

**LOST EXCEPTIONALISM?
COMPARATIVE INCOME AND PRODUCTIVITY IN AUSTRALIA AND
THE UNITED KINGDOM, 1861-1948**

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Abstract: Australia had one of the highest per capita incomes in the world in the late nineteenth century, although this exceptional position subsequently eroded over time. This paper compares national income and sectoral labour productivity in Australia and the United Kingdom between 1861 and 1948 to uncover the underlying sources of Australia's high income and the reasons for its subsequent relative decline. We find the country's higher per capita income was due primarily to higher labour productivity, since labour force participation, although higher in Australia than in the United States, was lower than in the United Kingdom. Australia had a substantial labour productivity lead in agriculture throughout the period, due to the importance of high-value-added, non-arable farming, and a smaller lead in industry before World War I. The early productivity lead in industry was largely based on the importance of mining, and disappeared as manufacturing became more important. There was little productivity difference in services. These results reaffirm the importance of Australia's successful exploitation of its natural resource endowments in explaining the country's high initial income.

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I. INTRODUCTION

By most accounts, Australia had the highest per capita income in the world during the late nineteenth century, substantially above that of the United Kingdom and other countries (Maddison 2003). Australia eventually lost this exceptional position. By the early twentieth century, Australia's per capita income was comparable to that of other leading countries, and just prior to World War II Australia's income trailed that of the United States and United Kingdom by a slight margin (McLean 2004).

The unusual evolution of Australia's position in per capita income rankings has led to numerous questions about the underlying sources of Australia's high income and the reasons for its subsequent relative decline. For example, McLean (2005b) explains Australia's high per capita income relative to the United States in the 1870s and 1880s as a combination of favourable demographic factors and higher labour productivity, with each explaining roughly half of Australia's superiority. McLean investigates various channels by which labour productivity might be higher, such as resource endowments, investment and capital accumulation, and education and schooling, but his conclusions about the productivity advantage and decline are speculative.

Another question concerning Australia's exceptional position is the accuracy of nineteenth century income comparisons. The successive versions of the Maddison (1982; 1991; 1995; 2001; 2003) data rest on the backward projection of time series of real GDP from a benchmark data near the present. This methodology has been called into question by Prados de la Escosura (2000) and Ward and Devereux (2003), who argue that index number problems make projection over long periods subject to

potentially large errors.¹ In addition, there are two differing estimates of Australia's nineteenth century GDP, those from Butlin (1962) and Haig (2001), raising the question of which series more accurately depicts Australia's income at the time.

These questions suggest the need for a further investigation into the sources of productivity differences between Australia and other rich economies of the time and the need for earlier benchmarks against which the accuracy of time series projections can be cross-checked. To this end, this paper examines comparative income levels and sectoral labour productivity in Australia and the United Kingdom between 1861 and 1948 using a 1937 benchmark. We confirm that Australia had a substantially higher per capita income than the United Kingdom in the late nineteenth century.

Furthermore, we show that this was due primarily to higher labour productivity, since labour force participation, although higher in Australia than in the United States, was lower than in the United Kingdom.

The sectoral estimates of labour productivity allow us to uncover the sources of Australia's initial lead and to trace out the path of Australia's subsequent convergence to the United Kingdom. Australia had a substantial labour productivity lead in agriculture throughout the period, due to the importance of high-value-added, non-arable farming. Australia had a smaller lead in industry before World War I based on the importance of the mining sector, but this lead disappeared as manufacturing became more important. There was little productivity difference in services.

¹ For example, the alternative method of those authors suggests that per capita income in the United States exceeded that of the United Kingdom much earlier in the nineteenth century than in Maddison's data. In the case of Australia, however, Prados de la Escosura's approach reduces Australia's income lead but does not change its high ranking; for example, his figures put Australia's per capita income at 16 per cent above the United Kingdom in 1880, whereas Maddison has 26 per cent.

II. DATA AND METHODS FOR AUSTRALIA/UK PRODUCTIVITY

COMPARISONS

1. Australian time series

The starting point for analyzing trends in comparative labour productivity performance in Australia and the United Kingdom is time series of output and employment by sector. The Australian time series for the aggregate economy and for the three main sectors of agriculture, industry and services are presented in Table 1.² The Australian statistics normally provide separate estimates for “agriculture”, “pastoral” and “dairying, forestry and fisheries”, but here all three groups have been included in agriculture to correspond with the UK classification. Industry includes mining, manufacturing, utilities, and construction, again to match the UK definitions. In both countries, the making of dairy products on farms is included in agriculture, while dairy produce made in factories is included in industry (Butlin, 1962: 125). Services cover the rest of the economy, including house rents.

These data on real output rely on the widely accepted series of Butlin (1962), based on deflated value-added data. We also make use of the alternative volume series provided by Haig (2001) to bring the series up to 1948. A key question is whether the Butlin or Haig series on Australian GDP are to be preferred for the period before World War II. Although both series show the same broad trends over this period and tell the same long-run story about the sectoral contributions of agriculture, industry and services, they nevertheless suggest quite different cyclical patterns before World War I. For several reasons that we will discuss later in the paper, we prefer the Butlin data. In particular, projecting the Haig (2001) time series backwards from our 1937 benchmark produces no period in which Australian per capita income was

² Note also that from 1900 onwards, Australian data presented on a July to June basis have been converted to a calendar year basis for international comparability.

substantially higher than in the United Kingdom. Yet so many authors have produced independent estimates of high levels of per capita income in Australia during the late nineteenth century boom that this feature of Haig's data ultimately makes it difficult to accept these figures over Butlin's. However, in Section IV of the paper, we discuss the Haig data and present alternative estimates of labour productivity using that series for purposes of comparison.

Employment data for Australia are shown in index number form in Part B of Table 1. The figures are taken from Butlin and Dowie (1969) for the period from 1891 onwards and from Haig (1989a) for the period before 1891. The pre-1891 data are based on totals for Victoria and New South Wales, covering about three-quarters of total Australian employment. Time series for output per employee in Table 1C are derived from Tables 1A and 1B. Labour productivity movements are volatile using the Butlin data, particularly in agriculture, where labour productivity falls very sharply between 1891 and 1901. For the economy as a whole, Butlin's figures in Table 1C show a drop in labour productivity of around 17 per cent across the decade.

2. UK time series

UK data are taken from Feinstein (1972) and have been described in detail in Broadberry (2006). It should be noted that the employment data before 1920 actually refer to the labour force from the population census, and hence may be expected to overstate employment slightly relative to the Australian definition. The territory covered refers to the whole of the United Kingdom including Ireland before 1920, with the data spliced at 1920 to reflect the secession of Southern Ireland, following the procedures of Feinstein (1972). The data for output, employment and output per employee are shown in parts A, B and C of Table 2, respectively. The UK economy exhibits fairly steady growth of labour productivity throughout the period, in all

sectors apart from in services during the interwar period, where labour productivity stagnated.

3. A benchmark for circa 1937

The labour productivity data in Australia and the United Kingdom can be combined to provide trends in comparative labour productivity for each sector in index number form. To pin down the comparative labour productivity level, we provide a benchmark estimate for circa 1937, using data on nominal value added per employee in each country, compared at sector-specific price ratios, adjusted for purchasing power parity (PPP). This is necessary because the exchange rate cannot be assumed to be a perfect guide to differences in prices between two countries, especially at the level of individual goods and services, or particular sectors (Thomas 1995). For example, a country with a comparative advantage in agriculture may expect to have relatively cheap food, while a country with a comparative advantage in manufacturing may expect to have relatively cheap industrial goods.

Table 3 provides an Australia/UK PPP for agriculture circa 1937, using Australian data for 1936/37 from the *Production Bulletin* and UK data for 1936 from the *Statistical Abstract of the United Kingdom*. Weights are based on shares in value added between major categories, such as arable, livestock and dairy farming, and shares of gross output within these major categories. Since the fixed exchange rate at the time was £Stg 1 = £A 1.25, the agricultural PPP of 1.03 indicates that food was relatively cheap in Australia, as would be expected.

Table 4 provides a PPP for industry, with Australian data for 1936/37 from the *Production Bulletin* and UK data for 1935 from the *Census of Production*. Weights reflect shares in value added for major industrial categories, such as chemicals, metals, etc., while within these categories, individual products are weighted in line

with shares of gross output. With the exchange rate at £Stg 1 = £A 1.25, the manufacturing PPP of 1.49 indicates that manufactures were more expensive in Australia, as would be expected. Within manufacturing, PPPs are above the exchange rate for all sectors except basic metals, reflecting a UK comparative advantage in all but the most natural resource intensive manufacturing industries. The manufacturing PPP is also assumed to apply to construction. A separate PPP is calculated for mining from the pithead price of coal in the two countries, and again shows clearly Australia's natural resource advantage.

For services, we have used a weighted average of the PPPs for agriculture and industry, taking the geometric mean of Australian and UK weights. This yields a PPP of 1.31.

Table 5 shows the comparative level of Australia/UK labour productivity by sector circa 1937, with nominal value added per worker converted at the exchange rate in Part A and at sector-specific PPPs in Part B. Using the sector-specific PPPs raises the Australian labour productivity lead substantially in agriculture and raises the UK labour productivity lead in industry. For the economy as a whole circa 1937, output per worker was almost 10 per cent higher in Australia than in Britain.

III. AGGREGATE AND SECTORAL RESULTS

1. Labour productivity and per capita income

Table 6 shows trends in comparative Australia/UK per capita incomes and labour productivity for the economy as a whole for the period 1861-1948 using the Butlin (1962) series for Australian GDP and the 1937 benchmark.

We begin by discussing per capita income, the indicator most widely considered in the literature. Per capita income was higher in Australia than in the

United Kingdom throughout the period 1861-1911, with a much larger Australian per capita income lead during the boom of the 1870s and 1880s. This translates into an even larger Australian lead over the United States, which is often treated as the *numeraire* country, as in Maddison (1982) and McLean (2005b), reflecting the fact that the United States was still catching-up to the United Kingdom during the late nineteenth century (Broadberry and Irwin, 2006). The United Kingdom pulled slightly ahead during the interwar period, but was again overtaken by Australia after World War II.

In terms of aggregate labour productivity, measured by GDP per employee, Australia remained decisively ahead of the United Kingdom throughout the whole period. This is due to the lower labour force participation rate in Australia as compared with the United Kingdom. This may at first sight seem to run counter to McLean's (2005b) finding that Australia's high labour force participation rate – not due to a favourable age structure, but to the male-female population distribution and participation rate - was one of the reasons for its per capita income lead over the United States in the nineteenth century. But as Table 7 indicates, the United States appears to be the outlier with its very low labour force participation rate. Thus, labour force participation was higher in Australia than in the United States, but still lower than in the United Kingdom.³

Another difference across the countries that plays a role in these differences is the number of hours worked. As Huberman (2004, Table 6) has documented, in 1870 the annual number of work-hours was about the same in Australia and the United Kingdom. By 1900, Australians were working 10 percent fewer hours annually and

³ McLean (2005b: Table 1) reports a slightly higher labour force share of the population in Australia than in our Table 7, using labour force data from Withers et al. (1985). These aggregate data include unemployed workers, who cannot be allocated across sectors, and cannot therefore be used in this study. Use of these data does not alter the conclusion that the share of the labour force was substantially lower in Australia than in the United Kingdom.

by 1913 were working 17 percent fewer hours annually. Taking into account the gains in leisure among Australian workers means that the relative decline in relative GDP per capita and per employee in 1901 and 1911 (in comparison with 1881 and 1891) is less severe than indicated. For example, Huberman (2004, Table 7) adjusts Maddison's data on per capita GDP in 1913 and finds that leisure-augmented income was 18 percent higher in Australia than the United Kingdom, as opposed to just 10 percent higher using the standard figures.⁴ This provides an international comparative dimension to the findings of Jackson (1992), who points out that leisure-augmented income grew faster than real product in Australia between 1889 and 1926.

2. Sectoral productivity performance

Table 8 provides a breakdown of comparative labour productivity levels by the three main sectors of agriculture, industry and services. It is clear that Australia's overall labour productivity lead owed a great deal to agriculture, where labour productivity was nearly twice the UK level in 1861, rising to a peak lead of more than three-to-one in the 1880s. Although the severe drought of the 1890s diminished Australia's advantage in this sector, as reflected in Butlin's figure for 1901, Australia's productivity rebounded and was more than double that of the United Kingdom through the first half of the twentieth century.

Since output per worker was broadly similar in US and UK agriculture during the nineteenth century, this suggests that Australia was the world's agricultural productivity leader at this time.⁵ The productivity difference seems to reflect the relative importance of high value added pastoral and dairy farming in Australia,

⁴ In other work, Huberman shows that hours worked converged again between the two countries in the 1920s and 1930s, so that would not be a major source of difference in the Table 6 figures for that period.

⁵ As Rostas (1948: 80) noted: "In comparing productivity of labour in industry, the U.S. represents the highest level so far attained....But in agriculture U.S. productivity appears to be surpassed by other countries with which we trade, notably New Zealand, Australia, and the Argentine".

compared with a high reliance on low value-added arable farming in the United States. McLean (2005b: 12) also observes that whereas the United States was much more abundant in cultivated or improved cropland, Australia's endowment of this higher quality land was greater on a per capita basis. In addition, the Australian staple of wool had a high value-to-weight ratio, required little capital and labour to produce, and promoted the development of subsidiary transport and financial services.

In terms of industry, although labour productivity was initially higher in Australia than in the United Kingdom, this probably reflected the importance of mining in Australia. The major gold discoveries in the early 1850s resulted in a huge expansion of the country's population and mining industry. Gold dominated Australia's industry and exports for several decades thereafter (Maddock and McLean 1984). In 1861, for example, mining accounted for 15.7 per cent of GDP, while manufacturing accounted for just 3.9 per cent (Butlin, 1962: 12-13). In the United Kingdom, by contrast, mining accounted for just 4.6 per cent of GDP in 1856 and manufacturing accounted for 22.2 per cent (Matthews et al., 1982: 222).

As in agriculture, the boom of the 1870s and 1880s and the slump of the 1890s show up strongly in the Butlin series for industry, although the decline in industry's relative productivity is not as serious as in agriculture. By about 1930, Australia falls behind the United Kingdom in overall labour productivity in industry.

To clarify trends in industry, Table 9 breaks the sector out into three components: mining, manufacturing (including utilities), and construction. In mining, Australia starts with a large lead that receives a boost with the Western gold discoveries around 1890. The lead peaks around 1920, but although the lead remains sizeable, by that time the mining sector had shrunk to a fraction of its former size.

Rather than a decline in relative productivity, it was the shrinking size of the mining sector that contributed to Australia's decline in overall industrial labour productivity.

The decline in mining coincided with the rise of manufacturing in Australia. By 1929, the GDP shares in Australia were 1.9 per cent in mining and 18.0 per cent in manufacturing (Butlin, 1962: 12-13). Although Australia had a sizeable lead in terms of manufacturing labour productivity for part of the late nineteenth century, this advantage begins to diminish around the turn of the century. By 1920, Australian industry was at parity with manufacturing in the United Kingdom, but it was 30 per cent behind in the 1930s. The fact that Australia fell significantly behind in industry as manufacturing became more important than mining suggests that policies to protect Australian manufacturing may have had an adverse impact on Australia's overall productivity and living standards (Anderson and Garnaut, 1987; Siriwardana, 1996). Australia's import tariffs rose sharply during the 1920s but again much further in the 1930s, about the time that Australia's relative productivity performance in manufacturing deteriorated significantly.

However, the movements in the relative productivity of construction roughly mirror those in manufacturing. A significant labour productivity advantage in construction was not sustained and, by 1929, Australia had fallen significantly behind in this sector. Since tariff protection presumably did not affect the non-traded construction sector as it did manufacturing, some factor other than protection – structural changes induced by World War I or the rise of labour market regulations during this period – may be responsible for the relative decline in labour productivity in these two sectors. Nonetheless, as a result of the declining size of the mining sector, and the failure of manufacturing and construction to maintain their advantage

in relative productivity, Australia fell behind the United Kingdom in overall industrial labour productivity.

Thus, Australia's productivity lead in industry appears to have been largely the product of natural resource endowments. David and Wright (1997) caution against regarding natural resource endowments as simply good fortune that required no entrepreneurship, since they do need to be discovered and ways of extracting them need to be adapted to specific local conditions. McLean (2004: 339) notes that well defined property rights and the provision of public goods were critical to the successful discovery and exploitation of natural resources. La Croix (1992) examines how the redesign of institutional arrangements in the mining industry helped ensure that the resources contributed to broader economic growth rather than rents accruing to just a limited segment of the population.

On the other hand, Australia clearly was not as successful as the United States in building up a high-productivity resource-intensive manufacturing sector. In part, this may be due to the greater tradability of Australia's resource base, which was exported in its raw form (McLean 2005b: Figure 5). By contrast, in the United States many minerals (such as iron ore) were effectively non-tradable due to their location so that they instead became embodied and exported in the form of final goods, such as iron and steel manufactures (Irwin 2003).

Finally, in services, Table 8 shows that labour productivity grew slightly more slowly in Australia than in the United Kingdom before World War I, although any difference in levels remained very small. After World War I, labour productivity continued to grow in Australia but stagnated in the United Kingdom, leading to the emergence of a small Australian labour productivity lead. Again, any difference in productivity levels in services remained very small during the interwar period.

3. The structure of economic activity

To assess the contributions of the three major sectors to comparative productivity performance, it is necessary to track their shares in economic activity as well as their comparative productivity levels. Table 10 shows the percentage distribution of employment by major sector for selected years. The sectoral shares of employment in 1871 are surprisingly comparable, with the share of agriculture only modestly higher in Australia than in the United Kingdom. It is worth bearing in mind that the United States around 1870 still had 50 per cent of its labour force in agriculture (Broadberry, 1998). This reflects the fact that Australian agriculture was characterised by very high labour productivity in the late nineteenth century, while US agriculture still had labour productivity at about the same level as in the United Kingdom (Broadberry and Irwin, 2006).

After 1871 the share of employment in agriculture declined much more slowly in Australia than in the United Kingdom, as falling transport and refrigeration costs expanded opportunities for the colonial economy to export agricultural produce to British and European markets (Schedvin 1990). By 1948, agriculture still accounted for 15.3 per cent of employment, substantially above the 5.2 per cent in the United Kingdom, and also more than the 11 per cent share in the United States at the time. The share of employment in industry was fairly stable in both Australia and the United Kingdom, with services growing in relative importance in both countries.

Table 11 then provides a breakdown of sectoral employment within industry. This shows the contrast between the stability of employment shares within British industry and the dramatic shifts within Australian industry. Mining was almost as important an employer of labour as manufacturing and the utilities in 1871, but by the end of the nineteenth century it had shrunk dramatically, in absolute as well as

relative terms. As noted earlier, this shrinking of the Australian mining sector helps to explain Australia's loss of labour productivity leadership in industry.

IV. CROSS-CHECKING THE RESULTS

The results presented above rely on the Butlin (1962) series for Australian real GDP. How would the sectoral labour productivity estimates differ if we used the alternative Haig (2001) GDP series for Australia?

Table 12A presents the Haig output series. The Butlin (1962) and Haig (2001) series show almost exactly the same trend over the long period 1861-1948, and tell the same long-run story about the sectoral contributions of agriculture, industry and services. However, they nevertheless suggest quite different cyclical patterns before World War I, particularly in agriculture and industry. The biggest differences are in the scale of the boom between about 1870 and 1890, and the depth of the subsequent depression of the first half of the 1890s, which have much greater amplitude in the Butlin estimates. The Australian boom of the 1870s and 1880s and the subsequent crash show up much more strongly in the Butlin series than in the Haig series. Figure 1 of Haig (2001), which compares the two series, shows significant divergences only during the 1870s and 1880s and then again around 1910. During both of those periods, the Haig estimates are significantly below those of Butlin..

Table 12B presents the per capita income and labour productivity comparison with the United Kingdom using the Haig series. Projecting the Haig time series backwards from our 1937 benchmark produces no period in which Australian per capita income was substantially higher than in the United Kingdom. With the Haig data, there is no late nineteenth century Australian exceptionalism. The maximum income lead of Australia is just 11 percent, achieved in 1911.

Table 12C presents the estimates of sectoral labour productivity using the Haig data. As expected, the biggest divergences with the Butlin results are in the scale of the lead in the late nineteenth century and the impact of the depression in the 1890s. For the economy as a whole, Butlin's figures in Table 1C show a drop in labour productivity of about 17 per cent across the decade, whereas Haig's data show rough stability of output in agriculture across the decade 1891-1901 and an increase of 7 per cent in labour productivity. In Butlin, the decline in industry's relative productivity is not as serious as in agriculture, whereas in Haig Australia's relative advantage increases a bit, perhaps reflecting further gold discoveries in Western Australia (as mining was still about 10 per cent of GDP, although declining rapidly). By about 1930, according to both measures, Australia falls behind the United Kingdom in overall labour productivity in industry.

The lack of any significant late nineteenth century difference in per capita income between Australia and the United Kingdom in the Haig data is problematic. The suggestion of relatively high per capita incomes in late nineteenth century Australia stretches back at least as far as Mulhall (1899), who reported values for national income per head around the year 1890 for 14 European and 4 new World countries, calculated in a not altogether transparent way from sectoral data on agriculture, mining, manufactures, internal transport, house rent, commerce, shipping, banking and professions. For Australia he reported an income per head of £40.2, against a figure of £33.7 for the United Kingdom, yielding an Australian per capita income lead of 19.3 per cent. Similarly, Clark (1951: 63, 141) reports figures on real product per employee around 1890 that give Australia a lead of 25.4 per cent over Great Britain.

Another way to provide a cross-check on the time series projections is to obtain an independent benchmark estimate of comparative Australia/UK per capita incomes in the late nineteenth century based on expenditure data. The data in Table 13, derived from Thomas (1995), provide such a benchmark check. Thomas drew largely on calculations of expenditure and prices in Victoria and New South Wales by the official statistician, T.A. Coghlan, which he compared with UK data from Prest (1954). With a PPP of £Stg 1 = £A 1.191, Thomas finds Australian GDP per capita 41.2 per cent above the UK level in 1891. This would be difficult to reconcile with an Australian lead of 2.7 per cent in the time series projection using the Haig data, but is not too far from the 24.3 per cent point lead implied by the Butlin series.

Furthermore, a similar expenditure based calculation conducted by Haig (1989b), with access to Coghlan's papers, found an Australian per capita GDP lead in 1891 of 36 percentage points, or around 10 per cent higher than the time series projection using the Butlin series. Finally, independently of Thomas (1995), Allen (1994) used detailed consumer price data to adjust national incomes across several English speaking countries for differences in costs of living in the late nineteenth century. He found that consumer real incomes were about one-third higher in Australia than in the United Kingdom in the 1880s, and that real wages in Australia were also very high by international standards during the same period.

Thus, so many authors have produced independent estimates of high levels of per capita income in Australia during the late nineteenth century boom that the lack of any significant lead vis-à-vis the United Kingdom in Haig's data ultimately makes it difficult to accept his figures over Butlin's.

Another reason to prefer Butlin's data over Haig's concerns the economic depression that started in 1891. As McLean (2005a: 3) observes: "There has been ample recognition in the literature that the Australian depression [of 1891-93] was both deep and prolonged." Yet according to Haig's data real GDP declined by just 1.6 percent between those years, whereas Butlin's real GDP declined 17 percent. It is inconceivable that this small blip in the Haig series is consistent with other data that demonstrate the severity of the period. The Haig figures are hugely out of line with the 26 per cent decline in real imports between 1891 and 1893 reported in Boehm (1971: Table 43), and the similar fall in other indicators, such as the 21 per cent drop in per capita consumption of beer (Boehm 1971: Table 44). They are also hard to reconcile with Rankin's (1992: 64) demonstration that New Zealand experienced a net inflow of migrants from Australia during the early 1890s.

In short, there seems to be little doubt that Australia enjoyed high levels of real expenditure per head up to the depression of 1891. This can only have resulted from either temporarily high levels of real output or alternatively from a price boom. Butlin's data suggest a real output boom while Haig's data suggest a price boom. For Haig's story to be correct, Australia would have had to have benefited from a huge terms of trade gain, yet Australia's terms of trade during this period are roughly unchanged (Bambrick 1970). At this stage, then, it is difficult to conceive of dispensing with the Butlin series, particularly for the pre-World War I period.

Finally, Table 14 compares our results with those of Maddison (2003: 75), who projects backwards from a 1990 benchmark. Maddison uses Haig (2001) for the period 1911-38, where the differences from Butlin (1962) are fairly small, but continues to use Butlin (1962) for the period 1861-1911. Since our 1937 benchmark is

quite close to Maddison's projected value for 1937, our estimates are broadly speaking supportive of the Maddison estimates. As in the cases of the US/UK and Germany/UK comparisons outlined in Broadberry (1998), our results suggest that time series projection and cross-sectional benchmarks can be consistent over long periods. The pessimism of Prados de la Escosura (2000) and Ward and Devereux (2003) appears to be unwarranted, at least in the cases of the United Kingdom, the United States, Germany, and Australia.

V. CONCLUSIONS

An investigation of comparative Australia/UK sectoral productivity performance highlights the reasons behind high income in Australia before World War II.

Although labour force participation was higher than in the United States, it was lower than in the United Kingdom. High Australian living standards were therefore dependent on achieving high levels of labour productivity. This occurred largely because of high labour productivity in agriculture. Although labour productivity in industry was initially also higher than in Britain, this was because of the importance of the high value-added mining sector. As manufacturing became more important, but increasingly protected behind trade barriers in the early twentieth century, Australia fell behind the United Kingdom in industrial labour productivity. There was little difference between the two countries in service sector labour productivity.

These results are shown to be robust on several dimensions. The broad long run trends between 1871 and 1911 and between 1911 and 1948 are similar using the output series of either Butlin (1962) or Haig (2001). Furthermore, projection from a 1937 benchmark can be checked against an independent expenditure benchmark for

1891. This suggests that the Butlin series are better at capturing the pattern of short run fluctuations during the late nineteenth century.

The story that emerges is consistent with McLean (2005b), who concludes that the proximate explanation for Australia's high labour productivity was its relative abundance in natural resources. To this we added richer sectoral detail indicating that Australia's lead in per capita income diminished as the mining sector declined and as the economy shifted from agriculture to manufacturing and services.

TABLE 1: Australian labour productivity by sector, 1861-1948 (1929=100)

A. Output				
	Agriculture	Industry	Services	GDP
1861	10.5	15.0	12.5	12.7
1871	17.6	21.8	17.4	18.6
1881	37.4	42.9	27.9	33.9
1891	55.8	63.4	41.1	50.1
1901	35.8	59.5	49.7	49.0
1911	79.6	82.9	72.4	76.7
1920	83.4	73.4	85.0	81.7
1929	100.0	100.0	100.0	100.0
1935	112.8	94.1	107.5	105.3
1937	124.8	107.0	116.3	115.9
1948	135.2	157.1	163.5	157.5

B. Employment				
	Agriculture	Industry	Services	GDP
1861	27.6	33.5	16.6	24.8
1871	37.0	34.6	20.9	29.1
1881	47.0	44.4	29.1	38.2
1891	58.5	58.0	47.8	53.6
1901	69.7	64.2	61.2	64.2
1911	87.1	92.6	76.3	84.1
1920	90.7	91.4	88.3	89.9
1929	100.0	100.0	100.0	100.0
1935	103.9	117.2	101.2	107.0
1937	104.8	129.3	108.4	114.3
1948	94.0	177.0	145.0	143.4

C. Output per employee				
	Agriculture	Industry	Services	GDP
1861	38.0	44.7	75.2	51.1
1871	47.5	63.2	83.5	63.9
1881	79.6	96.7	95.9	88.7
1891	95.4	109.3	85.8	93.5
1901	51.3	92.6	81.2	76.3
1911	91.4	89.5	94.8	91.2
1920	92.0	80.3	96.3	90.9
1929	100.0	100.0	100.0	100.0
1935	108.5	80.3	106.2	98.4
1937	119.1	82.7	107.4	101.4
1948	143.8	88.8	112.7	109.8

Sources: Output: 1861-1937: Butlin (1962: 460-461); 1937-48: Haig (2001: 28-30);
Employment: Butlin and Dowie (1969: 153); Haig (1989a: 1-4).

TABLE 2: UK labour productivity by sector, 1861-1948 (1929=100)

A. Output				
	Agriculture	Industry	Services	GDP
1861	91.1	24.9	35.3	34.0
1871	93.7	34.2	45.3	42.3
1881	89.8	42.0	55.9	50.1
1891	85.6	50.4	69.1	60.1
1901	87.3	63.1	82.2	72.1
1911	91.2	71.9	98.5	83.6
1920	83.5	78.0	95.2	87.0
1929	100.0	100.0	100.0	100.0
1935	103.4	112.5	107.1	109.2
1937	101.3	130.0	113.4	119.5
1948	114.4	148.2	120.9	131.0

B. Employment				
	Agriculture	Industry	Services	GDP
1861	168.7	59.6	44.0	62.2
1871	149.5	66.2	52.0	66.8
1881	137.0	71.8	60.0	70.2
1891	126.0	80.6	70.8	77.7
1901	116.0	91.0	84.3	87.3
1911	115.0	99.8	94.2	95.6
1920	115.9	109.5	97.2	104.2
1929	100.0	100.0	100.0	100.0
1935	91.2	98.3	109.2	102.9
1937	87.4	108.1	114.8	109.7
1948	80.1	124.6	118.8	118.4

C. Output per employee				
	Agriculture	Industry	Services	GDP
1861	54.0	41.8	80.2	54.7
1871	62.7	51.7	87.1	63.3
1881	65.5	58.5	93.2	71.4
1891	67.9	62.5	97.6	77.3
1901	75.3	69.3	97.5	82.6
1911	79.3	72.0	104.6	87.4
1920	72.0	71.2	97.9	83.5
1929	100.0	100.0	100.0	100.0
1935	113.4	114.4	98.1	106.1
1937	115.9	120.3	98.8	108.9
1948	142.8	118.9	101.8	110.6

Sources: Broadberry (2006), derived from Feinstein (1972).

TABLE 3: An Australia/UK PPP for agriculture, circa 1937

	PPP (£A per £Stg)	Australian weights (%)	UK weights (%)
Wheat	1.37	27.6	18.4
Barley	0.97	4.2	9.2
Wool	1.03	36.0	7.2
Beef	0.92	6.2	7.3
Mutton	0.42	2.7	7.2
Lamb	0.81	2.7	7.3
Bacon	0.96	1.4	7.3
Eggs	0.49	5.6	7.3
Butter	1.19	6.8	14.4
Cheese	0.96	6.8	14.4
Total agriculture	1.03	100.0	100.0

Sources: Prices: Commonwealth Bureau of Census and Statistics, *Production Bulletin, 1937-38, Part II, Primary Industries*; Central Statistical Office, *Statistical Abstract of the United Kingdom, 1924-38*. Weights: Derived from Butlin (1962) and Ministry of Agriculture, Fisheries and Food (1968).

TABLE 4: An Australia/UK PPP for industry, circa 1937**A. Manufacturing**

	PPP (£A per £Stg)	Australian weights (%)	UK weights (%)
Chemicals	1.38	7.2	7.9
Metals	1.16	12.2	12.4
Engineering	1.48	19.9	21.1
Textiles/clothing	1.33	16.5	21.1
Food, drink, tobacco	1.47	21.7	17.0
Other manufacturing	1.87	22.5	20.5
Total manufacturing	1.49	100.0	100.0

B. Total industry

	PPP (£A per £Stg)	Australian weights (%)	UK weights (%)
Manufacturing/construction	1.49	88.1	90.4
Mining	0.93	11.9	9.6
Total industry	1.43	100.0	100.0

Sources: Sources: Prices and weights: Commonwealth Bureau of Census and Statistics, *Production Bulletin, 1936/37, Part I, Secondary Industries*; Commonwealth Bureau of Census and Statistics, *Production Bulletin, 1936/37, Part II, Primary Industries*; Board of Trade, *Census of Production, 1935, Final Report*.

TABLE 5: Comparative Australia/UK GDP per employee, circa 1937

A. Compared at exchange rate				
	Agriculture	Industry	Services	GDP
Australia (£A)	356.7	216.0	364.8	309.0
UK (£Stg)	134.4	199.6	243.9	217.4
Exchange rate (£A per £Stg)	1.25	1.25	1.25	1.25
Australia/UK (UK=100)	212.3	86.6	119.7	113.7

B. Compared at sectoral PPPs				
	Agriculture	Industry	Services	GDP
Australia (£A)	356.7	216.0	364.8	309.0
UK (£Stg)	134.4	199.6	243.9	217.4
PPP (£A per £Stg)	1.03	1.43	1.31	1.31
Australia/UK (UK=100)	257.7	75.7	114.2	108.5

Sources: Nominal GDP per employee: Australia: Butlin (1962: 10-11) and Butlin and Dowie (1969: 153); UK: Feinstein (1972), Tables 9 and 59. PPPs: Tables 4 and 5.

TABLE 6: Comparative Australia/UK per capita income and labour productivity, 1861-1948 (UK=100)

	GDP per capita	GDP per employee
1861	102.8	108.9
1871	104.3	117.6
1881	131.3	144.9
1891	124.3	141.0
1901	102.8	107.7
1911	116.3	121.6
1920	104.3	126.9
1929	97.2	116.6
1935	91.3	108.1
1937	91.2	108.5
1948	106.1	115.7

Sources: Derived from tables 1, 2, 3 and 5.

TABLE 7: Labour force share of population (%)

	Australia	United Kingdom	United States
1871	39.5	44.5	32.4
1881	38.4	43.1	34.6
1891	38.2	44.1	37.0
1901	38.5	45.0	38.2
1911	42.5	45.0	40.6
1920	38.2	46.4	40.9
1929	35.6	42.6	39.1
1937	38.0	45.2	37.4
1948	42.3	46.1	41.2

Sources: Australia: Butlin and Dowie (1969: 1630); Maddison (2003: Table 2a); U.K.: Feinstein (1972: Tables 55, 57); U.S.: Lebergott (1966: Table 1); Kendrick (1961: Table A-VII); U.S. Department of Commerce (1975: Series A-7).

TABLE 8: Comparative Australia/UK labour productivity by sector, 1861-1948 (UK=100)

	Agriculture	Industry	Services	GDP
1861	176.4	117.8	98.4	108.9
1871	190.0	134.6	100.7	117.6
1881	304.5	182.0	108.2	144.9
1891	352.0	192.4	92.4	141.0
1901	171.0	147.0	87.5	107.7
1911	289.1	136.8	95.3	121.6
1920	320.1	124.1	103.3	126.9
1929	250.7	110.1	105.1	116.6
1935	239.9	77.2	113.8	108.1
1937	257.7	75.7	114.2	108.5
1948	252.5	82.1	116.4	115.7

Sources: Derived from tables 1, 2, 3 and 5.

TABLE 9: Comparative Australia/UK labour productivity in industry, 1861-1948 (UK=100)

	Mining	Manufacturing and utilities	Construction	Total industry
1861	117.7	88.0	130.2	117.8
1871	145.8	149.7	104.2	134.6
1881	136.2	169.8	227.8	182.0
1891	271.1	157.6	234.3	192.4
1901	299.2	124.1	140.2	147.0
1911	380.8	120.7	141.8	136.8
1920	416.0	99.2	158.6	124.1
1929	357.1	100.5	87.8	110.1
1935	200.4	70.2	73.2	77.2
1937	229.0	68.0	71.5	75.7
1948	319.8	70.9	47.1	82.1

Sources: Same sources as tables 1, 2 and 4

TABLE 10: Employment by sector, 1871-1948 (%)**A. Australia**

	Agriculture	Industry	Services
1871	28.0	40.6	31.4
1911	24.2	35.6	40.2
1929	23.4	32.3	44.3
1937	21.4	36.6	42.0
1948	15.3	39.9	44.8

B. United Kingdom

	Agriculture	Industry	Services
1871	22.2	42.4	35.4
1911	11.8	44.1	44.1
1929	7.7	45.2	45.1
1937	6.2	44.5	49.3
1948	5.2	45.5	49.3

Sources: Butlin and Dowie (1969: 153); Haig (1989a: 1-4); Feinstein (1972: Tables 59, 60).

TABLE 11: Industrial employment by sector, 1871-1948 (% of total employment)**A. Australia**

	Mining	Manufacturing and utilities	Construction	Total industry
1871	14.6	14.9	11.1	40.6
1911	4.9	19.4	11.3	35.6
1929	1.9	21.5	8.9	32.3
1937	2.5	24.5	9.6	36.6
1948	1.7	29.8	8.4	39.9

B. United Kingdom

	Mining	Manufacturing and utilities	Construction	Total industry
1871	4.0	33.7	4.7	42.4
1911	6.3	32.7	5.1	44.1
1929	5.4	34.6	5.2	45.2
1937	4.2	34.4	5.9	44.5
1948	3.7	35.7	6.1	45.5

Sources: Butlin and Dowie (1969: 153); Haig (1989a: 1-4); Feinstein (1972: Tables 59, 60).

TABLE 12: Alternative results using Haig's (2001) Australian GDP series**A. Haig's output estimates (1929=100)**

	Agriculture	Industry	Services	GDP
1861	10.1	18.4	12.5	13.4
1871	17.4	22.7	17.2	18.7
1881	25.6	31.3	25.2	26.8
1891	40.4	45.2	41.4	41.8
1901	49.1	60.8	52.7	53.4
1911	73.6	73.9	64.0	69.0
1920	76.4	74.5	77.6	75.8
1929	100.0	100.0	100.0	100.0
1935	113.2	107.2	103.9	106.3
1937	118.2	122.7	112.9	116.8
1948	128.1	180.2	157.8	158.7

Source: Haig (2001: 28-30)

B. Comparative Australia/UK per capita income and labour productivity, 1861-1948 (UK=100)

	GDP per capita	GDP per employee
1861	107.9	114.4
1871	103.9	117.2
1881	103.1	113.8
1891	102.7	116.5
1901	111.2	116.6
1911	103.9	108.6
1920	96.1	116.9
1929	96.5	115.7
1935	91.6	108.3
1937	91.2	108.5
1948	106.1	115.7

Source: derived from tables 12A, 2, 3, and 5

C. Comparative Australia/UK labour productivity by sector, 1861-1948 (UK=100)

	Agriculture	Industry	Services	GDP
1861	178.9	126.2	101.9	114.4
1871	198.2	122.0	102.2	117.2
1881	220.1	115.8	100.6	113.8
1891	269.3	119.7	95.9	116.5
1901	247.4	131.1	95.6	116.6
1911	282.0	106.3	86.9	108.6
1920	309.6	109.7	97.1	116.9
1929	264.7	95.9	108.3	115.7
1935	254.2	76.7	113.3	108.3
1937	257.7	75.7	114.2	108.5
1948	252.5	82.1	115.7	115.7

Source: derived from tables 12A, 2, 3, and 5

TABLE 13: An expenditure based benchmark of comparative Australia/UK GDP per capita for 1891

Australian GDP per capita (£A)	68.32
UK GDP per capita (£Stg)	40.63
Australia/UK GDP per capita (UK=100)	168.2
PPP at Australian expenditure weights (£A per £Stg)	1.117
PPP at UK expenditure weights (£A per £Stg)	1.269
PPP at geometric mean of Australian and UK weights (£A per £Stg)	1.191
Australia/UK GDP per capita at PPP (UK=100)	141.2

Source: Derived from Thomas (1995: 31-35).

TABLE 14: Comparison with Maddison's estimates of comparative Australia/UK GDP per capita (UK=100)

	Maddison	Broadberry/Irwin
1861	100.3	102.8
1871	99.0	104.3
1881	124.9	131.3
1891	117.4	124.3
1901	86.3	102.8
1911	108.4	116.3
1920	104.8	104.3
1929	95.6	97.2
1935	91.7	91.3
1937	92.4	91.2
1948	103.3	106.1

Sources: Derived from Maddison (2003: Tables 1c and 2c); Table 7A, using Butlin's (1962) Australian output data.

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