns 3 & 7 from Butlin, pp.10-11. Columns 4 & 8 from Haig, pp. 28-34

A more legitimate objection is that Butlin probably exaggerated the long boom from 1861 to 1891 by understating manufacturing employment and output at the beginning of the period. This is a point which Haig should have tackled more rigorously, showing his own employment estimates for Australian manufacturing and comparing them with those of Butlin (see Butlin and Dowie, “Estimates of Australian Work Force and Employment, 1861-1961”, *Australian Economic History Review*, September, 1969). Instead he presents a comparison for the state of Victoria.

Haig’s alternative to the Butlin approach is to use quantitative measures of output for seven sectors of GDP. This is a desirable crosscheck, but for 1861-1911 Haig does not have quantitative measures for 70 per cent of GDP, and uses employment (available in direct form only for NSW and Victoria) as a proxy. He amalgamates his sector estimates using 1891 output weights which Coghlan published in 1893. Although he makes a few comparisons between his results and those of Butlin they are limited and

casual. A further problem is that Haig describes his estimating procedure parsimoniously in five pages whereas Butlin provided 200. The above table facilitates systematic confrontation of their sector growth rates and structure (Butlin's value added and Coghlan's gross output). Haig relies heavily on measures for New South Wales and Victoria to fill gaps in information for Australia as a whole, whereas Butlin covers a wider and perhaps more representative range of states. For 1861-1911, Haig's estimates imply per capita growth of 1.6 per cent a year in NSW, 0.42 in Victoria, and 0.57 percent in Australia

For 1911-2 to 1938-9, Haig's estimates are of better quality. He has quantity indicators for manufacturing from his "Manufacturing Output and Productivity, 1910 to 1948/9", *Australian Economic History Review*, September, 1975. For the rest of the economy he was able to adjust his employment indicators for productivity change. The weights from his "1938/9 National Income Estimates", *Australian Economic History Review*, 1967, p.176 are also more satisfactory. I have now adopted Haig's estimates for 1911-38, but would like to see more detail of his evidence before adopting his estimates for 1861-1911.

Table A-3 Alternative Estimates of Australian Real GDP, calendar years 1861-1938

million 1990 international Geary-Khamis dollars

	Haig	Butlin		Haig	Butlin	Clark
1861	4,453	4,188	1901	17,764	16,201	
1862	4,625	4,133	1902	16,905	16,366	
1863	4,750	4,271	1903	18,436	17,661	
1864	4,867	4,739	1904	17,733	18,846	
1865	5,132	4,711	1905	19,038	19,066	
1866	5,539	5,014	1906	19,741	20,361	
1867	5,515	5,621	1907	19,936	21,187	
1868	5,929	5,896	1908	20,694	21,904	
1869	6,101	5,951	1909	21,608	23,695	
1870	5,898	6,392	1910	22,662	25,348	
1871	6,210	6,144	1911	22,967	25,541	
1872	6,484	6,805	1912	23,764	26,147	
1873	6,656	7,522	1913	24,861	27,552	
1874	7,187	7,770	1914	24,797	25,430	21,294
1875	7,398	8,624	1915	24,341	23,943	20,782
1876	7,593	8,596	1916	24,172	25,623	19,902
1877	7,796	8,954	1917	23,716	26,202	17,519
1878	7,976	9,809	1918	23,155	26,340	16,138
1879	8,249	9,946	1919	24,488	26,092	17,819
1880	8,421	10,470	1920	25,534	28,075	19,969
1881	8,929	11,241	1921	26,818	30,831	22,263
1882	9,702	10,608	1922	28,225	31,051	25,058
1883	10,694	12,178	1923	29,579	31,685	27,275
1884	11,132	12,233	1924	31,524	34,109	29,324
1885	11,296	13,032	1925	33,002	35,239	30,872
1886	11,702	13,197	1926	33,792	34,798	32,587
1887	12,265	14,603	1927	34,305	34,716	34,068
1888	12,546	14,685	1928	34,368	34,164	34,759
1889	13,702	15,953	1929	33,662	33,834	34,848
1890	13,772	15,402	1930	30,458	32,181	33,411
1891	13,890	16,586	1931	28,416	32,720	31,406
1892	13,640	14,547	1932	30,025	31,878	31,640
1893	13,663	13,748	1933	32,110	33,696	31,199
1894	13,819	14,217	1934	33,810	34,991	34,603
1895	14,015	13,418	1935	35,798	36,424	35,427
1896	14,288	14,437	1936	37,414	38,160	36,195
1897	15,147	13,638	1937	39,306	40,336	37,509
1898	15,749	15,760	1938	40,639	40,639	40,639
1899	16,592	15,760				
1900	17,186	16,697				

Source: Haig, pp. 28-30. He gives calendar year estimates for 1861-1911, fiscal years (beginning July 1st) for 1911/12 onwards. I adjusted the latter to a calendar year basis. For 1910/11, he presents no figures for the primary sector or GDP. To make the link between his two temporal segments, I used the 1910/11-1911/12 primary movement shown by Butlin. Clark (1957), pp. 90-1, real product adjusted to calendar year basis.

Table A.4: Australian Population, GDP and Per capita GDP, 1820-1870:

	A Multicultural Estimate								
	Population settler	Population aboriginal	Population Total	GDP settler	GDP aboriginal	GDP Total	Per capita settler	Per capita aboriginal	Per capita Total
1820	34	300	334	53	120	173	1,559	400	518
1821	35	296	331	55	118	173	1,573	400	524
1822	37	292	329	60	117	177	1,617	400	537
1823	41	288	329	68	115	183	1,661	400	557
1824	48	284	332	82	114	195	1,704	400	589
1825	53	280	333	93	112	205	1,748	400	615
1826	54	276	330	97	110	207	1,792	400	628
1827	56	272	328	103	109	212	1,836	400	645
1828	58	268	326	109	107	216	1,879	400	663
1829	62	264	326	122	106	228	1,968	400	698
1830	70	260	330	176	104	280	2,514	400	848
1831	76	257	333	189	103	292	2,487	400	876
1832	84	254	338	201	102	303	2,393	400	895
1833	98	251	349	214	100	314	2,184	400	901
1834	106	248	354	236	99	335	2,226	400	947
1835	113	245	358	312	98	410	2,761	400	1,145
1836	125	242	367	316	97	413	2,528	400	1,125
1837	134	239	373	344	96	440	2,567	400	1,179
1838	152	236	388	358	94	452	2,355	400	1,166
1839	170	233	403	345	93	438	2,029	400	1,087
1840	190	230	420	485	92	577	2,553	400	1,374
1841	221	227	448	434	91	525	1,964	400	1,171
1842	241	224	465	407	90	497	1,689	400	1,068
1843	251	221	472	497	88	585	1,980	400	1,240
1844	264	218	482	592	87	679	2,242	400	1,409
1845	279	215	494	630	86	716	2,258	400	1,449
1846	293	212	505	724	85	809	2,471	400	1,602
1847	309	209	518	876	84	960	2,835	400	1,853
1848	332	206	538	1,059	82	1,141	3,190	400	2,122
1849	373	203	576	1,126	81	1,207	3,019	400	2,096
1850	405	200	605	1,115	80	1,195	2,753	400	1,975
1851	438	198	636	1,412	79	1,491	3,224	400	2,345
1852	514	196	710	1,874	78	1,952	3,646	400	2,750
1853	601	194	795	2,315	78	2,393	3,852	400	3,010
1854	695	192	887	2,261	77	2,338	3,253	400	2,636
1855	793	190	983	2,383	76	2,459	3,005	400	2,502
1856	877	188	1,065	3,176	75	3,251	3,621	400	3,053
1857	970	186	1,156	3,040	74	3,114	3,134	400	2,694
1858	1,051	184	1,235	2,763	74	2,837	2,629	400	2,297
1859	1,097	182	1,279	3,720	73	3,793	3,391	400	2,965
1860	1,146	180	1,326	3,766	72	3,838	3,286	400	2,894
1861	1,168	178	1,346	3,766	71	3,837	3,224	400	2,852
1862	1,207	175	1,382	3,716	70	3,786	3,079	400	2,740
1863	1,259	173	1,432	3,841	69	3,910	3,051	400	2,731
1864	1,325	170	1,495	4,261	68	4,329	3,216	400	2,896
1865	1,390	168	1,558	4,236	67	4,303	3,047	400	2,763
1866	1,444	165	1,609	4,509	66	4,575	3,123	400	2,843
1867	1,484	163	1,647	5,055	65	5,120	3,406	400	3,110
1868	1,540	160	1,700	5,302	64	5,366	3,443	400	3,156
1869	1,592	158	1,750	5,351	63	5,414	3,361	400	3,095
1870	1,620	155	1,775	5,748	62	5,810	3,548	400	3,273

Fig. 1a Per Capita GDP: Australia-UK, 1820-2001 (Butlin-Haig variant)

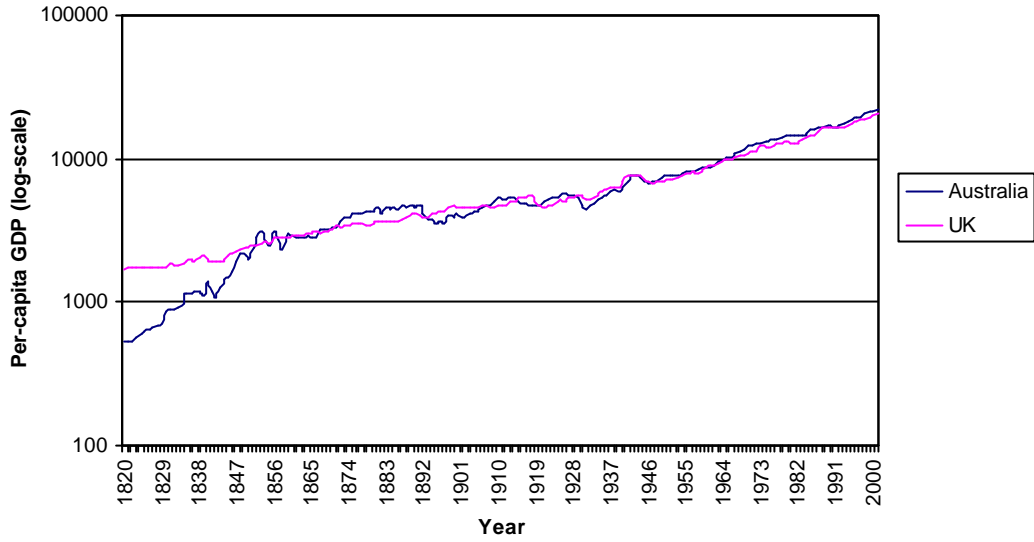


Fig. 1b Per Capita GDP: Australia-UK, 1820-2001 (Butlin-Clark variant)

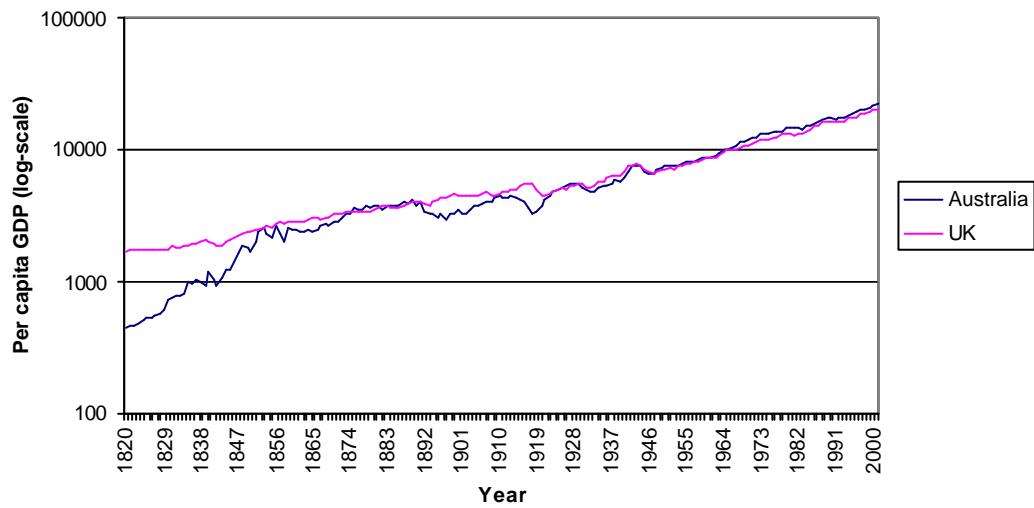
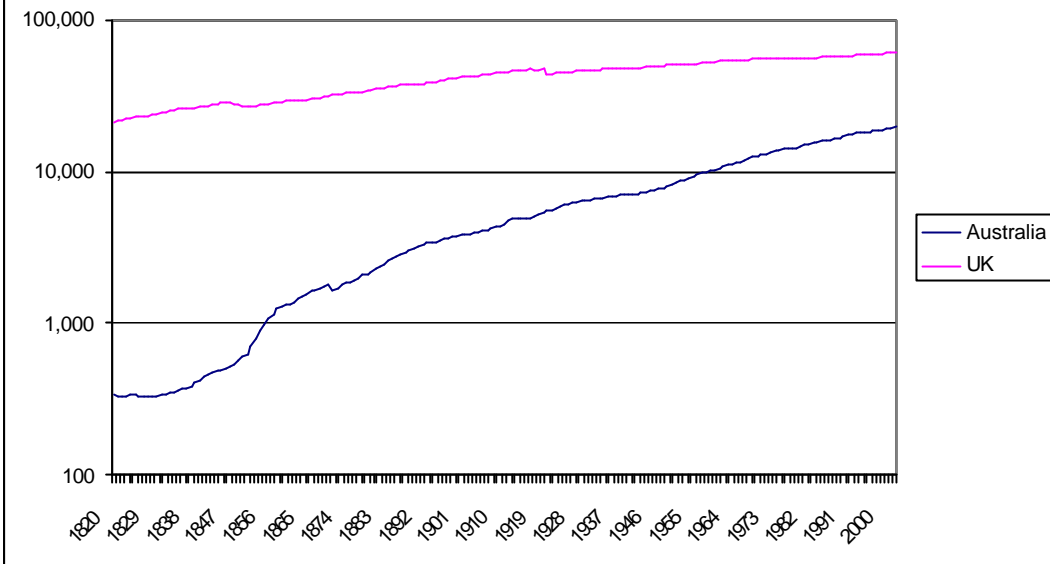


Fig. 2 Australia-UK: Population (000's), 1820-2002



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