Looking at the numbers

A view of New Zealand's economic history

Chapter: GDP

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Preface

The New Zealand Institute of Economic Research (NZIER) was founded in 1958 as a non-profit making trust to provide economic research and consultancy services. The institute is probably best known for its long-established *Quarterly Survey of Business Opinion* and *Quarterly Predictions.* The institute also undertakes a wide range of consultancy activities for government and private organisations.

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GDP

The concept of GDP

Gross domestic product, or GDP, is one of the most important economic indicators. This is because the change in real GDP is economic growth. Let's look at a definition of GDP:

GDP is the market value of all final goods and services produced within a country in a given time period. (Mankiw, 1998, p480)

An important word here is 'final' regarding 'final goods and services'. GDP does not include *intermediate consumption*, which is the goods and services used by firms in producing their output. The reason is that GDP measures the 'value added' to goods and services in an economy. At the firm level, a firm's value added is equal to its total output minus the goods and services it buys from other firms. Similarly, at the national level, GDP is equal to total output (often called gross output) minus intermediate consumption.

Nominal GDP is measured at current prices, while real GDP is measured in constant prices. In effect real GDP is nominal GDP adjusted for inflation. Changes in real GDP show changes in the *volume* of production.

Turning back to nominal GDP, there are three ways of measuring it:

- The production measure is equal to the value of all goods and services produced (gross output) minus intermediate consumption (goods and services used by firms in production).
- The expenditure measure is equal to spending on final goods and services (consumption, investment, and exports) minus imports (which by definition are made in a different country, and are therefore excluded from GDP).
- The income measure is the total income arising from production and is made up of payments to workers, government (indirect tax), and capital (depreciation and profit).

In theory, all three measures are equal. In practice, all three will differ slightly, owing to measurement difficulties.

For nominal GDP, Statistics New Zealand produces quarterly estimates of the expenditure measure, but only annual estimates of the production and income measures. For real GDP, Statistics New Zealand produces annual and quarterly estimates of the production and expenditure measures, but no estimates of real income GDP are currently produced.

In our analysis, we will be focusing on annual values of real GDP. We should note though that a related measure to GDP is GNP or gross national product. GNP is the value of production of a nation's permanent residents. It therefore includes income earned by domestic residents, regardless of the country in which they earn it. GNP equals GDP plus net property income from abroad.

Historical GDP estimates

How far back do official GDP figures go? We can get annual estimates, both nominals and reals, based on the System of National Accounts (SNA) back to 1971/72 (the official annual GDP data is for March years).

Before that we have the National Income and Expenditure series, for which annual figures are available back to 1938/39. As the name implies, these figures are focused on income and spending, rather than production. Nevertheless, from these income and expenditure figures Statistics New Zealand has produced annual estimates of both nominal and real GDP.

For years prior to 1938/39 we have to turn to unofficial estimates. Brent Lineham (1968) produced estimates of nominal GDP for 1917/18 through to 1938/39. He produced nominal GDP figures for 13 industries or sectors, aggregating these to get total GDP. The main method he used was to estimate wage payments and profits, building up income GDP figures. However, for some sectors—agriculture and forestry—production GDP figures were produced. In estimating wage payments, published accounts of actual wages and salaries paid were used. Where these were not available, data on wage rates and employment were used. For some groups of employees it was necessary to use census data and interpolate the data for intervening years. Where straight line interpolation seemed

inappropriate, adjustments were made, using annual employment data that was available for other groups as a basis for adjustment. Profit data was generally obtained from tax statistics or annual company reports. Lineham's estimates are for March years.

Hawke (1975) produced estimates of nominal GDP from 1918 back to 1870. He did this by using Australian data on the velocity of money. By using estimates of bank deposits (M2) and nominal GDP in Australia for the 1870–1918 period, he derived annual estimates of the velocity of money in Australia.[1] The assumption was then made that the velocity of money in New Zealand would be the same as in Australia. This assumption was reasonable, it was argued, given the level of integration between the banking systems of the two countries. Using these velocity estimates, and multiplying these by annual data on New Zealand's money, annual estimates of New Zealand GDP were derived.[2]

Hawke then produced in the same paper an alternative, and possibly better, set of estimates. He used Lineham's estimates of nominal GDP and figures on New Zealand money to estimate the velocity of money in New Zealand over the 1919–1933 period. He then derived a simple regression equation, expressing New Zealand's velocity of money in terms of Australia's velocity of money. He used this equation to produce estimates of New Zealand velocity back to 1870, and these were then in turn used to estimate nominal GDP. Hawke seemed to prefer this second set of estimates to the first.

So far so good. We now have annual estimates of nominal GDP. But how do we get real GDP? Easton (1990) produced a GDP deflator for the 1914–1977 period. His approach was to take a weighting of available price series. He determined the weights by deriving a

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[1] The quantity theory of money is based on the equation MV=PY where M is the quantity of money, V is the velocity of money, P is the price of output, and Y is real output. Rearranging, we get V=PY/M. Since PY is nominal output, velocity can be estimated by dividing nominal GDP by bank deposits. For further information on the quantity equation see Mankiw (1998), 616–619.

[2] Again using the quantity theory equation, PY, or nominal GDP, is equal to MV, or money times velocity.

regression equation which relates the official GDP deflator—over the period for which it is available—to various price series. The price series he used were:

- Consumers price index
- Wholesale price index
- Export price index
- Nominal weekly wage rate
- Wholesale price index for imported commodities.

The important thing is that all of these series are available back to 1915.

Note that these series broadly correspond to the components of expenditure GDP. The consumers price index (CPI) is a proxy for private consumption prices, and the wholesale price index can be seen as proxying investment prices, while the export price index covers export prices. The nominal weekly wage rate can be seen as accounting for price changes in labour intensive production, such as in the government sector. The price of imported commodities might be expected to come into the equation with a negative sign, offsetting some of the effects of imports on the consumers price index and the full wholesale price index. Interestingly this is what Easton found, with the import price series having a negative coefficient and the other series having positive coefficients.

Using his equation, Easton derived estimates of the GDP deflator back to 1915. He then used this deflator to produce real GDP back to the same year.

Rankin (1991) produced estimates of GNP for the 1859–1939 period. Rankin chose GNP, rather than GDP, and links this up with the official GNP series, which is available back to 1939. His paper provides nominal and real figures for calendar years (rather than March years).

Rankin first estimates nominal GNP, using a refinement of Hawke's methodology. Rankin notes that between the late 1880s and early 1900s, Hawke's estimates were broadly in line with one-off estimates of national income made at the time. But Hawke's

estimates for the earlier periods appear low; in particular, Hawke's estimates appear incompatible with an estimate made for 1865 by Charles Knight, a senior public servant. It seemed that Hawke's estimates of money velocity for this period were too low.

Rankin's approach was to estimate an equation for money velocity using Australian data, then use this equation to estimate the money velocity for New Zealand. The two explanatory variables in the equation were the general price index and trading bank deposits per capita. Rankin derived several equations; he ended up splitting the data into three sub-periods and deriving an equation for each.

New Zealand data for trading bank deposits per capita and prices were plugged into the equation to obtain estimates of New Zealand money velocity. These estimates were then used in the original quantity theory equation, in conjunction with New Zealand data on bank deposits, to obtain estimates of nominal GNP. The New Zealand price series that Rankin used—which ran back to 1859—was based on work by Easton (1984) and McIlraith (1911), although full details of how the price series was derived are not given.

Rankin's estimate for nominal GDP in 1865 was much closer to Knight's estimate than Hawke's had been. Even so, Rankin scaled the final results for nominal GNP so that they were consistent with benchmarks for various years, including Knight's. Finally, the long-run price series which Rankin had derived was used to deflate the nominal GNP series and derive estimates of real GNP.

Looking for patterns in historical GDP figures

Let's look now at the numbers. We have put together long run annual series for both nominal and real GDP using these sources:

1860–1933	Rankin (1991)
1933–1955	Easton (1990)
1955–2015	Statistics New Zealand (NZOYB, 1990 and 1998, and INFOS SNCA.S1RB01).

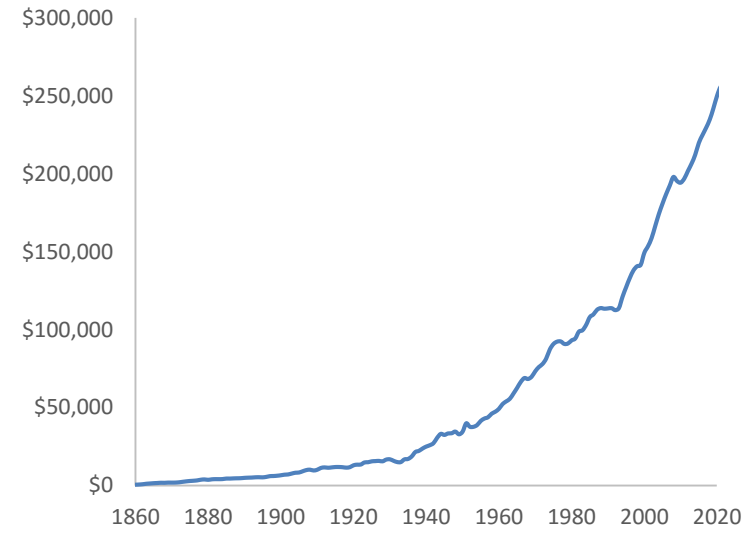
While Rankin's numbers are for GNP, we have assumed that changes in this series reflect changes in GDP. The data has been adjusted, aligning it to March years. Where data series have had to

be joined, the earlier series was factored so that its value at the splice point was equal to that of the later series.

Figure 1 shows the results for real GDP. Recessions, especially those in the late 1970s and late 1980s are clearly visible. But details of earlier years are not very clear, given that the high GDP values of later years are determining the scale of the graph, and 'squashing up' the results for earlier years. But let's leave an analysis of business cycles until later. Let's look first at long-run trends.

Figure 1 Real GDP from 1860

2009/10 dollars, millions



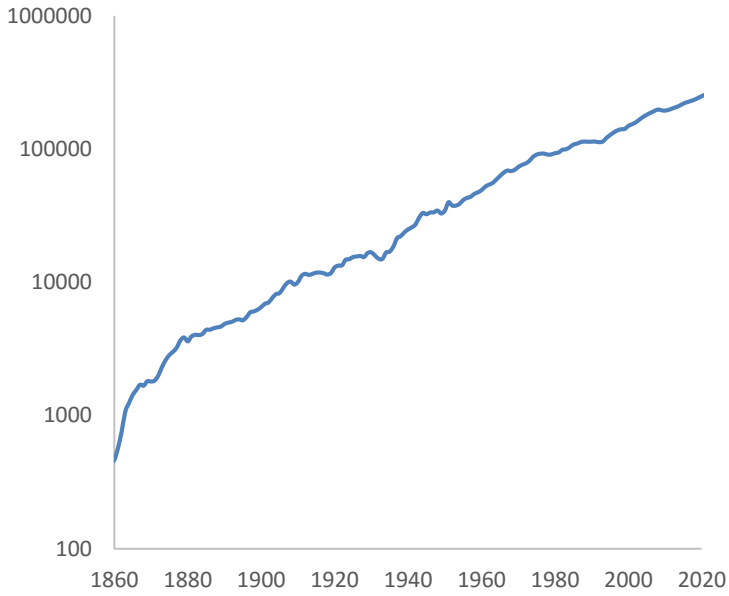
Sources: Rankin (1991), Easton (1990), Statistics New Zealand

Figure 2 shows the same data, but this time it is plotted on a logarithmic scale. This improves our ability to see movements in the earlier years, although it squashes movements in later years. More importantly though, on a logarithmic scale the slope of the chart approximates percent changes. So if the line is relatively straight in one portion, this indicates that the annual percent change during this period was relatively constant. If the slope were to suddenly increase

at the end of this period, it would indicate that the annual percent change had increased.

Figure 2 Real GDP from 1860 on log scale

2009/10 dollars, millions



Sources: Rankin (1991), Easton (1990), Statistics New Zealand

So, what can we pick out from Figure 2? We can see very strong growth in the 1860s, which eases back in the 1870s. We then have moderate growth from around the 1880s to the mid-1890s. Then growth picks up, and this carries through to the early 1910s. Growth is now low through to the mid-1930s. We see an acceleration of growth through to the mid-1940s, then—ignoring a few hiccups—steady growth through to the mid-1970s. Then growth flattens off again.

We can put some numbers to these periods (see Table 1).

The incredibly high growth of the 1860s is largely due to the gold rush, while the strong growth of the 1870s is the 'Vogel boom' due to high public spending, especially on infrastructure. It is interesting

to see that growth comes back to an average of 2.5 percent per annum in the 1880–1895 period. This period, or at least the 1880s, is often referred to as 'the long depression'. Our real GDP figures for this period, which are based on Rankin's, indicate that growth didn't entirely disappear at this time. However, as Table 1 shows, and as we will see later, real GDP per capita generally stayed flat in this period.

Table 1 Growth in real GDP, population, and real GDP per capita

Compound annual growth rate, percent

Period	GDP	Population	GDP per capita
1860–1870	14.5	12.0	0.5
1870–1880	7.2	6.6	0.5
1880–1895	2.5	2.3	-0.1
1895–1912	4.8	2.4	2.5
1912–1935	1.7	1.5	0.0
1935–1945	6.7	1.0	5.9
1945–1975	3.5	2.0	1.4
1975–2005	2.3	0.9	1.3
2005-2015	2.0	1.1	1.0

Sources: Rankin (1991), Easton (1990), Statistics New Zealand

The figures for 1895–1912 show growth booming. A factor in this was the growth of refrigerated shipping, which lifted export volume growth. Another factor was higher export prices. The figures in Table 1 also confirm that the twenty years or so from the beginning of the first world war to the end of the depression were indeed miserable for New Zealand with annual growth averaging only 1.7 percent per annum. Growth rose very strongly after the depression, and according to the figures here, the long expansion continued through to the mid-1970s. Since 1975, real growth has averaged around 2.0 percent per annum, which largely explains a loss of public confidence about the country's future growth prospects.

By and large, our examination of the real GDP figures confirms that our original division of New Zealand's economic history into six periods was reasonable. Table 2 shows real GDP growth for the last four of these periods.

Our GDP figures have, however, shown us a number of things:

- The 'farming period' of 1870–1914 contains three sub-periods: the 'Vogel boom' of the 1870s, the so-called 'long depression', and the strong recovery based on higher returns for farm products.
- The 'long expansion' started with a period of very strong growth immediately after the depression. This strong growth lasted until the end of the second world war.
- It can be argued that the 'long expansion' continued through to the mid-1970s, rather than ending in the mid-1960s. However, as we will see later, New Zealand's long-term problems with export earnings began in the mid-1960s.

Table 2 Growth in real GDP for four periods from 1870

Period	Compound annual growth rate
1870–1914: Farming	4.3%
1914–1934: War, struggle, depression	1.3%
1934–1966: Long expansion	4.4%
1966–2003: Off the OECD pace	2.5%

Sources: Rankin (1999), Easton (1990), Statistics New Zealand

Real GDP per capita

Real GDP per capita is often used as an indicator of how well off a population is, since it is a measure of the average real income of that population. We have already had a peek at real GDP per capita in Table 1. Now we'll have a closer look.

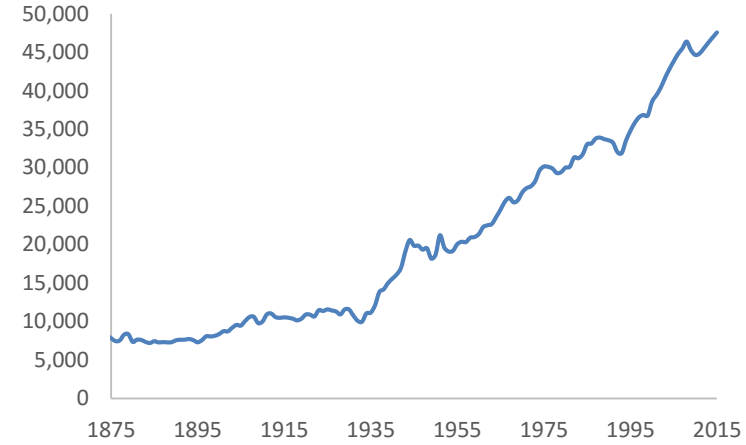
As Table 1 shows, when real GDP growth has been strong, population growth has also been strong. This largely reflects migration flows. The gold rush days clearly resulted in large population inflows. Even so, real GDP per capita grew very strongly in this period. Growth in real GDP per capita eased back in the 1870s, and growth disappeared altogether during the 'long depression'. Growth in real GDP per capita was robust over the 1895–1912 period, then went negative in the period through to 1935. Growth over the 1935–45 period was very strong, but the figure is overstated. Our population estimates in this period are for the de facto population, and in the year ended March 1945 many soldiers were still overseas. The GDP per capita figure for the March year 1945 would have been lower if the soldiers had been included in the population estimate.

Growth in real GDP per capita was reasonable over the thirty years from 1945; in total, real GDP per capita grew by around 52 percent over this period. Growth in real GDP per capita tailed off from 1975.

Figure 3 illustrates these results. The high growth rate in the 1935–45 period is particularly evident, as is the no-growth period of 1880–95. But perhaps the most striking feature of the chart is the change that occurs around the mid-1930s. Up until that point, growth in real GDP per capita is very low. From that point, growth takes off. What is driving this?

Figure 3 Real GDP per capita

2009/10 dollars



Sources: GDP data from Rankin (1991), Easton (1990), and Statistics New Zealand. Population estimates from Statistics New Zealand.

Table 3 sets out annual percent changes in real GDP, population, and real GDP per capita for the two periods. On the face of it, the difference in real GDP per capita growth isn't as marked as it looks in Figure 14. Growth in the 1860–1935 period averaged 1.3 percent per annum, while growth in the 1935–2015 period averaged 1.9 percent per annum. But there is a compounding effect at work here: a difference of 0.6 percent per annum in the growth rate makes a big difference over a period of 65 years or so.

Note that for real GDP, growth is actually higher in the earlier period than the later period, as is population growth. It seems that the higher growth in real GDP per capita in the second period is largely the result of population growth being lower.

But is this the full story? Both population and GDP in the earlier period are growing off a low base, and hence we would perhaps expect higher percentage growth rates in the earlier period. But let's look beyond this.

Table 3 Growth in real GDP per capita pre 1935 and post 1935

Annual compound growth, percent

Period	Real GDP	Population	GDP per capita
1860–1935	4.8	3.4	1.3
1935–2015	3.3	1.4	1.9

Sources: GDP data from Rankin 1991, Easton 1990, and Statistics New Zealand. Population estimates from Statistics New Zealand.

It can be argued that GDP per capita is a rough proxy for labour productivity. I stress 'rough'. Labour productivity is generally defined as output per worker rather than output per person, which is what real GDP per capita is. As we will see later, obtaining reliable data on labour supply—which would allow us to calculate labour productivity directly—is not an easy task. Anyway, taking GDP per capita as a rough measure of labour productivity, we can see that productivity turned up sharply after the depression of the 1930s. Is this simply due to the fact that population wasn't growing so strongly?

Maybe not. Perhaps it reflects a change in government thinking, and in policy. Following the depression of the 1930s, governments around the world knew that economic growth and productivity growth were major policy objectives. We saw the rise of Keynesian economics, which emphasised government spending as the mechanism for influencing growth, and the move to 'managing the economy'. While Keynesian policies have largely been replaced by monetarist policies over the last twenty years, the goal has remained the same: the economy has to be managed in such a way that will maximise productivity, or real GDP per person. The survival of elected governments has become dependent on this.

Perhaps it is too strong a claim to suggest that there has been a radical shift in thinking since the depression. It can be argued that Vogel was in fact managing the economy back in the 1870s when he began borrowing to finance a large public works programme. And in the 1890s, weren't the Liberals managing the economy, at least to some extent, by breaking up large land holdings and introducing welfare measures?

And before we get too smug about being on a stronger growth path for real GDP per capita than we were in an earlier age, look at Figure 4. It again shows our real GDP per capita, this time as an index beginning in 1960 from a base of 100. And yes, the index is generally climbing.[3] But the chart also shows an index of the OECD's real GDP per capita, and as can be seen, it has climbed more quickly than ours. We're simply getting left behind.

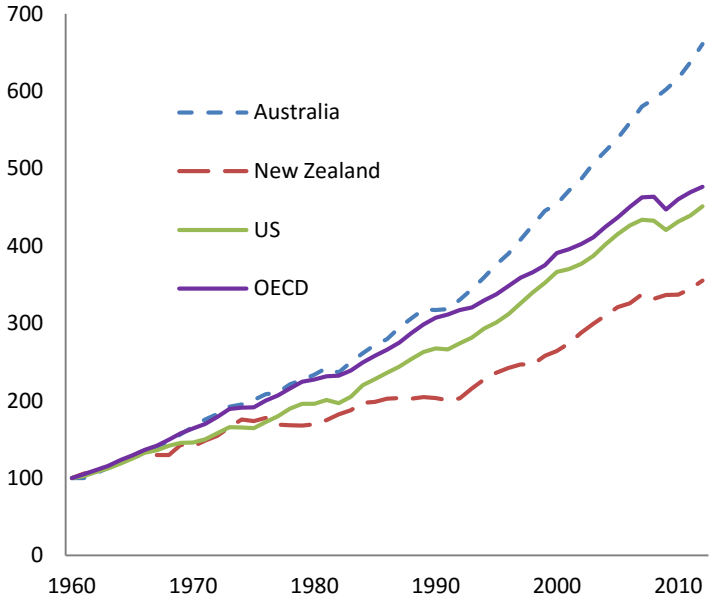
New Zealand GDP per capita growth since 2003 has been around 1 per cent per annum, enough to hold our relative position in the OECD but not to reverse the decline that occurred since the 1960s.

Briggs, Fan and Bishop (2001) show that growth in New Zealand's real GDP, and not just real GDP per capita, was lagging behind that of the OECD. They also show that this is correlated with our export performance. If the real value of our exports had shown the same growth as the OECD's real exports over the last 35 years, growth in our real GDP would also have been similar to that of the OECD.

[3] The slope of the line for New Zealand in Figure 4 appears much flatter than the line in Figure 3. This is largely due to the scales used in the charts, although the OECD's estimates of real GDP for New Zealand also show some slight differences from those produced by Statistics New Zealand.

Figure 4 Real GDP per capita, New Zealand and OECD countries

Index 1960=100



Source: OECD

So why has our real export growth foundered? We will come back to this issue later.

Business cycles

So far, we have looked at our real GDP series with a view to examining long-term trends. This has probably been a wise move. Given that our real GDP figures for the years prior to 1933 have been derived indirectly from monetary data, it's probably not a good idea to place too much emphasis on a figure for a particular year. All the same, we are used to looking at annual GDP growth figures to get a feel for where we are in the business cycle. Could we perhaps use our long-run series to examine business cycles of earlier times?

Figure 5 shows annual growth in real GDP. As can be seen, the figures for some years stand out.

Growth in 1951/52 was especially high, and this reflects high wool prices as a result of the Korean war. But let's focus on five-year averages rather than individual years. These figures tally with our earlier analysis: strong growth in the 1870s, weaker growth in the 1880s, a rise around the turn of the century, a drop in growth during the first world war with low or negative growth through to the mid-1930s. Then comes the boom, followed by the long expansion, followed by lower and erratic growth.

We can get a clearer look at business cycles by comparing actual GDP with 'potential GDP'. Potential GDP is what the economy would produce if unemployment was at its natural, or 'normal' rate (Mankiw, 1998, p682). In effect, it's the 'normal' level of GDP or the GDP you have when you're not having either a recession or a boom. In other words, potential GDP is the smooth track that GDP would take if we weren't having business cycles.

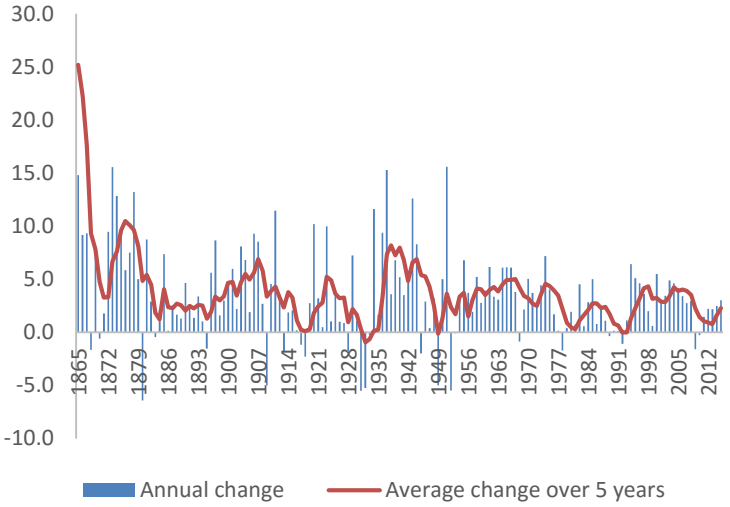
Table 4 Growth in potential real GDP

Period	Annual compound growth rate
1870–1880	6.8%
1880–1895	2.6%
1895–1912	4.2%
1912–1935	2.3%
1935–1945	5.5%
1945–1975	3.4%
1975–2005	2.4%
2005-2015	2.1%

Sources: Based on real GDP figures from Rankin (1991), Easton (1990), and Statistics New Zealand

Figure 5 Growth in real GDP from 1870

Annual percent change



Sources: Based on real GDP figures from Rankin (1991), Easton (1990), Statistics New Zealand

I have calculated potential GDP by taking a nine-year centred average. This is the average of the current year, the four preceding years, and the four subsequent years. Nine years seems a long period to take in calculating an average, but periods shorter than this didn't seem to do the job—the average was still showing some cyclical fluctuations. Real GDP, actual and potential, is shown in Figure 6. As can be seen, the potential GDP track is fairly smooth, and shows the 'underlying trend' in New Zealand's production.

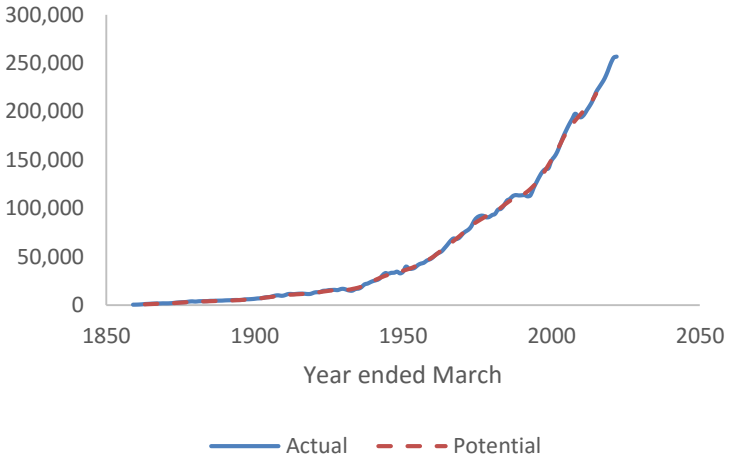
For the record, the growth in potential GDP is shown in Table 4. The growth rates for each period are very similar to those shown in Table 1 for actual GDP.

We can't calculate the change in potential GDP for the 1860–1870 period, since we don't have enough observations to take our nine-year average back to 1860. In producing a value for 2006 we used NZIER's forecasts of real GDP out to 2010 (as in *Quarterly*

Predictions, December 2006); with these figures we could calculate the nine-year average centred on 2006.

Figure 6 Real GDP, actual and potential

2009/10 dollars, millions



Sources: Based on real GDP figures from Rankin (1991), Easton (1990), and Statistics New Zealand

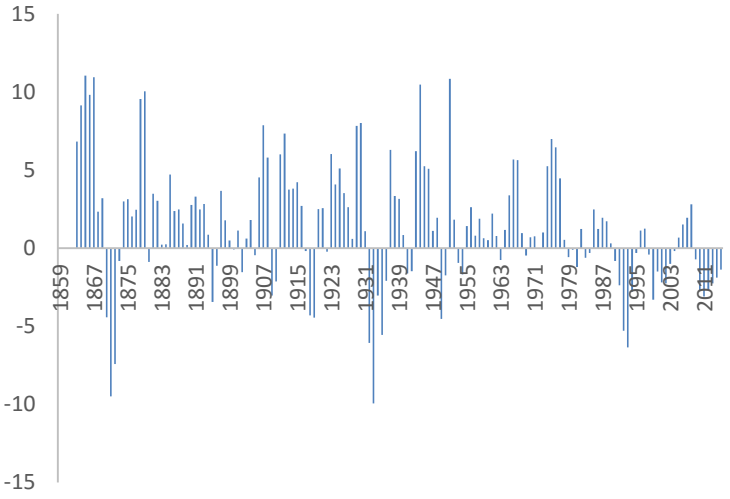
So, we have seen the trend. Now we can calculate deviations of actual GDP from potential. A negative deviation shows we're in the 'bust' part of the business cycle, a positive deviation shows we're in the 'boom' part of the business cycle. Figure 7 shows deviations from potential. These deviations have been expressed as a percent of potential GDP. For example, a value of -5 percent for a particular year indicates that real GDP in that year was 5 percent below its potential level.

The 1930s depression stands out in the chart. Another notable 'bust' was in the early 1870s, although this was partly the result of the end of the gold boom. Turning back to the great depression, which, on these figures, ran from the year ended March 1931 to the year ended March 1935, we can calculate the total deviation from potential for the full period. The figure was -7.5 percent. In other words, over this period as a whole, total production was 7.5 percent

less than potential production. Interestingly, the biggest deviation since then was in the 1989–92 downturn, when, for the period as a whole, actual GDP was 3.5 percent below potential. However, the scale of these calculated losses is sensitive to the way in which potential GDP is calculated, and we must take these figures as being indicative only.

Figure 7 Real GDP, difference between actual and potential

Percent difference from potential



Sources: Based on real GDP figures from Rankin (1991), Easton (1990), and Statistics New Zealand

An exercise

What causes, or drives, economic growth? (Warning: if you get a complete and correct answer to this, expect to get a Nobel prize in economics sometime in the future. But don't let that stop you.) In particular, what drives economic growth in New Zealand?