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# 10 Height, Health, and Economic Growth in Australia, 1860–1940

Greg Whitwell, Christine de Souza, and Stephen Nicholas

Australian economic development in the period 1860–1940 is conventionally divided into two starkly contrasting phases. The first was the long boom of 1860–90. This was a "golden age" of economic progress. Australia acquired the epithet "the workingman's paradise." By 1890, according to Angus Maddison, Australia had the highest real GDP per capita in the world (Maddison 1977, 126). The second phase, from 1890 to 1940, saw things go terribly wrong. In the 1890s Australia experienced a prolonged and deep depression. The end of the decade saw the onset of perhaps the worst drought in recorded Australian history. Recovery eventually began about 1904. Its sudden termination coincided with the outbreak of World War I. Economic growth was disappointing for most of the 1920s. As with just about every other country, the situation deteriorated further and much more markedly during the depression of the 1930s. Only after World War II did Australia begin to enjoy again the sort of prosperity experienced during the first long boom of 1860–90.

When output figures are taken as a guide, living standards improved markedly from 1860 to 1890 but grew much more slowly, or may even have stagnated, in the period from 1890 to 1940. In recent years there has been debate among Australian economic historians about whether living standards did in fact follow such a pattern. Discussion has focused in particular on whether living standards did stagnate between 1890 and 1940.

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Inevitably, questions have been raised about the adequacy of real GDP per capita as a measure of economic well-being. It remains true, however, that all those participating in the Australian debate take as their starting point the conventional output or income data. In providing a more accurate measure of changes in living standards, they have chosen to do more than describe trends in a variety of "social indicators." Rather they have produced, by diverse means, an "augmented" output series. This has been done by imputing a money value either to some of the partial indicators (such as infant mortality and improvements in the housing stock) or to the nonmarket activities excluded from the national accounts and then adding these to the output data. Different methods of augmenting the same output series lead to contradictory results: one procedure will show that living standards grew faster than the growth of real GDP per person, while another shows that they rose more slowly than the growth of GDP. Jackson is correct when he says that "this introduces an arbitrary and discretionary element into the scale of the numbers that are produced when an attempt is made to convert GDP into a more direct measure of well-being" (1992, 26).

This chapter makes a novel contribution to the Australian debate by offering an alternative approach to, and index of, changes in living standards. We eschew the conventional economist's measures and their augmented variants. Instead we present anthropometric data on the height of men and women enlisting in the Australian army during the Boer War and World Wars I and II. In doing so we make use of an approach that has attracted increasing interest among social scientists in a number of countries but that, until now, has been little used in analyzing trends in Australian living standards.

## 10.1 The Workingman's Paradise?

The point has already been made that economic historians conventionally describe the Australian economy between 1861 and 1891 as being remarkably prosperous. Unemployment was low, wages were high by contemporary international standards, and the fruits of prosperity were shared more or less equally by Australians as a whole. Occasionally, economic activity slackened, but recessions were neither deep nor protracted. Overall, it is argued, the Australian economy experienced rapid and sustained growth. Coghlan, in his pioneering work on labor and industry in Australia, argued that while the 1860s were a time of some difficulty for industrial labor, the 1870s and 1880s were years of prosperity. "Wages were rising, and, with few and short intervals, employment was abundant. It appeared as if a certain standard of life had been established definitely for Australian industrial workers, far and above that of Great Britain" (Coghlan [1918] 1969, 1239–40).

Implicit in the notion that Australia was a "workingman's paradise" are three different ideas. First, Australians were thought to be living in greater comfort than working men in comparable occupations in the mother country. Second,

the term implied that there were greater opportunities for Australian workers and their families to improve their lot and that these opportunities were achievable with greater ease than in Britain. Third, such opportunities were open to all. The contemporary view, then, was that both relatively and absolutely Australians had a better standard of living. As Shirley Fitzgerald puts it, "In both popular and learned observations about nineteenth century Australian society, two assumptions are firmly entrenched: firstly that the society was wealthy and secondly that it was egalitarian. These two ideas are seen to be compatible, with the one 'causing' the other, through the medium of mobility" (1987, 6). Contemporary observers might have sometimes witnessed the existence of both rural and urban poverty, but this was believed to be temporary.

Macarthy argued that the generally high per capita living standards during the 1860s, 1870s, and 1880s were made possible by "the relationship of scarce labour with the remarkable wealth of Australia's natural endowments" (1970, 56–57). Capital-intensive but non-labor-intensive exploitation of these resources made scarce labor highly productive in the primary industries. The resultant high wages "spread to other groups of workers" because of the unskilled nature of most work (Macarthy 1970, 57). Macarthy insisted that both unskilled and skilled labor received "extraordinarily high" wages. "In the seventies and eighties, railway workers, itinerant pastoral workers and miners were paid 7s or 8s a day," almost twice as much as their British counterparts (Macarthy 1970, 57). He also argued that differentials between skilled and unskilled workers were comparatively narrow. Pre-1850 differentials were broken down by the scarcity of labor (Connell and Irving 1980, 130). More recent research has confirmed these findings. Mark Thomas's assessment is that for "the last quarter of the nineteenth century, at least, Australia was experiencing a reduction in wage dispersion, distorted only by the severity of the depression of the 1890s" (1991, 170).

The concept of the workingman's paradise has been enduring, and research by modern historians and economic historians has tended to perpetuate this rosy view of the second half of the last century. During the past 20 years or so, however, a certain amount of revisionist work has been carried out, although it is not possible to speak of a full-blown standard of living debate. Acknowledging the shortcomings of conventional economic indicators of well-being, the revisionists' work has tended to concentrate on challenging the assumptions underlying the concept of the workingman's paradise. With the exception of Graeme Snooks's work on estimating gross community income (see below), no attempt has been made by the revisionists to rework the output and income data for the period 1860–90.

The level of home ownership was one of the first issues to be tackled. Noel Butlin had argued in 1962 that during the long boom more than 50 percent of houses in Australia were owner occupied (1962, 259–60). More recent research, however, shows that the ideal of home ownership was realized only by a minority of urban dwellers, although it was much more common outside the

metropolitan areas (Jackson 1970; Dingle and Merrett 1972; Davison 1978, 175–89). It remains true, however, that from an international perspective Australian home-ownership rates were high; they were certainly higher than in major British cities, and there were few cities in the United States that could match Australian home-ownership rates (see Frost 1991, 123–26).

It could be argued that the level of home ownership is only of peripheral importance in determining trends in living standards. Clearly, home ownership was an important ideal. It signified the acquisition of a certain amount of wealth and status as well as independence. Housing quality, however, is a better indicator of living standards than housing tenure. Would people be better off if they owned or were in the process of paying for houses that were poorly constructed and surrounded by equally insanitary properties?

Urban historians have gathered an impressive amount of evidence on the quality of housing in Australia. For the most part, however, the research has been done in terms of individual cities; few attempts have been made to provide an overview for Australia as a whole. Nevertheless, two things seem reasonably clear. First, great variations in the quality of housing existed both in individual metropolitan areas and in country areas. Second, Australian houses, whether owner occupied or not, were overall much more spacious, and Australian cities tended to be much less crowded, than was the case in other countries (Frost 1991).

In addition to the issue of home ownership, revisionists have questioned whether incomes rose as quickly during the long boom as is commonly assumed. More especially, they have cast doubts on whether the rise in incomes was something experienced by all occupational groups. Before proceeding, it needs to be said that money incomes are a very inadequate proxy for the standard of living. This is so because, among other things, variations in family size, goods and services received in kind from an employer or from family, and the value of the time family members, such as wives and children, spend in nonmarket activities also need to be accounted for (Travers and Richardson 1993, chap. 1). Unfortunately, these other aspects of income are difficult to measure for historical populations. Economic historians have had to make do with information on incomes earned from market activities only. The work of Graeme Snooks (1994), mentioned below, is a notable exception.

Traditionally, economic historians have relied on officially published wage rates for information on incomes during the nineteenth century. Lee and Fahey have argued, however, that such evidence presents a distorted picture in the sense that actual earnings differed markedly from published wage rates. Their work has strongly attacked the conventional assumption that during the long boom labor markets were tight and hence that full employment prevailed (Lee and Fahey 1986, 2). For many workers, they argued, actual earnings varied considerably from what might be deduced from wage rates published in the colonies' yearbooks and statistical registers. Instability and insecurity of employment were major characteristics of most jobs because of the prevalence of

casual labor. Shirley Fitzgerald said of Sydney that "within the construction industry the normal fluctuations in the building cycle were accentuated by uneven rates of immigration and by a large erratic public building programme. Much manufacturing was undercapitalized, and used labour on a daily basis. Port work is always seasonal and irregular, but more so if the bulk of the cargo being shipped is primary produce of a limited range, and the pastoral industry impinged on the Sydney economy not only because of its widely varying labour requirements, but because the processing of its raw materials was also seasonal" (1987, 202).

In the country, too, much work was casual. Pastoral stations, for example, might have a small number of more or less permanently employed boundary riders and stockriders, but a large proportion of a station's workforce worked on day or piece rates or on contract (Fox 1991, 35).

Lee and Fahey maintained that the pronounced seasonal variability of work was a fundamental cause of the extent of casual labor. For many industries summer was a time of intense activity. Activity then slackened, and by winter a trough was reached. Lee and Fahey also confirmed the flow-on effects of the seasonal characteristics of the rural production cycle on the demand for labor at the ports and by urban industries. Not all work was subject to seasonal fluctuations to the same extent. The service industries, clerical occupations, and the professions were least affected by it, and in these industries greater security of employment was the norm, although, for example in the case of clerks, not always at better rates of pay than for those of the casual labor force (Kingston 1988, 48).

Apart from seasonal fluctuations, Lee and Fahey also found instability of employment because of the characteristics of Australian manufacturing, which until the late 1880s "was characterised by labour intensity, low levels of capitalisation, short production lead times and small inventories of stock on hand" (1986, 16). On the other hand, industries such as apparel manufacturing houses, large newspapers, highly capitalized food-processing firms, breweries, and big metalworking establishments offered more stable employment opportunities.

The unskilled faced greater job insecurity than the skilled, although skill was found not to be the sole determinant of job security. Long-standing working relationships between employer and worker or family connections were often also important. Nor was the situation static throughout the long boom. By the 1880s changes in urban manufacturing increased job opportunities for unapprenticed, unskilled juveniles and for women, who were frequently employed on a casual basis. These jobs were created often at the expense of skilled tradesmen.

Lee and Fahey suggested that temporary unemployment, or indeed underemployment, was a fact of life for many Australians during the second half of the nineteenth century and that this phenomenon increased in magnitude as the century wore on. Their analysis suggests that even though the differential

between published wage rates for the skilled and unskilled may have been narrow, the gap in actual earnings between the two broad groups of workers may have been larger than previously thought.

The large variation in hours and hence earnings emphasized by recent historical work has made any assessment of material living standards much more complex. It has also made generalizations about the living standard experienced by different socioeconomic groups more problematic.

## 10.2 Inadequacies of the Economist's Measures: The Debate on What Happened to Australian Living Standards, 1890–1940

In 1983 Ian McLean and Jonathon Pincus pointed to a conundrum about Australian economic development in the period 1890–1940.[1] The economist's favored summary measure of economic well-being—real income or product per capita—suggested an extremely poor performance, when compared both to other advanced countries and to Australia's growth performance before and after this 50-year phase. Angus Maddison's estimates suggest that from 1890 to 1940 Australia's growth in real GDP compared favorably with other advanced countries. They indicate also, however, that Australia experienced both the most rapid population growth and the slowest increase in real income *per capita* among the developed countries (Maddison 1977, 103–31). Real GDP per capita, measured in 1966–67 dollars, rose from $915 in 1891 to only $1,045 in 1938–39. Likewise, real consumption expenditure per capita, measured in 1966–67 dollars, reached its peak of $775 in 1889, virtually identical to the $773 achieved 50 years later in 1938–39. While there was much volatility between 1889 and 1938–39, the twentieth-century peak achieved in 1926–27 was a mere 13.5 percent above the 1889 figure (McLean and Pincus 1983, 195).

This evidence suggests that Australian living standards may have stagnated between 1890 and 1940. But if that were so, McLean and Pincus argued, why was it that a host of other indicators indicated unequivocally that living standards had improved substantially during this period? What should we make of the fact, for example, that the life expectancy of an Australian male born in 1890 was only 50 years but that of an Australian male born in 1940 was 65 years? And what about the substantial reduction in the average working week for urban Australians, from 52–54 hours in 1890 to 45 hours in 1939? There was also a marked improvement in the quality of the housing stock. Furthermore, by the late 1930s one in ten Australians had a telephone, one in eight a motor vehicle, and one in six a radio. In 1890 these consumer durables were either nonexistent or at best something to exercise the imagination (McLean and Pincus 1983, 193).[2]

1. An earlier version of the paper, containing a full set of the data on which the 1983 article is based, is McLean and Pincus (1982).

2. In their 1982 paper, McLean and Pincus provide a more comprehensive analysis of these, as well as of a number of other, partial indicators of living standards than is done in the 1983 article.

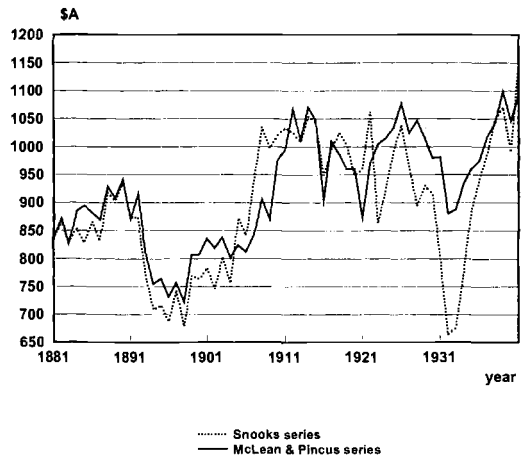


**Fig. 10.1 GDP per capita, Australia, 1880–1940**
*Sources:* Adapted from Snooks (1994, 180–81) and McLean and Pincus (1982, 29–30).

McLean and Pincus sought to reconcile two contradictory stories: that told by the economist's measures on the one hand and by the partial indicators of the quality of life on the other. The first step was to revise Noel Butlin's estimates of domestic product. A problem with the Butlin series was that consumption and its deflator had been arrived at residually. By using an alternative and, in their opinion, more appropriate deflator, namely retail price indexes, McLean and Pincus argued that the trend growth in real GDP per person, 1891 to 1938–39, increased by 0.2 percent per annum. (The revised estimates of real GDP per capita are shown in fig. 10.1, where they are compared with another, more recent, reestimate by Graeme Snooks.) The next step was to deal with the reduction in weekly working hours, which they calculated was of the order of 18 percent. By assuming that workers had exchanged leisure for the income they would have earned had they worked longer hours, and hence that leisure was "purchased" at a marginal cost equal to the hourly wage rate, and by generalizing from the paid labor force to the population as a whole, McLean and Pincus argued that real GDP per capita should be increased by 18 percent for the period 1890 to 1938–39, which represented an annual average increase of 0.3 percent. They used a similar procedure in trying to determine the effect on GDP of an apparent decline in retirement ages. The 1891 census showed that the labor force participation rate of males did not fall below 80 percent until age 75, whereas the 1933 and 1947 censuses showed that the fall began at about age 63. McLean and Pincus argued that if the 1939 aged population had had the 1890 labor force participation rate, then labor input would have been about 11 percent higher than it was. This represented an increase in the annual growth rate of real GDP of 0.2 percent. Finally, there was the issue of the increase in life expectancy, which rose for men by about 25 percent in the

period from 1890 to 1940. It followed that those men aged 20 in 1940 could consume 25 percent more over their lifetime than their counterparts in 1890 just by living longer. The question was, What was the appropriate rate to discount the value of the extra future years of consumption? If the discount rate is set at 4 percent, McLean and Pincus argued, then the average annual growth in real GDP, 1891 to 1938–39, increased by 0.2 percent. A zero discount rate increased it by 0.4 percent.

Depending on the discount rate used for additional life expectancy, McLean and Pincus's estimates suggest an annual average growth rate in real GDP per capita, 1891 to 1938–39, of either 1.5 or 1.7 percent, which compares with measured real GDP per capita growth of only 0.6 percent. The augmented measure might lead one to conclude that living standards did not stagnate between 1890 and 1940. The difficulty, however, as McLean and Pincus themselves acknowledged, is that the augmented growth rate cannot be compared with growth rates in either the first long boom of 1860–90 or the second long boom of 1940–73. There is a possibility, they said, "that adjustments similar to those we have performed might yield proportionately higher growth rates for the other two periods distinguished, leaving the 1890–1940 period relatively stagnant" (1983, 201).

Not surprisingly, the McLean and Pincus paper has had its fair share of critical commentators. R. V. Jackson pointed to a number of conceptual and technical difficulties in the paper, notably some instances of double counting. His contribution was largely negative, in that he was content to point to weaknesses in McLean and Pincus's analysis but did not offer an alternative measure of changes in living standards. His assessment was that "the characterisation of the decades after 1890 as a period of relatively slow growth in living standards can be allowed to stand, though the relative rate of improvement may have been somewhat greater than is suggested by the conventional national accounting measures" (1992, 44). His overall verdict was that

> the prospect of constructing a persuasive summary indicator of wellbeing . . . remains remote. Given the difficulties and arbitrary procedures that are necessarily involved, and given the inevitable partiality of whatever aggregate indicator is developed in this context, it might be more fruitful to attempt something less ambitious. In particular, we would do well to concentrate on the development of measures which aim to do no more than show the change in the volume of economic activity that is relevant to wellbeing. GDP already provides us with an indicator of market output and there is good reason to extend this measure to include an imputation for the nonmarket work which produces output for consumption within the household. This would not pretend to measure the overall level of wellbeing but would serve as an index of both market and nonmarket production of the final goods and services which contribute to wellbeing. (1992, 44)

This is precisely what Graeme Snooks has done. Snooks provided estimates of what he calls "gross community income" (GCI) for the period 1800–1990.

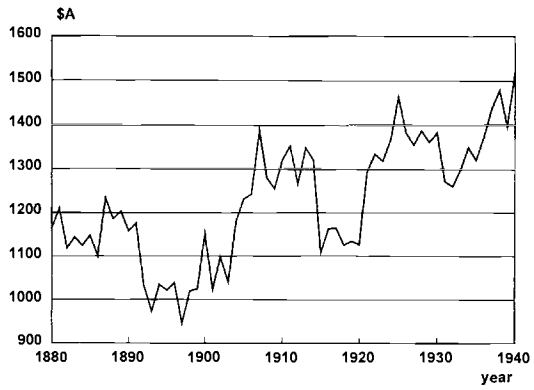


**Fig. 10.2 Gross community income per capita, Australia, 1880–1940**
*Source:* Adapted from Snooks (1994, 172–73).

He defines GCI as "a measure of the total economic activity that takes place in both the household and market sectors on an annual basis. It is an extension of the concept of GDP to the Total Economy." The market sector is divided, following convention, into the private and public sectors. The household sector refers to "the production of economic goods and services that could be marketed, but are not" (Snooks 1994, 267).[3] The total economy comprises the household, private, and public sectors.

Snooks is unequivocal about the significance of his estimates of GCI in interpreting economic growth and community living standards in the period 1890–1940: "No matter how much some scholars wish to revive the status of the period 1890 to 1939, particularly in relation to the second half of the nineteenth century, it must be seen as adding little of a permanent nature to average material standards of Australian society" (1994, 25; see also 135). GCI per capita grew by only 0.3 percent per annum from 1889 to 1939, whereas it grew by 1.2 percent per annum from 1861 to 1889, and 2.9 percent per annum from 1946 to 1974. (Fig. 10.2 shows Snooks's estimates of real GCI per capita for the period 1860–1940.) And if one considers GCI *per household,* there was in fact a decline of 0.2 percent per annum from 1889 to 1939, compared with a rise of 1.7 percent per annum from 1861 to 1889. GCI per household, Snooks insisted, is "the most appropriate measure of average living standards" (1994, 25).

Snooks did concede that the quality of life, as indicated by mortality, morbidity, and leisure, improved significantly during this period. But it is important, he argued, "to emphasize the fact that the acquisition of material goods

3. Snooks cited as examples "the preparation of meals and the associated clearing away and dishwashing, laundry, house cleaning, child-care and informal education, the production of clothing and furnishings, garden care, house repairs, and other activities such as shopping, record keeping, and payment of household accounts" (1994, 157, 267).

and services did not much improve, because it is the command over material goods and services that gives human society the resilience to survive in the longrun. In the past, societies that have failed to achieve *economic resilience*—failed to compete successfully in the race for economic power—have not survived. Economic resilience, not the acquisition of non-material gains, is the underlying objective of viable societies." "This critical issue," Snooks suggested, "appears to have been overlooked by previous scholars when discussing the issue of growth and living standards" (1994, 25).

## 10.3 Height and Living Standards

There is a diversity of opinion on what happened to Australian living standards in both the 1860–90 period and the 1890–1940 period. The evidence provided by some of the partial indicators appears to contradict the trends suggested by data on real income and output per capita. There is the additional difficulty that economic historians have devised a variety of different, and inconsistent, measures of augmented income levels.

An important alternative indicator that captures both the material and non-material aspects of the standard of living is the average nutritional status of a population. For the economic historian it has the virtue of permitting more specific observations about the standard of living experienced by the population as a whole as well as by population subgroups. Average nutritional status can be defined as "the outcome of the nutrient intakes since conception balanced against the demands of those nutrients for health, growth, work, play, warmth and happiness" (Floud, Wachter, and Gregory 1990, 18–19).

A study of average nutritional status, however, presents the researcher with formidable problems. On the supply side, it would require a consistent series of data containing detailed information on food consumption over time. For Australia, as for other countries, such data tend to be rare if available at all, although some valuable work has recently been carried out on the history of food and nutrition in New South Wales by Walker and Roberts (1988). For their research, Walker and Roberts drew on a wide variety of sources such as convict ration scales, rations on convict and immigrant ships, and rations in Sydney infirmaries and asylums. The dietary scales used, however, often represented the minimum nutritional intake and could therefore not say much about actual nutritional intake by individuals. On the demand side, a study of nutritional status would necessitate the construction of an index of various factors that may affect nutritional intake. In practice, this would be a near impossible task, complicated by the question of what weight to attach to the various components of total demand on nutritional intake. These might include demands made on nutritional intake for maintenance and growth of the body, to fight disease, or to maintain a high work intensity.

Fortunately, a convenient proxy exists for average nutritional status, namely, human height. It follows that height-for-age, the change in height between suc-

cessive ages (velocity or rate of growth), the age at which final height is reached, and final adult height are reliable and important indexes of a country's health and nutrition (Eveleth and Tanner 1976, 1; Fogel et al. 1983). Anthropologists, biologists, and nutritionists have found each of these measures of stature to be sensitive indicators of nutritional inputs and environmental impacts during the growing years. In a sample of developed and underdeveloped countries, average height was found to be highly correlated with the log of per capita income, which suggests that factors correlated with poverty such as poor diet, hard work, and poor medical care are major sources of nutritional deprivation and slow growth (Steckel 1986, 1–7).

Height data, used in conjunction with information on wages, mortality, and morbidity, offer a new way of assessing Australian living standards. Poor nutrition, revealed during wartime shortages, may slow growth, and disease may also retard growth by impeding the absorption of nutrients and diverting nutrition to combat infection. Malnutrition and illness may interact to produce an effect on height larger than the separate effects of each in isolation (Scrimshaw 1975, 22). Catch-up growth (where velocity exceeds the average rate for a given chronological age) may follow brief periods of malnutrition, but if environmental conditions are unsatisfactory, growth may resume at no more than the normal rate. Prolonged but moderate malnutrition tends to delay and diminish the adolescent growth spurt and postpone the age at which adult height is attained. Malnutrition that is severe and chronic may substantially erode the typical growth pattern and result in permanent stunting (Steckel 1986, 1992).

Height provides a net rather than a gross measure of nutrition and depends on the nutrition available for physical growth after claims made by body maintenance, work, and other physical activity. Clearly, the economic historian must investigate work intensity, the disease environment, and the state of public health, as well as nutritional inputs, if the growth spurt and average heights are going to be used to proxy changes in male and female living standards in the past. Unfortunately, it is not possible to determine precisely when during their growing years men and women were affected by changes in their living standards, but environmental factors predominate. While genes are important determinants of individual height, studies of genetically similar and dissimilar populations under various environmental conditions show that differences in average heights across most populations are due to environmental, not genetic, factors (Steckel 1992, 16).

## 10.4 Data and Findings

In trying to determine trends in height, economic historians have relied principally on military data. This has been our main source as well. We have collected data on 4,676 Australian-born men enlisting for World War I and 7,025 Australian-born men recruited for World War II. We have also collected information on 3,435 Australian-born men who joined the volunteer Common-

**Table 10.1** **Number of Male Observations Used in Height Profiles**

| | Australian-Born | Victorian | Non-Victorian |
|---|---|---|---|
| Total sample | 10,526 | 6,456 | 4,070 |
| Rural | 5,936 | 3,135 | 2,801 |
| Urban | 4,590 | 3,321 | 1,269 |

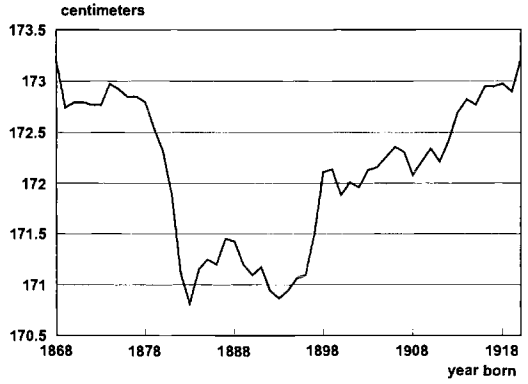


**Fig. 10.3 Australian male recruits, five-year moving averages**

wealth Boer War contingents of 1902. (Data sources are described in appendix A. Enlistment procedures and practices are discussed in appendix B). Although very few women enlisted in the Australian army during World War I, many thousands did so during World War II. Our data include information on 4,841 Australian-born women recruited during World War II.

Table 10.1 shows that the sample size was reduced to 10,526 once terminal heights had been determined. (Appendix C provides an analysis of the data. It discusses the results of tests for normality and describes our procedure for deciding on terminal heights.) The table also shows that there are a large number of Victorians in our sample. Victoria was, after New South Wales, the most populous colony/state in Australia in the period under review. Its capital city, Melbourne, was the largest Australian city for much of the second half of the nineteenth century and was eventually eclipsed by Sydney only during the twentieth century. The predominance of Victorians arises essentially because the World War II data are derived from the attestation papers of recruits enlisting in that state. This raises questions, of course, about the representativeness of our sample. Clearly, one has to exercise some caution in interpreting the Australia-wide trend in heights (fig. 10.3), although we do contrast the Victorian and non-Victorian trends (see fig. 10.4). There will always be difficulties in interpreting results based on birthplace. The fact that a person was

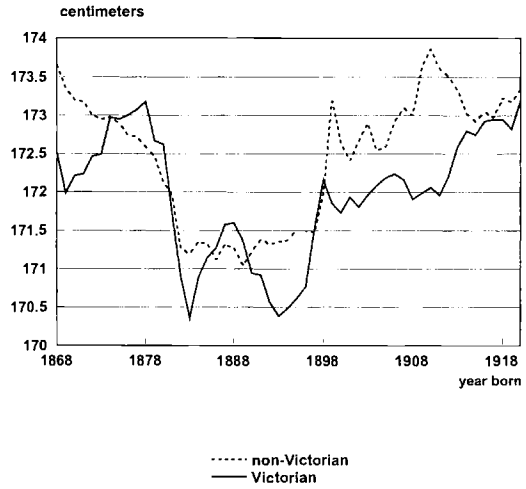


**Fig. 10.4 Victorian and non-Victorian male recruits, five-year moving averages**

born in Victoria does not mean, of course, that he or she then stayed there until recruitment. Indeed we know that there was a high degree of geographic mobility in Australia during the period under consideration.

Table 10.1 also provides information on the numbers of people in our sample from rural areas and from urban areas (the latter are defined as towns with 5,000 or more inhabitants in either 1901 or 1921). If it seems that there is a relatively large number of people from urban areas, it has to be remembered, as we will discuss in more detail below, that Australia was already a highly urbanized nation by the late nineteenth century. By 1901, some 51 percent of the population in eastern Australia lived in urban areas (Jackson 1977, 93). Although Victoria was the most highly urbanized state, the non-Victorian rural-born recruits are clearly overrepresented.

Figure 10.3 shows five-year moving averages of final attained height for Australian male recruits.[4] Heights were indexed to the year of birth.[5] Heights were reasonably stable during the 1870s. A dramatic decline in height occurred from 172.8 cm in 1878 to 170.8 cm in 1883. There then occurred a recovery to 171.5 cm in 1885 before a further decline to 170.9 cm in 1892–94. Heights improved rapidly after 1896, reaching a peak of 172.1 cm in 1898–99. From that point the trend continued upward but at a slower rate, reaching 173.2 cm

4. Five-year moving averages are used for smoothing purposes. The results do not change using single-year data.

5. More fully, our method is as follows. In the year 1888, to use this as an example, 160 recruits were born. Their average final height was 67.31 inches. We calculate an average height for each year and then smooth it by using five-year moving averages.

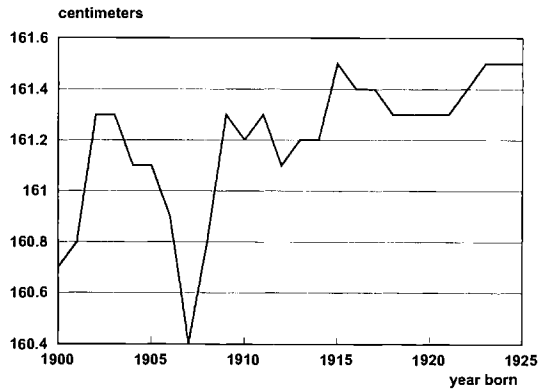


**Fig. 10.5 Australian female recruits, five-year moving averages**

in 1920, the last year in which we have a suitably large sample size. However, by 1920 heights had only attained the level achieved in 1867–68.[6]

Figure 10.4 shows that the general pattern for the Australian-born males in figure 10.3 was repeated for males born in Victoria and males born outside Victoria (mainly in New South Wales, Queensland, and South Australia). In both cases there is a marked decline in heights during the 1880s and a plateau that lasts until the mid-1890s, followed by a sustained recovery. However, there are also some differences. One is that there was an improvement in height in Victoria until the end of the 1870s, before a sharp fall. Outside Victoria a fall in heights was more gradual and consistent. It also began earlier, dating from the late 1860s. There are differences also in the timing and the extent of the recovery of heights.

Our sample included 4,841 Australian-born women recruited into the army during World War II. The height profile for women in figure 10.5 contrasts sharply with that for males. Heights declined in the first years of twentieth century before experiencing an upward trend, although the improvement in height was very slight and occurred very slowly. Heights rose from 63.28 inches in 1900 to reach a temporary peak of 63.52 inches in 1902 and 1903. They then fell to a minimum of 63.14 inches in 1907. By 1924, the last year for which we have an adequate sample size, a new peak of 63.60 inches had been attained. The profile of female heights suggests that, compared to men, women experienced different access to nutrients, a different disease environment, a different level of work intensity, or some combination of all three.

It is possible that the trends for male and female heights shown in figures

6. It might be argued that the major shifts evident in fig. 10.3 are associated with different recruitment regimes, where the World War I recruits replace the Boer War recruits and where the World War II recruits replace those from World War I. However, when we run five-year moving averages for each individual data set the trends are consistent.

**Table 10.2 Occupational Classification**

| Occupational Groups | | Occupational Dummies |
|---|---|---|
| 1. | Upper professional | Professional |
| 2. | Graziers | Professional |
| 3. | Wheat and sheep farmers | Farmers |
| 4. | Lower professional | Professional |
| 5. | Managerial professional | Professional |
| 6. | Self-employed proprietors | Professional |
| 7. | Other farmers | Farmers |
| 8. | Clerical and related workers | Semiskilled |
| 9. | Armed services and police | Semiskilled |
| 10. | Craftsmen and foremen | Skilled |
| 11. | Shop assistants | Semiskilled |
| 12. | Operative and process workers | Semiskilled |
| 13. | Drivers | Semiskilled |
| 14. | Personal, domestic, and other service worker | Unskilled |
| 15. | Miners | Unskilled |
| 16. | Farm and rural workers | Unskilled |
| 17. | Laborers | Unskilled |

*Source:* Broom and Jones (1976).

10.3, 10.4, and 10.5 are influenced by biases in our sample. Heights may vary with occupations, urban-rural birthplace, and state/colony in which birth occurred, resulting in the height movements in these figures being statistical artifacts of the changing occupational and regional structure of our samples. To cite one of a number of possibilities, a shift in our sample from skilled to unskilled workers could account for the declining heights during the "golden age" of the 1880s. To test this hypothesis, regressions were run on height allowing for occupation, state of birth, urban-rural birthplace, and birth by quinquennia.[7] In table 10.2 occupation dummies were calculated by placing each occupation from the attestation papers into one of the 17 occupational categories from Broom and Jones (1976). These 17 occupational categories were then collapsed into five classes: professional, farmers, skilled, semiskilled, and unskilled. Urban birth location was defined as being born in a town whose population in 1901 or 1921 was greater than 5,000. The state of birth is recorded on the attestation papers.

Regression results on the entire male data set in table 10.3 show that composition effects by occupation and state do not disturb the period effects evident in figures 10.3 and 10.4.[8] The excluded groups in the regression were men born before 1871 in the professional and farmer classes for all states except New South Wales and Victoria. Skilled, semiskilled, and unskilled men were sig-

7. The difference in the number of observations in the first and second columns is explained mostly by the exclusion of Boer War recruits from the second column. Part of the difference is due also to a lack of full information.

8. Note that there was no evidence on urban-rural birthplace for Boer War recruits.

**Table 10.3** **Regression Model for Composition Effects**

| | Regression 1: All Data (1) | World War I and II Males (2) | Females (3) |
|---|---|---|---|
| Urban | | −0.19 | −0.16 |
| | | (0.083) | (0.097) |
| Skilled | −0.48 | −0.39 | |
| | (0.117) | (0.143) | |
| Semiskilled | −0.40 | −0.42 | |
| | (0.105) | (0.126) | |
| Unskilled | −0.62 | −0.66 | |
| | (0.102) | (0.124) | |
| Farm laborers | −0.38 | −0.51 | |
| | (0.134) | (0.182) | |
| Clerical/office | | | −0.21 |
| | | | (0.141) |
| Birth 71–75 | −0.18 | | |
| | (0.16) | | |
| Birth 76–80 | 0.09 | | |
| | (0.158) | | |
| Birth 81–85 | −0.80 | | |
| | (0.195) | | |
| Birth 86–90 | −0.62 | −0.03 | |
| | (0.178) | (0.158) | |
| Birth 91–96 | −0.85 | −0.24 | |
| | (0.163) | (0.138) | |
| Birth 96–00 | −0.19 | 0.41 | |
| | (0.222) | (0.138) | |
| Birth 01–05 | −0.15 | 0.45 | |
| | (0.188) | (0.172) | |
| Birth 06–10 | −0.20 | 0.40 | |
| | (0.171) | (0.151) | |
| Birth 11–15 | 0.03 | 0.49 | |
| | (0.141) | (0.127) | |
| Birth 15–19 | | | 0.23 |
| | | | (0.158) |
| Birth 16+ | 0.19 | 0.70 | |
| | (0.140) | (0.121) | |
| Birth 20+ | | | 0.11 |
| | | | (0.1136) |
| VIC | −0.17 | −0.10 | 0.16 |
| | (0.090) | (0.115) | (0.145) |
| NSW | −0.13 | −0.03 | |
| | (0.106) | (0.142) | |
| Intercept | 68.47 | 67.92 | 63.54 |
| | (0.164) | (0.156) | (0.205) |
| $R^2$ | 0.013 | 0.013 | 0.011 |
| $N$ | 10,364 | 8,191 | 3,372 |

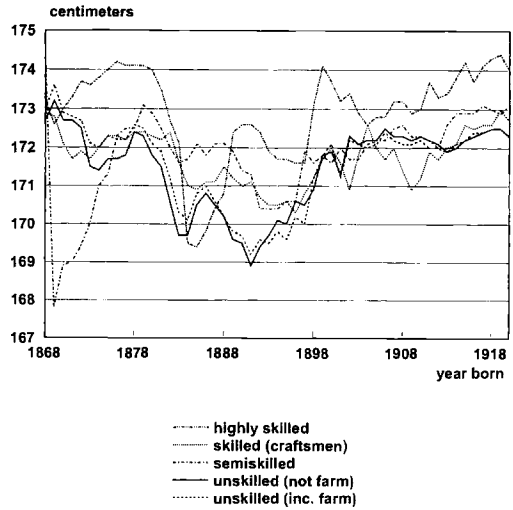


**Fig. 10.6 Height by class, five-year moving averages**

nificantly shorter than professionals and farmers. This is consistent with figure 10.6, which plots the five-year moving average of each of the occupational dummies. The state dummies were not significant, although recruits born in New South Wales were shorter, and recruits born in Victoria were taller, than recruits from other states. Allowing for occupation and state of birth, the negative and statistically significant quinquennial dummies show declining heights for men born between 1879 and 1893. Although heights rose continuously from 1894, the average height of recruits born after 1894 did not reach the average height of recruits born before 1880 until 1906.

Regressions using the World War I and II data are presented in column (2) of table 10.3. The excluded groups in the regression were rural-born professionals and farmers born before 1886 in all states except New South Wales and Victoria. Men born in urban areas were significantly shorter than those born in rural area. Furthermore, skilled, semiskilled, and unskilled men were significantly shorter than professionals and farmers, the excluded groups. The state dummies were not significant. Allowing for composition effects, the quinquennial dummies are negative (but insignificant) for men born before 1896 and positive and significant for the post-1896 birth year quinquennial coefficients. These results are consistent with the five-year moving averages of World War I and II heights in figure 10.3, where average heights fell before 1896 before rising until 1919.

The final regression in table 10.3 presents results from the female recruits. The urban birthplace coefficient was the expected negative sign, but insignificant. Victorian-born women were taller than women from the rest of Australia,

although this coefficient is not statistically significant either. The quinquennial dummies were not significant, with women's heights stagnant through the whole period, which is consistent with the five-year moving averages in figure 10.3.

Allowing for composition effects, all the regressions in table 10.3 confirm the time profiles displayed in figures 10.3, 10.4, and 10.5, which shows that the movements in male and female heights were not an artifact of changes in occupational groupings or the in mix of urban-rural or state birthplace.

## 10.5 Additional Anthropometric Evidence: Heights of Schoolchildren

Anthropometric work conducted early this century confirms a marked improvement in height in the first two decades of the twentieth century. It also demonstrates, inter alia, that Australian children were taller than their British counterparts and that rural children were taller than those in urban areas. In New South Wales in 1918–19, observations were made of the heights and weights of 112,259 boys and 104,211 girls. One of the things revealed in the survey was the pronounced degree to which children attending schools in rural districts had a bigger physique than those living in metropolitan areas or in large country towns. The children were also classified into parentage groups. It was found that children with "both Australian" parents were both heavier and taller than those with parents "one Australian, one foreign." The latter were in turn heavier and taller than those with parents "both foreign," with "foreign" being defined as outside Australia or New Zealand (Cumpston 1989, 101, 102).

Of particular interest for our purposes are two surveys conducted by the Department of Education of Victoria in 1912 and in 1922. In the former, the heights and weights of 5,833 boys and 5,631 girls were recorded. In the latter, observations were made of 14,561 boys and 11,966 girls. The results are shown in table 10.4. What stands out is that for each of the ages between 4 and 16, the 1922 children were taller than those of 1912.

Drawing on the New South Wales studies of schoolchildren, Sutton went on to call attention to "the curious and important fact that the child born in Australia of Australian born parents is taller and heavier than the boy born in Australia of overseas parents, though both have lived in Australia all their lives. Both definitely exceed the immigrant child in stature and weight, and the immigrant is above the average of the homeland." "In spite of many discussions of Australian characteristics," he continued, "that is almost the only definite fact yet recorded concerning the Australian child. We are growing them bigger and better. . . . The Australian children of overseas parents were in the majority in school in the nineties, the Australian of Australian parentage was in the majority in 1911, while the Australian of Australian grandparents is beginning to make a definite appearance" (1931, 614).

**Table 10.4** **Average Height (in inches) of Victorian Schoolchildren, 1912 and 1922**

| | 1912 | | | | 1922 | | | |
|---|---|---|---|---|---|---|---|---|
| | Elementary School | | High School | | Elementary School | | High School | |
| Age | Boys | Girls | Boys | Girls | Boys | Girls | Boys | Girls |
| 4 | | | | | 40.4 | 39.9 | | |
| 5 | 41.0 | 40.5 | | | 42.2 | 42.0 | | |
| 6 | 42.7 | 42.2 | | | 44.3 | 44.0 | | |
| 7 | 45.0 | 44.5 | | | 46.5 | 45.9 | | |
| 8 | 47.2 | 46.5 | | | 48.3 | 47.8 | | |
| 9 | 49.0 | 48.5 | | | 50.3 | 49.9 | | |
| 10 | 50.7 | 50.0 | | | 52.2 | 51.7 | | |
| 11 | 52.2 | 51.5 | | | 54.1 | 53.9 | 55.4 | 56.5 |
| 12 | 54.5 | 54.0 | | | 55.5 | 56.2 | 55.8 | 58.3 |
| 13 | 55.5 | 56.5 | | | 57.6 | 58.3 | 58.8 | 60.7 |
| 14 | 57.5 | 59.0 | 60.5 | 61.5 | 59.6 | 60.0 | 61.5 | 62.0 |
| 15 | | | 63.2 | 61.7 | 61.5 | 67.5 | 63.8 | 63.0 |
| 16 | | | 64.5 | 62.0 | | | 65.5 | 63.7 |
| 17 | | | 65.1 | 62.6 | | | 67.1 | 63.7 |
| 18 | | | 66.3 | 62.7 | | | 67.6 | 65.0 |

## 10.6 Mortality and Morbidity

### 10.6.1 Mortality

It is important to supplement the height data by information on other measures of physical well-being, especially mortality and morbidity data. There are difficulties in interpreting changes in mortality rates over time since death rates are affected by the age structure of the population. Mortality rates as between different social groups for our period are not known, but Ruzicka has argued that

> mortality has taken its toll of lives in an inequitable fashion. Class differentials have existed in Australia as in other Western societies, though the evidence as to the extent of the mortality effect of such differentials is less well documented than, for instance, in the United Kingdom. Although sufficient information and hard data are even more limited, it may be confidently surmised that higher mortality has prevailed among the less privileged, less formally skilled, less educated and less fully-waged people. This area has been so far inadequately explored in Australia although it is likely that the lower social classes are more at risk from occupational diseases and accidents, and have been less quick to relinquish dietary habits and life styles now recognised as hazardous. (1989, 46)

**Table 10.5 Australia: Life Expectancy at Selected Ages, 1870–81 to 1932–34**

| Age | 1870–81 | 1881–90 | 1891–1900 | 1901–10 | 1920–22 | 1932–34 |
|---|---|---|---|---|---|---|
| | | | *Males* | | | |
| 0 | 46.47 | 47.20 | 51.08 | 55.20 | 59.15 | 63.48 |
| 10 | 49.18 | 48.86 | 51.43 | 53.53 | 56.01 | 58.02 |
| 20 | 40.80 | 40.58 | 42.81 | 44.74 | 46.99 | 48.81 |
| 30 | 33.27 | 33.64 | 35.11 | 36.52 | 38.44 | 39.90 |
| 40 | 26.20 | 26.50 | 27.65 | 28.56 | 30.05 | 31.11 |
| 50 | 19.80 | 19.74 | 20.45 | 21.16 | 22.20 | 22.83 |
| 60 | 13.79 | 13.77 | 13.99 | 14.35 | 15.08 | 15.57 |
| 70 | 8.88 | 8.82 | 8.90 | 8.67 | 9.26 | 9.60 |
| 80 | 5.39 | 5.11 | 5.00 | 4.96 | 5.00 | 5.22 |
| | | | *Females* | | | |
| 0 | 49.64 | 50.84 | 54.76 | 58.84 | 63.31 | 67.14 |
| 10 | 51.67 | 51.95 | 54.46 | 56.38 | 59.20 | 61.02 |
| 20 | 43.26 | 43.43 | 45.72 | 47.52 | 50.03 | 51.67 |
| 30 | 35.75 | 36.13 | 37.86 | 39.33 | 41.48 | 42.77 |
| 40 | 28.95 | 29.08 | 30.49 | 31.47 | 33.14 | 34.04 |
| 50 | 22.26 | 22.06 | 22.93 | 23.69 | 24.90 | 25.58 |
| 60 | 15.51 | 15.39 | 15.86 | 16.20 | 17.17 | 17.74 |
| 70 | 9.69 | 9.70 | 9.89 | 9.96 | 10.14 | 10.98 |
| 80 | 5.69 | 5.27 | 5.49 | 5.73 | 5.61 | 6.01 |

*Sources:* For New South Wales, Victoria, and Queensland only, Burridge (1884); remainder of data are from official life tables for Australia (Young 1976, 3).

We do have, however, estimates of life expectancy at birth for the period being surveyed (table 10.5). These estimates were constructed from generational life tables. It can be seen that a male born, for instance, in 1870–81 could expect to reach age 46.47. By 1920–22 this had increased to 59.15 years. Given the still high level of infant mortality, which was a major component of total mortality, as were accidents and tuberculosis, the rise in life expectancy at birth during the long boom can be interpreted as a positive indication for the standard of living, just as the even more marked rise in life expectancy for those born in the first 40 years of the twentieth century was cited by McLean and Pincus as a sign of a definite improvement in living standards.

Comparing the period 1870–81 with 1920–22, we can observe a marked improvement in survival values for males and females. In the period 1870–81, 59 percent of males and 62 percent of females could expect to survive from birth to 45 years of age. By 1920–22 the proportions had increased to 78 percent and 81 percent (Young 1976, 2). A substantial improvement can be seen also in age-specific mortality rates (table 10.6). In the 50 years surveyed in table 10.6, mortality rates were halved in each of the age groups up to and including those aged 35–44 years. There were significant reductions also in the 55–64 and 65–74 age groups (Young 1976, 7).

**Table 10.6** **Australia: Age-Specific Mortality Rates at 1870–72 and 1920–22**

| | Males | | Females | |
|---|---|---|---|---|
| Age Group | 1870–72[a] | 1920–22 | 1870–72[a] | 1920–22 |
| 0[b] | 126.0 | 70.1 | 109.4 | 54.5 |
| 1–4 | 17.1 | 7.1 | 16.2 | 6.2 |
| 5–14 | 3.9 | 1.8 | 3.4 | 1.5 |
| 15–24 | 5.0 | 2.6 | 4.7 | 2.3 |
| 25–34 | 7.8 | 3.9 | 7.4 | 3.8 |
| 35–44 | 11.1 | 6.1 | 10.7 | 5.2 |
| 45–54 | 17.6 | 11.3 | 13.2 | 7.9 |
| 55–64 | 30.8 | 23.1 | 22.8 | 15.5 |
| 65–74 | 60.2 | 50.9 | 46.5 | 38.6 |
| 75+ | 129.3 | 146.3 | 113.9 | 125.9 |

*Source:* Young (1976, 8).

[a]Rates for Victoria.

[b]Rates per 1,000 live births registered.

### 10.6.2 Infant Mortality

During the second half of the nineteenth century, infant mortality in Australia—at well over 100 deaths per 1,000 births as compared to 10 deaths per 1,000 live births in 1981[9]—was very high by modern standards, though the Australian record compared favorably with that of European countries and the United States. The infant mortality rate displayed considerable variation between the different colonies. In general, this can be related to the pattern of settlement. Close scrutiny of the available statistics reveals that in all the colonies, except Western Australia, infant death rates were rising during the 1880s. Rates started to decline by the end of that decade. However, all colonies experienced a temporary rise in the infant mortality rate during the late 1890s, and this was particularly so for Western Australia, which had previously recorded infant mortality rates below the national average. Tasmania, throughout the period 1870–1900 recorded, with the exception of 1883, consistently lower annual rates than the national average rate. As to the most populous colonies, New South Wales and Victoria, the data show that Victoria's infant mortality rate was on average higher than that in New South Wales, although this differential was eliminated by the 1890s (see Vamplew 1987, 58, table MFM 146–154). The Australia-wide trend is shown in figure 10.7.

The main cause of the still high infant mortality rates is revealed by looking at the main causes of infant deaths, that is, deaths of infants below one year of age. It now seems likely that at least half of all infant deaths were due to infant

9. Statistics on infant mortality are only available from 1870 onward. The records of infant deaths before 1870 are believed to be incomplete (Vamplew 1987, 58). See also Mein Smith (1991, 13) for comments on the shortcomings of the available data.

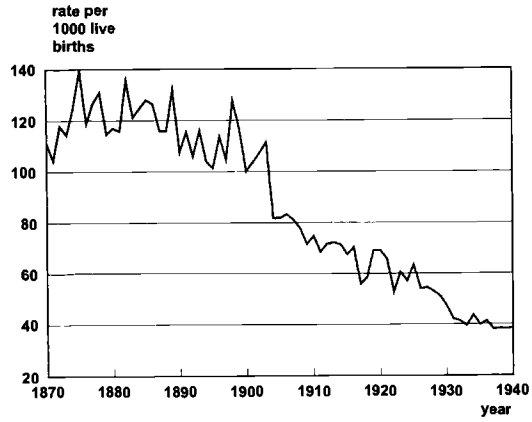


**Fig. 10.7 Infant mortality, Australia, 1870–1940**
*Source:* Adapted from Vamplew (1987, 58).

diarrhea associated with a lack of hygiene and contamination of water, milk, and other foods. It has been argued that considerable disparities existed between the infant mortality rates of urban areas and those of rural areas, mainly because "babies in the rapidly growing cities were more susceptible to gut infections" (Mein Smith 1991, 22–23). Within the less healthy urban environment there were also significant differences in infant mortality rates by social class, although no exact statistics are available on this issue.

### 10.6.3 Morbidity

In an important piece published in the *Medical Journal of Australia* in 1928, J. H. L. Cumpston argued that there are two great indexes of public health, namely, intestinal and respiratory infections, which in turn include enteric fever,[10] diphtheria, scarlet fever, measles, and whooping cough. Death rates from enteric fever showed that the year 1890 represented a dividing line.

Before then, death rates were high, being between 30 and 80 per 100,000. After 1890, however, death rates were lower (never being above 30, with Western Australia being the sole exception) and declining. By 1920 the death rate from enteric fever had fallen to 10 per 100,000. Diphtheria was introduced to Australia in 1858–60. Thereafter, it declined steadily in incidence. The only exception was a marked rise in the period 1887–90. With the introduction of antitoxin in 1895, however, "the biological history of the disease was obscured." There were irregular outbreaks of scarlet fever following its introduc-

10. Note that "enteric fever" (and other contemporary names such as "colonial fever") refers in fact to typhoid. Note further that correct diagnoses of typhoid only became possible at the turn of the century with the advent of bacteriology, and hence, until then, typhoid was called many names, even sometimes typhus, which is an entirely different disease spread by fleas.

tion to Australia. Major epidemics occurred at infrequent intervals from 1865 to 1880. The tide began to turn from around 1880 until it ceased to have any importance as a cause of death. This change, Cumpston argued, occurred between 1890 and 1900. After 1900 scarlet fever was at best negligible. For measles the dividing line was 1900. Before then measles epidemics were experienced regularly. During the epidemic years, the incidence of death was high: somewhere between 50 and 200 per 100,000. After 1900, however, the death rate from measles was usually lower than 10 per 100,000. While the disease became less epidemic, it became more endemic, in that the death rate during the interepidemic periods was higher after 1900 than before. Cumpston suggested that the history of whooping cough in Australia could be split into three distinct periods. The first was before 1880, when death rates were high. The second was from 1880 to 1900 (1910 in some states), during which the level of epidemic mortality was generally lower than in the preceding period. The third was the period since 1900, "in which the mortality level has been much lower than before 1900, the fluctuations from year to year are less pronounced and the mortality rate in the interepidemic intervals has not fallen to so low a level as had been the case previously."

The outstanding point to emerge from Cumpston's survey was that "1890 to 1900 was a critical period." "The public health student," he argued, "must inevitably adopt this period as the central point for his examination of Australian public health conditions." "The improvement which occurred at this epoch," he judged, "has not been matched since; little advance has been made on the level of mortalities of the principal public health diseases which was then attained" (1928, 334).

We postpone to the next section the question of what developments led to the 1890s being such a turning point in Australia's history of public health. The point to be made here is that while the 1890s was, from an economic viewpoint, a truly dismal period for the eastern Australian colonies, it was a period of significant improvement in terms of the disease environment. This melioration must have contributed in turn to the improvement in height shown in figures 10.3 and 10.4.

## 10.7 Explaining Trends in Heights

Floud et al. noted that "height is not determined either by heredity or environment, but always by both" (1990, 5). They went on to argue, however, that "we can attribute relatively greater influence to genetic causes in producing *within-group* variance and relatively greater influence to environmental causes in producing *between-group* variance" (1990, 7). This means that if, for example, we are trying to understand the variation in height of a group of friends born in the same year, we should give primary weight to genetic causes as the explanation. If, however, we are comparing the average height of the group of friends with that of the group of their parents, environmental factors will be

the more important causes of the difference. It follows that, in explaining the changes shown in figures 10.3 and 10.4, we need to give particular attention to the environmental factors that contributed to the observed trends, for our interest is in between-group variance.

Our data raise several questions. We have chosen to limit our discussion to what we consider to be the two principal ones. First, why did heights peak as early as 1879 and then fall, before reaching a trough in 1895? What sort of environmental shock produced such a protracted decline? Second, how are we to interpret the improvement in height from the mid-1890s?

### 10.7.1 Causes of the Decline from 1880

*The 1890s Depression*

One obvious cause of the fall in heights during the 1880s was the depression of the 1890s. The reason for this lies with the fact, noted earlier, that a person experiences two major growth spurts: one in early infancy and the other in early adolescence. The depression affected some members of the 1880s generation by retarding their adolescent growth spurt. It seems unlikely, however, that the explanation of the 1880s decline in height lies entirely in terms of the depression. What other factors might have contributed? Did it reflect perhaps the influence of industrialization?

*Industrialization*

Much anthropometric analysis in recent years has been used to contribute to the long-running debate over what happened to living standards during early industrialization. In the Australian case, however, industrialization is likely to be of negligible importance in explaining the trends seen in figure 10.1. Industrialization in Australia was slow and protracted. It is true that in the period 1860–90 manufacturing's share of total product increased. Its share, according to N. G. Butlin, rose from 4–5 percent in 1861 to 10–11 percent in 1891. Allan Thompson, by contrast, argued that manufacturing's share rose much higher, to about 15 percent in 1891.[11] Jackson pointed out that "such large differences in the estimated share of manufacturing in gross domestic product is due partly to measurement difficulties that are themselves revealing about the nature of Australian industrial development in this period." He went on to argue that "some of the measurement problems arise because a considerable amount of Australian manufacturing was carried on in backyard establishments. *There was not much in the way of a recognisable factory system in Australia even at the end of the nineteenth century*" (1977, 115–16; emphasis added). Likewise, Graeme Davison, writing about industrialization in Melbourne in the 1880s, noted that one should not "minimize the continuing significance of small backyard workshops." "Optimistic contemporaries," he points out, "often misjudged the general state of manufacturing by the healthful appearance of a

11. The argument is summarized in Jackson (1977, 114–16).

**Table 10.7** **Share of Urban in Total Population, Eastern Australia, 1841–1901**

| Year | Percentage Urban |
|---|---|
| 1841 | 30 |
| 1851 | 34 |
| 1861 | 38 |
| 1871 | 41 |
| 1881 | 43 |
| 1891 | 51 |
| 1901 | 52 |

*Source:* Jackson (1977, 93).

conspicuous giant." Furthermore, "although the number of clothing factories using steam power doubled during the 1880s, mechanized factories never comprised more than 10 percent of those registered. So far from becoming an industry based on large factories, most firms seem to have employed a diminishing number of hands, at least within the factory itself" (1978, 45).

*Urbanization*

A much more important environmental factor was the metropolitan nature of the Australian pattern of settlement. Australia during the long boom was already a highly urbanized society by the standards of any continent. According to Vamplew, by 1881, 45.8 percent and, by 1891, 48.9 percent of the Australian population lived in urban areas (1987, 40). We can also consider Jackson's figures presented in table 10.7, which show a sustained rise in urbanization in the second half of the nineteenth century. Table 10.8 demonstrates that, compared to other "regions of recent settlement," Australia had attained a very high level of urbanization by the turn of the century. In addition, a peculiarity of Australian urbanization was that the urban population was concentrated in a handful of relatively large cities: Australia's pattern of urbanization was (and remains) a primate rather than rank distribution. By 1901, 70 percent of the total urban population in Australia lived in towns with a population of 100,000 and over. By contrast, a much lower proportion, 47 percent, lived in such towns in the United States in 1900 (Jackson 1977, 97). Australia's two largest cities, Sydney and Melbourne, had populations of just under half a million by this date.

*Melbourne's Typhoid Epidemic: Sinclair's Index of Well-Being*

In an important piece published in 1975, Sinclair argued that the typhoid death rate was "an index of a major hazard of nineteenth-century living" and that accordingly it "was an important aspect of well-being" (1975, 154). Sinclair used this index to assess trends in well-being in Melbourne, the capital of Victoria, from 1870 to 1914. As he explained, "Melbourne was a focal point of metropolitan expansion before about 1890 and so contained a large propor-

**Table 10.8** **Share of Urban in Total Population in Australia and Other New Countries, circa 1900**

| | Year | Minimum Population Counted as Urban | Percentage Urban |
|---|---|---|---|
| Australia | 1901 | 2,500 | 52 |
| United States | 1900 | 2,500 | 40 |
| Canada | 1901 | 2,500 | 35 |
| Australia | 1891 | 10,000 | 44 |
| Uruguay | 1890 | 10,000 | 30 |
| Argentina | 1890 | 10,000 | 28 |
| Chile | 1885 | 10,000 | 17 |
| Brazil | 1888 | 10,000 | 10 |

*Source:* Jackson (1977, 94).

tion of the population of Australia throughout the period under consideration" (1975, 154). Typhoid fever was a major cause of death in nineteenth-century Australia and was especially prevalent in Melbourne in the 1880s: "In 1889, its deadliest year on record, it was the fifth most important single cause of death in Victoria and was not far behind heart disease, which ranked second.[12] Typhoid was *the* most important cause of death of teenagers and young adults. It was also one of the few diseases of which a resident of Australia was more likely to die in the 1880s than a resident of England. At that time, the English death rate from typhoid was only about half the Victorian" (Sinclair 1975, 154).

Typhoid struck mostly in the warm summer months from December to April–May, a period commonly known as the "typhoid season." Young people in the preadolescent and adolescent age groups were worst affected by the disease. In 1889, for example, those between the ages of 10 and 25 made up 25 percent of all typhoid deaths in Victoria (*Victorian Year Book,* 1889–90, 381). The *Melbourne Argus* referred to typhoid as "the pestilence that walketh in darkness" and as "the annual scourge," thereby attributing to the disease an aspect of inevitability. Typhoid was also known as the "pauperising fever."[13] A man who contracted the disease would lose his job until he recovered, which could take up to six months. In the meantime, his family might be reduced to poverty as a consequence of the loss of the breadwinner's income (Stannage 1979, 252).

In 1889, Melbourne's worst typhoid year, there were 560 reported deaths from the disease in Melbourne and suburbs, and deaths from typhoid made up more than 5 percent of all deaths (de Souza 1988, 23). Yet the typhoid death rate alone does not adequately indicate the full extent of the typhoid problem.

12. The top five causes of death, in descending order, were phthisis (consumption), heart disease, diarrhea, accidents, and typhoid.

13. For an account of perceptions of typhoid in Melbourne, 1855–90, see de Souza (1988).

Typhoid was not a particularly deadly disease in the sense that modern medical knowledge suggests a fatality rate of one in ten, although this can vary according to the virulence of the disease (de Souza 1988, 3, 6). For a one-in-ten fatality rate the number of typhoid cases in Melbourne and suburbs would have been 5,600 in 1889 alone, a much more poignant indicator of how the quality of the urban environment had deteriorated.

At different times, all of Australia's largest cities experienced a sanitary crisis. Even the smallish city of Perth, capital of Western Australia, experienced, albeit a little later than the other Australian capital cities, a number of bad typhoid years during the 1890s following the influx of people attracted by the gold discoveries of that decade. The experience of Perth also illuminates another aspect of the urban sanitary crisis, namely that, while diseases such as typhoid were no respecters of class, inner working-class suburbs suffered more than other suburbs from filth and rubbish (Stannage 1979, 253). Indeed, Fitzgerald (1987) has argued that the increasing degeneration of the environment in Sydney was a major factor in a deteriorating standard of living for large parts of that city's population during the long boom years, 1860–90.

An especially interesting aspect of Sinclair's analysis is his comparison of the typhoid death rate with the annual rate of increase in real GDP per capita for the three decades, 1871–80, 1881–90, and 1900–01 to 1909–10. In both the 1870s and 1880s the typhoid death rate rose, reaching a peak in 1889. There is, however, some confusion about what happened in the 1870s, for the typhoid death rate remained constant for some age groups but rose for others. Further, in the second half of the decade, those aged 20–24 ceased temporarily to be the most vulnerable age group. What is unequivocal about the 1870s, Sinclair argued, is that per capita income rose strongly and this, in the absence of any conclusive evidence that other components of well-being had an offsetting effect, indicated an improvement in general well-being. In the 1880s, by contrast, there occurred both a sharp increase in the incidence of typhoid in Victoria and, for Australia as a whole, a marked slowing down in the annual rate of increase in per capita income: the latter fell from 2.4 percent in the 1870s to only 0.6 percent in the 1880s.[14] Sinclair concluded cautiously that "in view of the small order of magnitude of the rise in average real income, there seem to be no strong grounds for seeing the 1880s as a decade of increased well-being and some reason for regarding them as a period of deterioration" (1975, 158). The typhoid death rate fell sharply in the years 1890–92 and again from 1898, but the beneficial effects this had on well-being were swamped by the loss of real income experienced during the depression. But just as the 1890s witnessed an undeniably pronounced decline in well-being, the period from about 1900

14. Sinclair relied on Butlin's estimates of real GDP per capita. The revised estimates of McLean and Pincus alter the picture, especially when the measure is the average annual increase in real GDP per capita in compound terms. For the decade 1870–79 real GDP per capita increased at an annual average compound rate of 1.7 percent. In the succeeding decade, 1880–89, this slowed to 1.2 percent, a less dramatic change than that suggested by the Butlin series.

to 1914 saw a major reversal of this trend. These years, Sinclair judged, "appear to have been the setting for the most significant advance in well-being of the whole period under consideration. Real income per head rose at least as rapidly as in the 1870s but, in contrast to the position in the 1870s, the typhoid death rate fell to an unprecedentedly low level" (1975, 158).

His conclusions on the period as whole are worth quoting at length:

> The trends in well-being suggested by the joint indicators, income per head and the typhoid death rate, cast a different light on the period 1870–1914 from the conventional one. The 1880s have often been presented as the highlight of the period since 1860, whereas the tendency of economic historians to neglect the first decade of the twentieth century could lead to an impression of near stagnation at the time on the part of the casual observer. It would appear, however, that, considered in the light of key indicators of economic progress, the 1880s may have been a period of relapse whereas the early years after the turn of the century brought rapid and balanced advance. This means a shift in the conventional perspective on post-1860 development such that it reaches its culmination in 1914 rather than comes to an explosive end in the 1890s. (Sinclair 1975, 158–59)

*The Urban Disamenities Argument: Further Considerations*

Our height data provide some support for Sinclair's assessment, notably his view that the 1880s was "a period of relapse." More generally, our data, like Sinclair's joint indicators, call into question the periodization around which debate has focused. The notion of a long boom reaching a glorious peak in the 1880s is seriously misleading. Likewise, the idea that between 1890 and 1940 there was little improvement in economic well-being does not sit easily with the improvement in height and the reduction in morbidity, nor with the other indicators mentioned by McLean and Pincus.

What is also interesting about Sinclair's work is that it suggests an urban disamenities argument as an explanation for declining heights. More precisely, it could be argued that the evidence provided by infant mortality and typhoid death rates suggests two things: during the long boom urban areas in Australia were becoming progressively less healthy places to live in, and by the 1880s some sort of crisis situation was experienced. A sustained, indeed accelerating, increase in population during the 1870s and the first half of the 1880s placed unbearable pressure on an entirely inadequate sanitary infrastructure.[15]

The rapid pace of urbanization in eastern Australia in the 1880s supports the argument. McCarty points out that Melbourne grew at nearly 6 percent per annum during the 1880s, so that by 1891 four out of ten Victorians lived in the capital. He also notes, however, that Sydney grew just as fast as Melbourne during the 1880s. Adelaide grew at an even faster rate in the 1870s (McCarty 1978, 22).

15. Jackson (1977, 33, table 6) showed that the annual increase in population was as follows: 1871–75, 2.9 percent; 1876–80, 3.3 percent; and 1881–85, 3.8 percent.

Just as metropolitan facilities came under increasing strain and the disease environment worsened, so too did the economic environment. We have already noted that although economic growth continued during the 1880s it did so at a markedly slower rate. If we go beyond the aggregate statistics and consider trends in income of different occupational groups, we find further evidence of that 1880s represented a deteriorating economic environment. Recent work by Robert Allen (1994) on real incomes in Sydney, 1879–1913, suggests that the real wages of workers such as bricklayers, laborers, and manufacturing workers tended to stagnate, and in some cases even declined, during the 1880s.

Further support for the urban disamenities argument comes from Alison Pilger in her analysis of the rejected World War I volunteers. She has pointed out that a remarkably high percentage of those who volunteered for service were rejected because they failed to meet the medical and physical standards set for military service. "Of the estimated total of 590,000 men of military service age medically examined during the war, 213,000 were rejected out of hand or discharged shortly afterwards as unfit. Of those passed and sent overseas, a further 17,300 were returned as unfit without seeing active service" (Pilger 1992, 11). Being under the minimum height was a relatively unimportant reason for rejection. The more common causes were things such as poor eyesight, chest diseases or deformity, hernias, dental problems, feet deformities, varicose veins, and poor physique (Pilger 1992, 12, 14).

There was a notable irony here. As Pilger observed, "During the first world war, when thousands were being rejected for war service or discharged after recruitment as unfit and unhealthy, the larger-than-life image of the bronzed digger—fit, athletic, tall and unbeatable, emerged to claim the attention of all and, at the same time, to hide the appalling reality, not only of the French trenches but of the flawed health of Australia's young manhood of the time" (1992, 18).

Pilger was correct in arguing that, in understanding the disabilities that were revealed in the wartime recruiting depots, it is necessary to examine "the familial and environmental influences that were present in late colonial urban society at the birth and during the childhood of the majority of future volunteers" (1992, 16). She pointed to the work of social historians like Fisher, Kelly, and Gandevia, who have revealed the extent of urban poverty as well as the insanitary and unhealthy state of Australian cities during the 1880s and 1890s.[16] "By any standard," she wrote, "urban Australia of the 1880s and 1890s, into which most of the future volunteers for the first world war were born, or were brought as small children, was a poor and unhealthy environment in which to grow and develop" (1992, 16).

Our data on urban and rural heights support the urban externalities argument. Figures 10.8 and 10.9 show that those born in rural areas tended to be

16. Another important contributor in this field is Lewis. See, e.g., Lewis (1979) and Lewis and Macleod (1987).

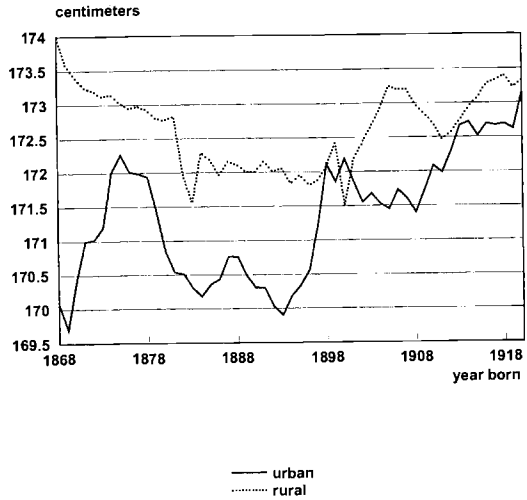


**Fig. 10.8 Urban and rural male recruits, five-year moving averages**

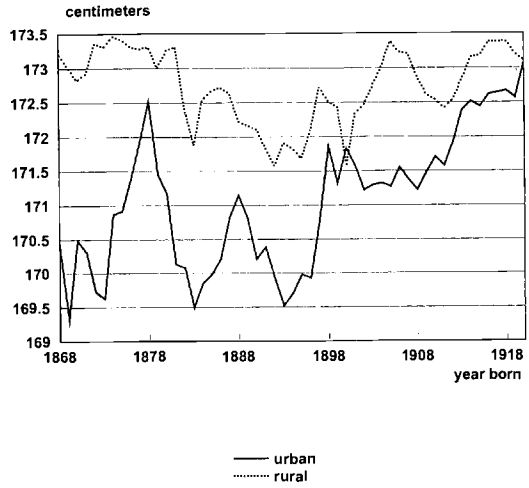


**Fig. 10.9 Victorian urban and rural male recruits, five-year moving averages**

taller than those from urban areas, though figure 10.10 reveals that this was not always the case in the non-Victorian states. Figure 10.8 indicates also that the heights of rural recruits tended downward from at least the late 1860s through to the 1890s. The decline in heights of urban recruits, however, occurred later (from about the mid-1870s) and was much more severe. Another contrast is that the recovery in urban heights occurred earlier. It is clear from figures 10.9

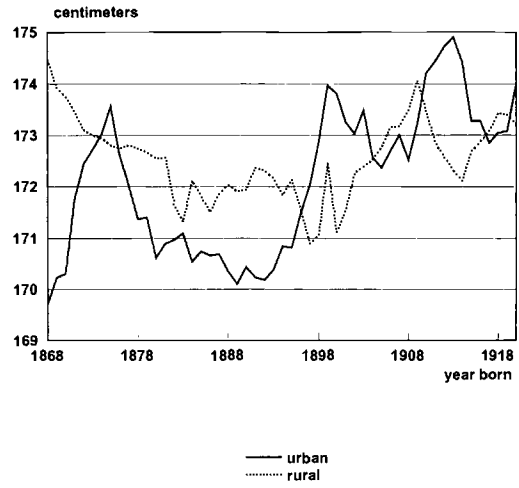


**Fig. 10.10 Non-Victorian urban and rural male recruits, five-year moving averages**

and 10.10 that the fall in heights was largely an urban phenomenon in both Victoria and the non-Victorian states, though this was much more obviously the case in Victoria.[17]

A possible qualification to the urban disamenities argument is that the low-density sprawl of so many Australian cities was conducive to a much less virulent disease environment than in those cities in Europe and parts of the eastern United States characterized by tenement housing and high population density. However, Phillippa Mein Smith and Lionel Frost cast doubt on "the simple assertion that there were intrinsic public health advantages in low-density living" (1994, 261). They did this by examining infant mortality in late-nineteenth-century and early-twentieth-century Adelaide, capital of South Australia. Adelaide had unhealthy "black spots" in which infant mortality was very high, but interestingly, these "black spot" streets were very similar to their neighbors: "There were no obvious physical characteristics which set Adelaide's 'unhealthy' streets apart from its 'healthy' ones" (Mein Smith and Frost 1994, 267). By the turn of the century, Mein Smith and Frost suggested, the level of crowding and cleanliness inside houses was more important than either the closeness of houses or conditions outside houses in determining the health of people living in Adelaide's suburbs (1994, 271). Their analysis of rate books shows that "where new mothers were young and recently married, they were often living with kin, thus affecting the level of crowding inside certain houses.

17. Note that the urban-rural division is based on birthplace: in the absence of evidence on how many rural recruits continued to live in rural areas, there are problems in interpreting figs. 10.8–10.10.

In a particular district or street, the overall population density and number of houses per acre in some cases obscures the population density *within* individual houses" (Mein Smith and Frost 1994, 269). The conclusion is that "a family with adequate income, diet, education, and the knowledge, as well as resources, to practise family planning, hygiene and safe weaning of the baby was just as likely to be able to avoid mortality in a high density as in a low density city" (Mein Smith and Frost 1994, 271).

### 10.7.2 The Improvement in Height from 1895

Part of the rise in heights from 1895 must reflect the improvement in economic conditions in the decade or so up to 1914. Some people born during the 1890s were able to enjoy a period of catch-up growth because their adolescent growth spurt coincided with an improvement in the economic environment. However, there was a continued rise in height up to our terminal date, 1920, and this occurred despite the poor performance of the Australian economy during World War I and in the early postwar years.

What other factors were at work? We have noted already that the 1890s marked a turning point in Australia's public health record: the disease environment turned decidedly better. Undoubtedly, this contributed to the rise in heights. But this only begs the question: why did the disease environment improve from the 1890s? Cumpston's explanation was that there were two principal factors at work. One was the change in the age distribution of the population that saw a reduction in the proportion of people "at susceptible ages." The other was "the first real introduction of sanitary activities." In his view, organized public health activities did not become general until after 1880. He pointed to the stimulus provided by the passing of the English Public Health Act of 1875. A Royal Commission was appointed in 1888 to inquire into Melbourne's sanitary condition.[18] In New South Wales the Dairies Supervision Act was introduced in 1886, which imposed stringent sanitary conditions on dairies. In Queensland five special inquiries were held between 1884 and 1889 on enteric fever and sanitation. Similar sorts of activities occurred in other colonies (Cumpston 1928, 334).

Cumpston was quick to point out that these initiatives were to a large extent "opportunist in character," in that the primary stimulus was an outbreak of epidemics in the early 1880s. Likewise, continuing public health initiatives required renewed epidemics, notably the Sydney bubonic plague at the beginning of the twentieth century (Cumpston 1928, 334–35). Various acts were introduced in South Australia in 1898, Queensland in 1898 and 1900–1917, New South Wales in 1902, Tasmania in 1903 and 1908, and Victoria in 1907

18. The outcome of the 1888 Royal Commission was the 1889 and 1890 Health Acts. The 1890 Health Act provided for the establishment of the Board of Public Health. Public health administration became more centralized. This was crucial to the 1891 act, which set up the Board of Works, which in turn was charged with the construction of a long overdue underground sewerage system for Melbourne.

and 1915 that established regulations for notifying and controlling infectious diseases: infected children had to be kept away from school, the local authority notified, and if necessary the school premises disinfected (Young 1976, 30). Of importance also were governmental attempts in Australia from the late nineteenth century to improve drainage and sewerage. So too was the development from the end of century of the new field of bacteriology (Young 1976, 30).

There has been debate about why infant mortality experienced a steep decline from the turn of the century. The decline is often attributed to the work of the infant welfare movement, which sought to educate mothers in caring and feeding their babies. J. S. Purdy could argue in 1922 that "without in any way wanting to minimize the effect of improved general sanitation, as represented by purer water supplies, sewerage and a better milk supply, it is worthy of note that the decline in the death-rate at ages under five and more especially among infants under one, synchronizes with the crusade which has been almost universally preached and the work undertaken to secure the better feeding and nurture of infants" (1922, 289).

Purdy drew attention especially to "the efforts of the trained women inspectors appointed in connection with the scheme formulated by the Sydney Municipal Council in 1903 for the preservation of infant health" and to the scheme, formulated in 1904, for home visiting mothers and for issuing a pamphlet on the care and feeding of infants (1922, 294).

Mein Smith, however, has identified several weaknesses in this argument. There is, for example, a temporal mismatch in that the mother and baby movement only flourished in Australia *after* 1918, yet the big fall in infant mortality occurred *before* 1918. Likewise, there is a spatial mismatch in that across Australia the mother and baby movement spread unevenly, while the decline in infant mortality was reasonably even (Mein Smith 1991, 30).

Discussing the history of the Australian public health movement, Mein Smith pointed out that there was "a shift in the critical focus from water and sewage in the late nineteenth century to cleaner milk supplies, adulteration and food legislation around 1900, and then the concern to improve mothers' practices" (1991, 25). Almost certainly, the measures that characterized each of these three phases contributed to an improvement in the disease environment. The difficulty is to judge whether these measures initiated a decline in mortality rates or simply sustained a preexisting downward trend. Just as Mein Smith has cast doubt on the significance of the mothers and babies movement, so too have writers, such as Bryan Gandevia, argued that "there was no close temporal correlation between the introduction of effective sewage systems and the decline in mortality, even from typhoid fever" (Gandevia 1978, 132–33).

The contribution of the public health movement to an improvement in the disease environment has to be seen in the context of the late-nineteenth-century fertility decline. The Australian birthrate began to fall from about 1860. The fall was temporarily halted in Victoria, Queensland, and South Australia during the 1880s. By 1890 the Australian birthrate was 35 births per 1,000 population.

In the period 1862–90 it had declined by about 20 percent. There was an especially steep decline in the birthrate during the 1890s. By 1903, it had fallen to 25.3 births per 1,000 population. The trend continued downward, eventually reaching 16.4 births per 1,000 population in 1934, the lowest level in Australia's demographic history (Ruzicka and Caldwell 1982, 76–81). Accompanying this was a decline in family size. Married women born in 1861–66 bore an average of 5.02 children, those born in 1871–76 an average of 4.02, and those born in 1897–1902 an average of 2.77 (Ruzicka and Caldwell 1982, 206).

There are difficulties in understanding the interrelationship between the decline in infant mortality and the fall in the birthrate. Jackson and Thomas noted that "one view is that the fall in mortality induced a fall in the birth rate by reducing the number of births required for a given number of children to survive infancy. There are also grounds, however, for arguing that the fall in the birth rate itself contributed to the reduction in childhood mortality because individual survival chances were greater in smaller families, where there was less exposure to infection from older siblings and where a given money income would buy more food, clothing, and space for each child" (1995, 10).

Gandevia argued that, indirectly, the decline in the birthrate "gave impetus to measures aimed at preserving the lives of the infants who were born, while, contrariwise, parental realisation of the improved outlook for the survival of their children gave them some confidence in limiting their families. The circle may be completed by suggesting that fewer children meant more time for the mother to care for them effectively, and more money to feed them properly" (1978, 93).

Likewise, Mein Smith's judgment was that "infant survival improved when couples began contracepting. Smaller families and the better spacing of births reduced infant mortality by increasing income per family member, allowing parents more time with their children, reducing overcrowding, and protecting the mother's health. Probably the causal chain went in both directions: from lower fertility to lower infant mortality, and from lower mortality to lower fertility. Both the declines in fertility and infant mortality rates and their perceived causes, then, may be seen part of a larger concept that demographers . . . have begun to call the 'health transition'" (1991, 24–25).

## 10.8 Conclusion

Anthropometric data provide a useful alternative to standard economic measures of economic well-being. Our data point to several conclusions that are relevant to the debate on living standards in the periods 1860–90 and 1890–1940. First, Australian well-being did not advance continuously upward from 1860 to 1890. Our evidence suggests that the idea that the 1870s and 1880s were some sort of golden age has to be reassessed. To put it another way, the height data indicate that the decline in living standards did not begin, as is commonly assumed, with the onset of the depression of the 1890s; it began at

least a decade before that. Second, the data indicate a sustained increase in the living standards of Australian-born males from the mid-1890s through to 1919, the terminal point of our data series. They suggest also a marginal improvement in the living standards of Australian-born women in the first 20 years of the twentieth century. Our analysis indicates that average nutritional status, measured by changes in human height, is influenced not only by changes in average income but, perhaps more important, by changes in the disease environment. The latter improved markedly from the 1890s. The reasons for this are complex and arise from a conjunction of public health initiatives and improved public health education in the context of a marked decline in the birthrate. We concur with McLean and Pincus in arguing that there is a need to reevaluate the course of economic well-being in Australia in the decades following the 1880s. We are cautious, however, in overstating the gains made from 1895 onward, for the fact is that even by 1920 there had not been a return to the peak height experienced 50 years earlier. Nor do we wish to deny the severity of the depression of the 1890s and its effect on material well-being. However, implicit in our analysis is the suggestion that an analysis of living standards based solely on traditional economic measures is likely to be misleading. In situations where GDP per capita is increasing slowly, or even declining, it is possible for living standards to be improving in that average nutritional status is rising. Clearly, the definition of living standards needs to be broadened.

## Appendix A
## *Data Sources*

The Boer War data were collected from records of the Commonwealth Boer War recruits held at the Australian Archives, Victorian Regional Office, Brighton, Victoria.[19] The sample size is approximately 95 percent of the total number of records available.

The World War I data are derived from information contained in attestation files held at the Melbourne branch of the Australian Archives.[20] The files are a comprehensive collection of enlistments from each of the Australian states for the years 1914–19. The World War II data, by contrast, are based on information in attestation files held by the Victoria branch of the Department of Veterans' Affairs; these contain information only on those people who enlisted in Victoria (though of course this includes people born in other states and

19. Australian Archives, Victoria, Commonwealth Records Series B4418, Department of the Army, Central Army Records Office, *Dossiers of Boer War Servicemen 1901–1902*. The Victorian Regional Office of the Australian Archives has now moved to Lonsdale Street, Melbourne.

20. The relevant file number is MT 1486/1.

abroad). In both cases, files were selected randomly. The World War I files are grouped in several hundred boxes and organized alphabetically. The World War II files are grouped in tied bundles and organized according to enlistment number.[21]

The attestation papers used for the 1902 Boer War contingent record information on height, place of birth, permanent residence, date and place of enlistment, age in years and months at the time of attestation, marital status, religion, trade or calling, previous military experience, and, where stated, weight.

There are similarities between the attestation papers used in both world wars. The World War I papers record information for each individual on the town in which he was born, whether he was a natural-born British subject or a naturalized British subject, his age and date of birth, his trade or calling, whether he was or had been an apprentice, whether he was married, single, or a widower, the name and address of next of kin, the nature of previous military service, height, weight, chest measurement, complexion, color of eyes and hair, and religious denomination. The World War II papers record information on age, date of birth, birthplace, occupation, religious denomination, height, and weight.

## Appendix B
## *Enlistment Procedures and Requirements*

Recruits for the 1902 Boer War contingent had to meet a variety of requirements. For the second Commonwealth contingent (as for the first) the minimum height standard was set at 5 feet, 6 inches. Men also had to be between 20 and 40 years of age, healthy, good shots, and good horsemen. They should have had experience in the management of horses and been used to bush life. Preference was also given to men who had seen service in South Africa or had other military experience. Men were preferably single. Not all these requirements were rigidly adhered to.

Minimum height requirements were set for both World War I and II. In World War I the minimum height was originally set at 5 feet, 6 inches. Another requirement was a chest measurement of at least 34 inches, though those of lighter build could enlist as drivers in the artillery (Bean 1938, 59). An additional restriction was that only those between ages 19 and 38 were allowed to enlist. Initially enlistment centers were restricted to the capital cities, and some recruits traveled up to a thousand miles to reach them. Rejection on medical grounds could be a source of bitter disappointment: "The medical inspection

21. The enlistment number is not in accord with the date of enlistment; i.e., the lowest number does not represent the first to enlist. The numbers appear to have been chosen randomly.

was exceedingly severe. 'Many of them,' wrote one medical officer, 'have thrown up good jobs, and have travelled hundreds of miles. They have been fêted as heroes before leaving, and would rather die than go back rejected. Some I have to refuse, and they plead with me and almost break down—in fact some do go away, poor chaps, gulping down their feelings and with tears of disappointment in their eyes'" (Bean 1938, 59).

In 1915, enthusiasm for the war was still high, and many of those who had been rejected did all that was possible to have the decision overturned: "Scores of men rejected because their chests were too small took courses at physical culture schools; short men tried all known methods, and others invented hitherto unknown ones, to increase their height, and the number of men who had disqualifying defects removed by operation was 'legion'" (Robson 1970, 40).

Over time, the enlistment requirements became much more lax. Speaking of the "first contingent" of 1914, Bean says that "at this stage men were rejected for defective or false teeth, who, a year later, were gladly accepted" (1938, 59). As early as January 1915 standards had been lowered to a height requirement of 5 feet, 4 inches and a chest measurement of 34 inches (Pilger 1992, 11). With seeming inexorability, the minimum height requirement was further reduced, so that by April 1917 it was only 5 feet. The age requirement was effectively extended to include all those between 18 and 45 years old. For an interesting analysis of the principal reasons for rejecting World War I volunteers, see Pilger (1992, 11–19).

In World War II the minimum height was again set at 5 feet, 6 inches and again it was subsequently reduced. In this instance, however, it was decided as early as June 1940 to reduce the minimum height to 5 feet. It was simultaneously decided to raise the upper age limit to 40 (Long 1952, 87n).

In both wars there was a distinct ebb and flow in the pattern of enlistment. Hasluck provides a useful comparison:

> The gross monthly recruiting figures for the A.I.F. [Australian Infantry Forces] show that in the first six months of the war [World War II] 21,998 men enlisted, compared with 62,786 in the first six months of the 1914–18 war. . . . As news became worse the enlistments rose. . . . The news of the Dunkirk evacuation on 28th May was followed in June by 48,496 enlistments, the highest monthly total recorded—higher even than the total of 36,575 in July 1915 when news from Gallipoli sent enlistments to the peak for the whole of the 1914–18 war. In October and November [1940] there was another fall in numbers. . . . By September [1941] . . . voluntary enlistment was producing fewer men than the Army staff in Australia regarded as necessary to maintain the A.I.F. . . . In the first two years of war voluntary enlistments had not reached the totals attained in 1914–16. Up to the end of August 1941, the total of enlistments in the A.I.F. from a population of 7,000,000 was 188,587 whereas in the first two years of the 1914–18 war 307,966 had been accepted from a population of 5,000,000. . . . On the other hand Australia had set herself a high standard in this regard in 1914–15, and by the end of 1941 voluntary enlistment had enabled her to form and main-

> tain a slightly larger number of divisions in proportion to population than, for example, the United States were to maintain under conscription at any stage of the war. (1952, 399–400)

Conscription was often talked about in both wars. It was a particularly sensitive issue during World War I. A referendum calling for the introduction of conscription was held in 1916 and narrowly lost.[22] One individual who took a prominent role in the anticonscription campaign and indeed against Australia's involvement in the war more generally was the Catholic archbishop of Melbourne, Cardinal Mannix. The cardinal was an influential man, wonderfully articulate and a staunch supporter of Ireland's quest for independence from Britain. He saw the war as a British war and hence one for which Australia should lend no support.

The attitude of Irish Australians to enlistment raises questions about the representativeness of our sample, for such was Cardinal Mannix's hostility to the war and such were his persuasive powers that it might be concluded that a great many Irish Australians chose not to enlist. This in turn would mean that the working classes are underrepresented in the sample, for typically this is the class to which Irish Australians belonged. Lloyd Robson has argued, however, that "no matter what anyone claimed, the constant sectarian strife had not led to a decrease in the number of Catholics who volunteered" (1970, 148). It is true, of course, that not all the Irish Australians were Catholics. Our analysis of the Boer War data demonstrates that one also has to distinguish between the Australian Irish born in Ireland and those born in Australia. The latter showed no reluctance to enlist, whereas the former did. This is significant in that the Boer War was also portrayed by the Catholic Church in Australia as a British war in which Australia should not be involved.

Some analysts have suggested that the 1916 conscription referendum was lost in country districts, specifically the wheat-growing areas. It is clear, however, that in our sample people from country areas are not underrepresented.

It should be noted that about 417,000 men enlisted in the AIF during World War I. This number represented approximately 40 percent of all Australian men aged 18–45 (Robson 1970, 202–3), an astonishingly high proportion.

World War I was very much a man's war. This was less the case for World War II. Up to the beginning of 1941, Australian women played a distinctly minor role in the munitions effort and took even less part in direct war activities. At the end of June 1941 only 1,399 women were in the army, navy, and air force (with 1,181 of these in the army). Most of them were members of the Australian Army Nursing Service (Hasluck 1952, 406–7). According to Hasluck, "The slowness to make better use of women in the war effort seems to have been due very largely to male obtuseness, coupled with a lingering idea that war is a man's work and that a woman in a uniform or a pair of overalls, working in the company of men, would create all sorts of unmentionable diffi-

22. Another was held in 1917 and again was lost by a narrow margin.

culties" (1952, 401). An important breakthrough occurred in the second half of 1941. The Australian prime minister returned from a visit to England and, impressed by the contribution women had made to the British war effort, promoted the idea of establishing three women's services. This was eventually agreed to, if only reluctantly. Accordingly, the Women's Auxiliary Australian Air Force, the Women's Royal Australian Naval Service, and the Australian Women's Army Service (AWAS) were established. By April 1942 the AWAS establishment alone had been set at 6,000. "The Women's Services were thus, once the ice was broken, readily accepted and were to expand" (Butlin and Schedvin 1977, 31). Announcements that additional women would be enlisted for the different services "started a rush of applications" (Hasluck 1970, 61).

# Appendix C
## *Analysis of the Data: Tests for Normality and Determination of Terminal Heights*

The standard tests for normality were performed on each of the Boer War, World War I Australian-born male, World War II Australian-born male, and World War II Australian-born female data sets. Figures 10C.1–10C.4, which plot the military heights to the nearest inch, show that there was no truncation due to the enforcement of minimum height standards, nor any evidence of any twisting or other distortion to the height distributions. In table 10C.1, Jarque-Bera tests, which test whether the first four moments of the sample distributions are consistent with the normal distribution, found that the heights of males and females were normal, or Gaussian.

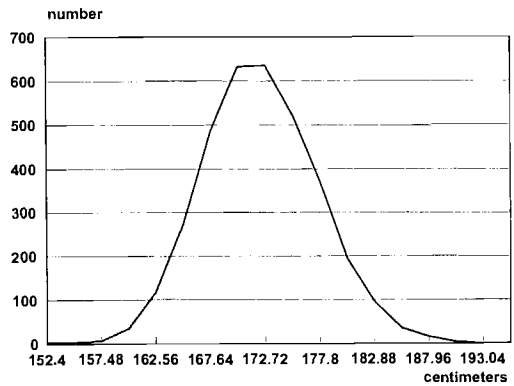


**Fig. 10C.1 Height distribution, Boer War male recruits**

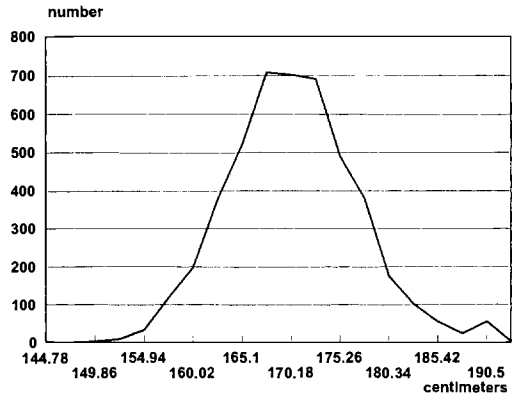


**Fig. 10C.2 Height distribution, World War I male recruits**

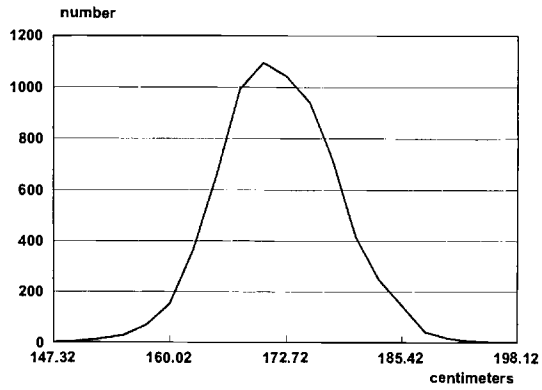


**Fig. 10C.3 Height distribution, World War II male recruits**

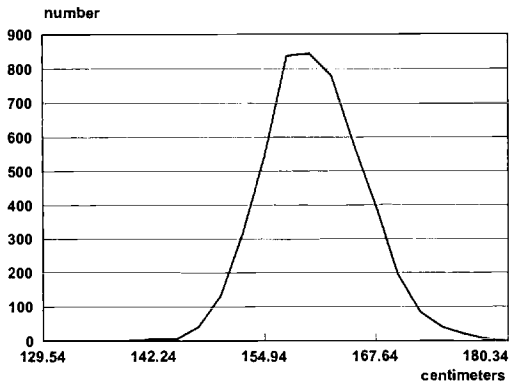


**Fig. 10C.4 Height distribution, World War II female recruits**

**Table 10C.1 Jarque-Bera Test for Normality**

| Sample | Jarque-Bera | Observations | Australian-Born |
|---|---|---|---|
| Australian male Boer War | 2.44 | 4,055 | 3,435 |
| Australian male WWI | 2.80 | 6,340 | 4,676 |
| Australian male WWII | 3.26 | 8,029 | 7,025 |
| Australian female WWII | 3.44 | 5,109 | 4,841 |
| Total | 4.46 | 23,533 | 19,977 |

*Note:* The critical value at 95 percent confidence is 5.99.

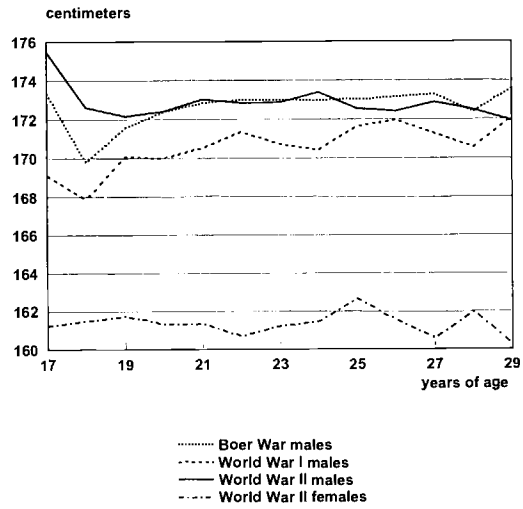


**Fig. 10C.5 Average height by age, male and female recruits 17–29 years**

There was evidence of height heaping. Heights were measured to the quarter-inch, but heaping at the full and half-inch infected all our military data. Although not a desirable quality, heaping is not uncommon in studies of heights. Simulations suggest that heaping has a relatively minor adverse effect in the estimation of mean heights because its effects tend to cancel out one another (Steckel 1992).

Figure 10C.5 shows the growth spurts of the male and female recruits. These were used to determine at what age the male and female recruits stopped growing. From these graphs, terminal height was obtained for men enlisting in World Wars I and II at age 21, for men enlisting in the Boer War contingent at age 22, and for women enlisting in World War II at age 19. We excluded all men and women under these ages and also all recruits over age 49, when the body begins to shrink.

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