

Productivity Statistics: 1978–2014

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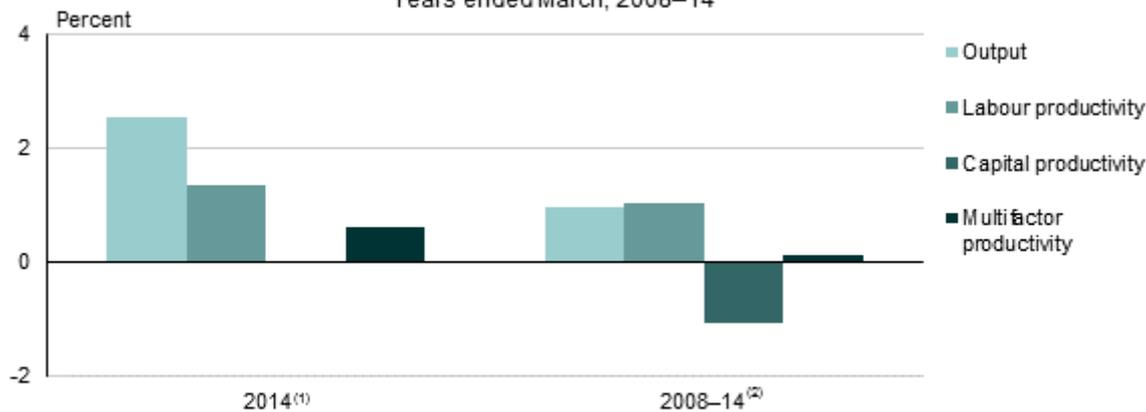
Key facts

For the measured sector, in the year ended March 2014:

- A 2.5 percent increase in the output index was largely driven by strong output growth in the construction industry.
- Labour productivity increased 1.4 percent – due to stronger growth in output (up 2.5 percent) than in labour inputs (up 1.2 percent).
- Growth in capital inputs increased 2.9 percent; capital productivity declined 0.3 percent.
- Multifactor productivity (MFP) grew 0.6 percent.

Measured sector's output and productivity indexes

Percentage change
Years ended March, 2008–14



1. Change from year ended March 2013.

2. Change from average annual growth rates, year ended March.

Source: Statistics New Zealand

Productivity is best observed in growth cycles (the span of years between the peak of one cycle and that of the following cycle). Over the current incomplete cycle, 2008–14, average annual changes in the measured sector were:

- 1.0 percent increase in the output index
- Labour inputs fell 0.1 percent; labour productivity rose 1.0 percent.
- Capital inputs grew 2.0 percent; capital productivity fell 1.1 percent.
- MFP rose 0.1 percent.

The measured sector series begins in 1996 – includes all industries except public administration and safety, education and training, health care and social assistance, and ownership of owner-occupied dwellings.

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See [Definitions](#) for explanations of terms used in this commentary.

Key aggregates for the measured sector

The changes in the key indicators for the year ended March 2014 closely track the changes for the long-run average 1996–14. The output and labour productivity growth rates experienced in the year ended March 2014 have had positive contributions to the growth rates in the latest incomplete cycle, 2008–14.

The table below shows average annual rates across growth cycles. The benefit of breaking the data into cycles is that we better account for factors that tend to vary within a cycle, such as capacity utilisation. This way, we can make comparisons of productivity performance between periods with the effect of these additional factors minimised. Growth cycles are the span of years between the peak of one cycle and the peak of a following cycle; the 2008–14 period will not be complete until the next peak in output occurs.

See [Data quality](#) for more information on growth cycles.

Key aggregates for the measured sector⁽¹⁾					
Variable	1997–2000 ⁽²⁾	2000–2008 ⁽²⁾	2008–2014 ⁽²⁾	2014 ⁽³⁾	1996–2014 ⁽²⁾
	Percent				
Output (value added)	2.8	3.5	1.0	2.5	2.6
Labour input	0.0	2.0	-0.1	1.2	1.0
Labour productivity	2.8	1.4	1.0	1.4	1.5
Capital input	2.4	3.9	2.0	2.9	3.0
Capital productivity	0.4	-0.4	-1.1	-0.3	-0.4
Total input	1.0	2.8	0.8	1.9	1.9
Multifactor productivity (MFP)	1.8	0.6	0.1	0.6	0.7

1. The measured sector series begins in 1996.
 2. Average annual growth rates, year ended March.
 3. Year ended March.

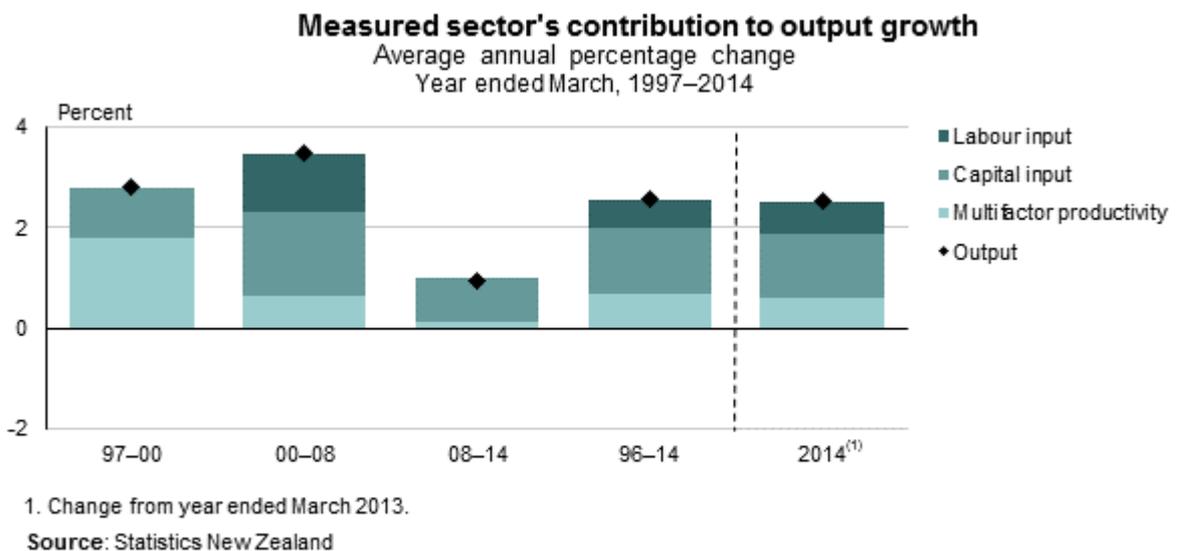
Output growth driven by contributions of capital inputs

Growth accounting examines how much of the economy's growth in output can be explained by one or more of the following:

- contribution of additional labour
- contribution of additional capital
- MFP.

The 2.5 percent increase in output growth in the year ended March 2014 was driven by increased contributions from capital inputs (up 1.3 percent), and increased contributions from labour inputs and MFP (both up 0.6 percent). The contribution to output from labour is significantly higher in the latest year compared with the latest incomplete growth cycle.

The following graph presents the contribution of additional labour, additional capital, MFP, and growth in output, measured across three growth cycles (the latest cycle incomplete), for the whole series and for the year ended March 2014.

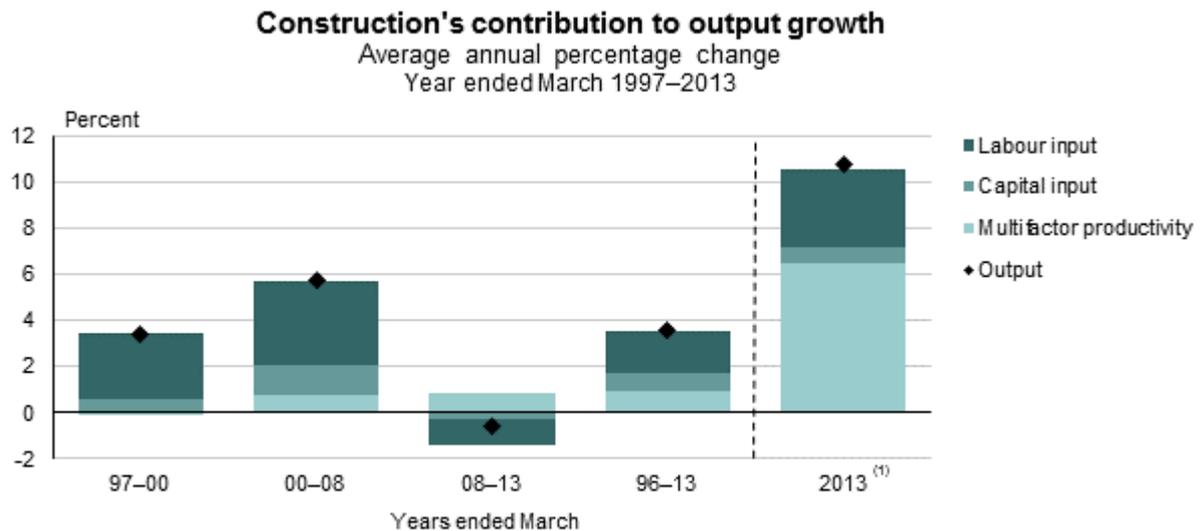


Labour inputs and MFP contribute to strong construction output growth in 2013

Industry-level data is now available to the year ended March 2013, so we can provide more detail at the industry level. The construction industry had high growth in output in the March 2013 year (up 10.8 percent). The following graph, which breaks down the percentage increase in construction output for 2013 and previous growth cycles, shows the growth came from additional labour inputs and MFP.

The contribution to output from labour inputs was significantly higher in 2013 (up 3.4 percent) than for the 2008–13 cycle (down 1.2 percent), and was almost the same as the contribution from labour inputs in the 2000–08 cycle (up 3.6 percent).

Agriculture, forestry, and fishing also had increases in labour productivity in 2013.



1. Change from year ended March 2012.

Source: Statistics New Zealand

Labour productivity increases in 2014

The 1.4 percent growth in labour productivity in the year ended March 2014 was due to stronger growth in output (up 2.5 percent) than in labour inputs (up 1.2 percent). Provisional data shows the growth in labour inputs for the year ended March 2014 was largely driven by increased labour hours in the manufacturing and construction industries.

We will publish detailed industry information for 2014 in next year's Productivity Statistics release.

The average annual growth in labour productivity over the 2008–14 period was 1.0 percent, compared with the series (1996–2014) average annual growth of 1.5 percent.

Capital deepening and MFP contribute to labour productivity growth

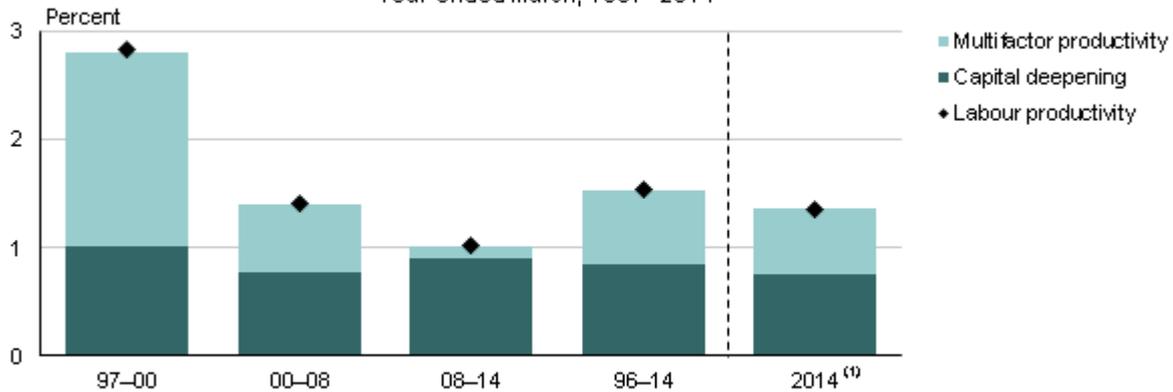
A change in labour productivity can come from two sources:

- a change in capital available per hour of paid labour (known as capital deepening or capital shallowing)
- a change in MFP.

For the year ended March 2014, the 1.4 percent increase in labour productivity can be disaggregated as positive contributions from capital deepening (0.8 percent) and MFP (0.6 percent), with growth in MFP in 2014 exceeding MFP growth in the latest incomplete cycle 2008–14 (up 0.1 percent).

The following graph presents the contributions to labour productivity over the three economic growth cycles (last one incomplete), over the entire series, and during the year to March 2014.

Measured sector's contribution to labour productivity growth
Average annual percentage change
Year ended March, 1997–2014



1. Change from year ended March 2013.

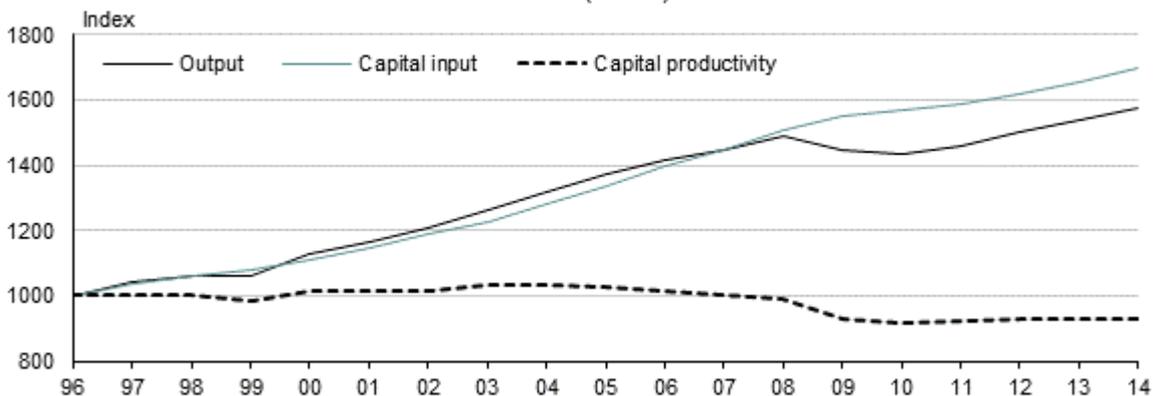
Source: Statistics New Zealand

Capital productivity declines slightly

Growth in capital productivity had a 0.3 percent decrease for the year ended March 2014, due to higher growth in capital inputs (up 2.9 percent) than in output (up 2.5 percent). The increase in capital inputs is mainly attributable to the transport, financial services, and construction industries.

Productivity statistics do not account for changes in capacity utilisation of capital, as we assume capital assets are used at a constant rate throughout the growth cycle, and over their life. Due to this assumption, growth in capital input may be understated when capacity utilisation is increasing (as for most of the 2013 and 2014 March years), and capital productivity may be overstated.

Measured sector's capital, and output indexes
Year ended March, 1996–2014
Base: 1996 (=1000)

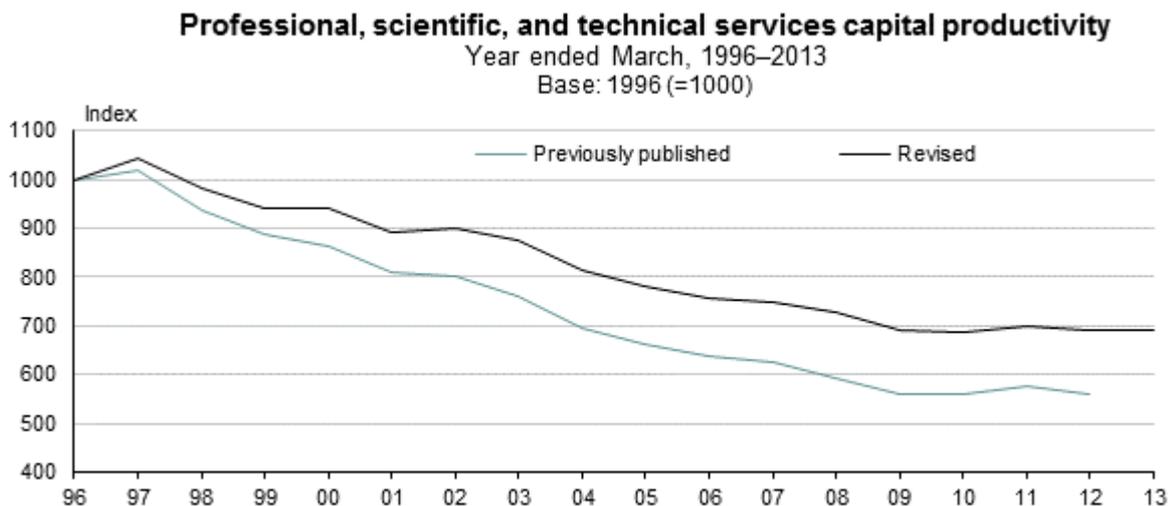


Source: Statistics New Zealand

R&D investment affects capital productivity

One update to the international standards implemented in the National Accounts (Industry Benchmarks): Year ended March 2012, was the capitalisation of research and development (R&D). We now consider expenditure on R&D to be investment in fixed assets and include it in gross fixed capital formation. This consequently increases the productive capital stock of the economy.

Business services is the industry most affected by the addition of R&D as a fixed asset – R&D comprised about one-third of the industry’s productive capital stock between 2008 and 2014. We now see a slower decline in capital productivity in this industry (as the graph below shows) caused by a slower increase in the industry’s capital inputs. This is because R&D makes up a significant proportion of this industry’s productive capital stock, but has grown at a slower rate than other asset types, such as software and non-residential buildings. As a result, each asset’s share of the industry’s cost of capital has declined with the inclusion of R&D.



Source: Statistics New Zealand

Successful innovation needs more than just R&D was released on 29 June by the New Zealand Productivity Commission. This media release introduces two papers that explore the relationship between R&D expenditure and innovation at the firm level, using data from Statistics New Zealand’s Longitudinal Business Database.

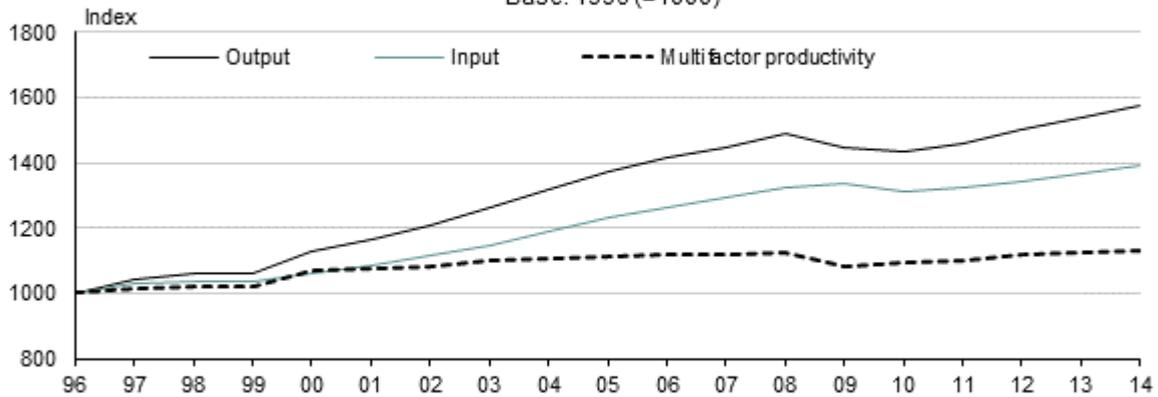
Increase in MFP

MFP is measured as a ratio of output to combined capital and labour inputs (total inputs). MFP reflects growth in output that cannot be attributed to growth in capital or labour inputs. Examples are technological change, or improvements in knowledge, methods, and processes.

In the year ended March 2014, MFP increased 0.6 percent, as output growth (up 2.5 percent) exceeded growth in total inputs (1.9 percent).

Measured sector's input, output, and productivity indexes

Year ended March, 1996–2014
Base: 1996 (=1000)



Source: Statistics New Zealand

Over the latest incomplete growth cycle (2008–14), total output grew 1.0 percent and total inputs grew 0.8 percent, resulting in MFP growth of 0.1 percent a year on average.

An Australia–New Zealand comparison

The data used in this comparison starts in 1996, as this is when the industry coverage of the series are comparable.

New Zealand experienced higher rates of growth in capital productivity and MFP than Australia over the long-run average of the period 1996–2014. Australia had relatively higher growth in labour productivity over the period, with growth in the capital-to-labour ratio that was more than double that of New Zealand's.

For more detailed data see the Excel tables in the 'Downloads' box.

Australia and New Zealand productivity⁽¹⁾

Average annual growth rates
1996–2014

Variable	Australia	New Zealand
	Percent	
Output	3.5	2.6
Labour productivity	2.3	1.5
Capital productivity	-1.8	-0.4
Multifactor productivity	0.6	0.7
Labour input	1.2	1.0
Capital input	5.3	3.0
Total inputs	2.9	1.9
Capital-to-labour-ratio	4.1	2.0

1. Australia's market-sector industries aggregate, compared with New Zealand's measured sector series. See [Data quality](#) for more detail.

Definitions

About the productivity statistics

Productivity is a measure of how efficiently inputs (capital and labour) are used within the economy to produce outputs. Productivity is commonly defined as a ratio of a volume measure of output to a volume measure of input.

Growth in productivity means that a nation can, for example, produce more output from the same amount of input, or the same level of output from fewer inputs. Productivity growth is an important contributing factor to a nation's long-term material standard of living.

More definitions

ANZSIC 2006: the Australian and New Zealand Standard Industrial Classification 2006. This classification is used to allocate enterprises undertaking similar productive activities to the same industry.

Average annual growth rate: reflects the average increase (or decrease) in a variable across a period of time. Rates are calculated as geometric means, which take account of the compounding of growth rates over time. Arithmetic averages give higher growth rates and would lead to a different index figure for the latest year when applied to the base year.

Capacity utilisation: the difference between the potential and actual use of an input. Capacity utilisation is high when actual output is close to potential output because the most use is being made of labour and capital. In the productivity measures produced by Statistics NZ, it is assumed that capital and labour are utilised at a constant rate over time.

Capital-to-labour ratio: is a measure of the capital input index divided by the labour input index.

Capital deepening: is positive growth in the capital-to-labour ratio. See also 'contribution of capital deepening'.

Capital income: is that part of the cost of producing gross domestic product (GDP) that consists of gross payments to capital. It represents the value added by capital in production, and is equivalent to the gross operating surplus, less the labour income of working proprietors, plus the capital proportion of taxes, less subsidies on production.

Capital productivity: is measured as a ratio of output to capital input. The ratio is derived by dividing the index of the chain-volume measure of GDP by an index of capital services. Capital productivity reflects not only the contribution of capital to changes in production, but also the contribution by labour and other factors affecting production.

Capital services: reflect the amount of 'service' each asset provides during a period. For each asset, the services provided in a period are directly proportional to the asset's productive capital value in the period. As an asset ages and its efficiency declines so does the productive capital value and the services the asset provides. Capital services is the appropriate measure of capital input in production analysis.

Capital shallowing: a decline in the capital-to-labour ratio.

Chain volume measures: annually-reweighted chain Laspeyres volume indexes referenced to

the current-price values in a chosen reference year (ie the year when the quarterly chain volume measures sum to the current-price annual values). Chain Laspeyres volume measures are compiled by linking together (compounding) movements in volumes, calculated using the average prices of the previous financial year, and applying the compounded movements to the current-price estimates of the reference year.

Compensation of employees: the total remuneration, in cash or in kind, payable by an enterprise to an employee in return for work done by the employee during the accounting period. It has two sub-components: wages and salaries; and employers' social contributions. Compensation of employees is not payable for unpaid work undertaken voluntarily, including the work done by members of a household within an unincorporated enterprise owned by the same household. Compensation of employees excludes any taxes payable by the employer on the wage and salary bill (eg payroll tax, fringe benefits tax).

Contribution of capital deepening: the growth in the capital-to-labour ratio, weighted by capital's share of total income. Given that capital's share of total income is always less than 100 percent, the contribution of capital deepening is always less than the growth in capital deepening. It is used for growth accounting for labour productivity.

Contribution of capital input: the growth in the capital input index, weighted by capital's share of total income. Given that capital's share of total income is always less than 100 percent, the contribution of capital input is always less than the growth in capital input. It is used for growth accounting for output.

Contribution of labour input: the growth in the labour input index, weighted by labour's share of total income. Given that labour's share of total income is always less than 100 percent, the contribution of labour input is always less than the growth in labour input. It is used for growth accounting for output.

Former measured sector: this is similar to the measured sector but has a narrower industry coverage, but longer time series. It includes industries AA1-KK1 and RS1. The series are available from 1978.

Gross domestic product (GDP): the total market value of goods and services produced in New Zealand within a given period, after deducting the cost of goods and services used up in the process of production, but before deducting allowances for the consumption of fixed capital. Thus, GDP is 'at market prices'. It is equivalent to gross national expenditure, plus exports of goods and services, less imports of goods and services.

Gross mixed income: the surplus due to owners of unincorporated businesses. It is often referred to as profit, although only a subset of total costs is subtracted from the output of unincorporated businesses to calculate it. Gross mixed income is split and allocated to capital and labour as factors of production.

Growth accounting: decomposes the growth rate of an industry's output into the part due to the increase in factors of production (labour and capital) – and that which cannot be accounted for by changes in labour and capital utilisation. This residual growth in output that can't be accounted for is known as multifactor productivity (the extent to which an industry is getting more output from the same amount of inputs).

Growth cycle: the span of years between the peak of one cycle and the peak of a following cycle. Peaks are determined using statistical techniques, and are chosen to represent high points in capacity utilisation of the economy. Productivity is best analysed over growth cycles, as annual movements can be volatile and don't usually represent true changes to the underlying

production function.

Index: a simple way of expressing, in percentage terms, the change in some variable from a given point-in-time to another point-in-time.

Inventories: a class of produced non-financial assets consisting of: stocks of outputs that are still held by the units that produced them before being further processed, sold, delivered to other units, or used in any other ways; and stocks of products acquired from other units that are intended to be used for intermediate consumption or for resale without further processing.

Labour income: the part of the cost of producing GDP that consists of gross payments to labour. It represents the value added by labour in production, and is equivalent to compensation of employees, plus the labour income of working proprietors, plus the labour proportion of taxes, less subsidies on production.

Labour input index: an index of the weighted number of hours paid in the measured sector. It is created by weighting together the industry-level labour volume series using labour income weights.

Labour productivity: measured as a ratio of output to labour input. Labour productivity estimates are indexes of real GDP per hour paid. Labour productivity reflects the contribution of labour to changes in product per labour unit, but is also influenced by the contribution of capital and other factors affecting production.

Labour volume series (LVS): an estimate of the total number of hours paid in paid employment per week, for the whole economy or for a given industry.

Measured sector: the industry coverage of the productivity statistics is defined as the 'measured sector'. It consists of industries AA1-MN2 (except LL2), RS1, and RS2. These industries mainly contain enterprises that are market producers. This means they sell their products for economically significant prices that affect the quantity that consumers are willing to purchase. The series is available from 1996.

Multifactor productivity (MFP): estimates are indexes of real GDP per combined unit of labour and capital. They are derived by dividing chain-volume estimates of market sector GDP by a combined measure of hours paid and capital services. An increase in value is referred to as technical change or efficiency growth. However, it is more accurately interpreted as some combination of technological progress, efficiency gain, deviation from constant returns to scale, unobserved change in capacity utilisation, or departure from economy-wide long-run equilibrium. MFP is essentially a residual, and so also captures the impact of unobserved inputs on production.

Output: chain-volume value added. Annual value added for the measured sector is derived following the same procedures used to derive constant-price GDP, a chained Laspeyres volume index of the constant-price value added of the industries making up the measured sector. The resulting chained volume series is re-expressed as an index with an expression base of 1000 in the March 1978 year.

Productive capital stock: a measure of productive capacity that forms the basis for the measure of capital services. Productive capital stock estimates are derived as the written-down value of each asset its efficiency decline due to age. This stock is measured in units of 'standardised efficiency'.

Rental prices: also referred to as the 'user cost of capital'. It is the unit cost for the use of an asset for one period. That is, the price for employing or obtaining one unit of capital services. The rental price for an asset is determined by its price index when new, its rate of economic depreciation, the average tax rate on production within the industry, and an exogenous real rate of return (set at 4 percent).

Total income: the part of the cost of producing GDP that consists of gross payments to factors of production (labour and capital). It represents the value added by these factors in the process of production and is equivalent to current-price GDP.

Related links

Upcoming releases

Productivity Statistics: 1978–2015 will be released on 23 March 2016.

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[The release calendar](#) lists all our upcoming information releases by date of release.

Past releases

[Productivity Statistics](#) has links to past releases.

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Data quality

Period-specific information

This section contains information that has changed since the last release.

- [Notes about this release](#)
- [Data sources](#)

General information

This section contains information that does not change between releases.

- [What productivity analysis does](#)
- [Output series methodology](#)
- [Labour series methodology](#)
- [Capital input series methodology](#)
- [Capital and labour income shares](#)
- [Total input series methodology](#)
- [Calculating the productivity indexes](#)
- [Growth accounting decomposition](#)
- [Expression base](#)
- [Estimating growth cycles](#)
- [Industry coverage – the measured sector](#)
- [Comparing New Zealand's productivity statistics with Australia](#)

Period-specific information

Notes about this release

Data for 2013 and 2014 are provisional estimates. Industry-level data is available up to 2013, inclusive. We present the 2014 data for the measured sector and former measured sector. See below for further information about what constitutes the measured and former measured sectors.

We have incorporated updated international standards and other improvements to national accounts data (key inputs into the productivity calculations) into this release.

See [Preview of 2014 national accounts improvements](#) for more about the updates.

Data sources

We derived the data used in this release from the sources below.

Productivity statistics data sources		
Data	Publication	Release date
Output	Gross Domestic Product: December 2014 quarter	19 Mar 15
Labour volume	Linked Employer-Employee Data: March 2014 quarter	25 May 15
	Household Labour Force Survey: September 2014 quarter	5 Nov 14
	Quarterly Employment Survey: September 2014 quarter	5 Nov 14
	Linked Employer-Employee Data: March 2013 year (annual tables)	27 Nov 14
Capital	National Accounts (Industry Benchmarks): Year ended March 2012	21 Nov 14
Income shares	National Accounts (Industry Benchmarks): Year ended March 2012	21 Nov 14
User costs	National Accounts (Industry Benchmarks): Year ended March 2012	21 Nov 14

General information

What productivity analysis does

Productivity analysis aims to explain the drivers of output growth. Output growth can be attributed to either an increase in labour or capital input, more efficient use of inputs, or a combination of both.

Productivity measures can be either single factor (relating a measure of output to a single measure of input), or multifactor (relating a measure of output to total inputs). Labour and capital productivity are single- (or partial-) factor productivity measures; they show productivity growth in terms of that particular input. Multifactor productivity (MFP) takes into account substitution between labour and capital inputs, and is therefore not directly affected by a change in the mix of inputs.

The output measure chosen may be either gross output or value added. Gross output is the total value of products produced in the economy, while value added is the total value of products produced minus the value of intermediate inputs used during the production process. The official productivity series all use chain-volume value added as the output measure. Separate series are produced for labour productivity, capital productivity, and MFP.

Productivity measures cover a subset of the economy referred to as the 'measured sector'. See more detail in [Industry coverage – the measured sector](#). We use the series for output, labour inputs, and capital inputs for deriving partial productivity estimates. The two primary inputs (labour and capital) are combined to form a composite input index, which then allows for the residual calculation of MFP. A change in MFP reflects the change in output that cannot be accounted for by changes in the measures of labour and capital inputs.

Productivity measurement

Our method of estimating productivity statistics is based on OECD guidelines, as outlined in [Measuring Productivity—OECD Manual Measurement of Aggregate and Industry-level Productivity Growth](#) (OECD, 2001). The approach adopted is "the index number approach in a production theoretic framework".

See [OECD](#) for a PDF of the manual.

Calculating productivity

The calculation of productivity statistics begins by assuming a **production function** of the form:

$$V = A(t) \times f(L,K)$$

where V = value-added in constant prices

L = real labour inputs

K = real capital inputs

f(L,K) = a production function of L and K that defines an expected level of output

A(t) = a parameter that captures disembodied technical shifts over time, ie outward shifts of the production function allowing output to increase with a given level of inputs (= MFP).

Given the existence of index values for labour volume and value-added, it is possible to calculate **labour productivity for the measured sector** as:

$$LP = V / L$$

Where LP = an index of labour productivity. This is an index of value-added in constant prices divided by an index of labour inputs.

Similarly, a **capital productivity index** KP is calculated as:

$$KP = V / K$$

Where KP = an index of capital productivity. This is an index of value-added in constant prices divided by an index of capital inputs.

Caution needed with interpreting productivity measures

Care is needed in interpreting the partial measures of productivity. For example, **labour productivity** only partly measures 'true' labour productivity (ie the personal capacities of workers or the intensity of their efforts). Labour productivity reflects the level of capital available per worker and how efficiently labour is combined with the other factors of production. Labour productivity may change due to a substitution of capital for labour (capital deepening) or due to a change in MFP, with no change occurring in the labour input itself.

Capital productivity measures have similar constraints. We assume capital services in production analysis to be proportional to the capital stock. If the relationship does not change over time, the growth rate of capital services is identical to the rate of growth of the capital stock. This is clearly an unrealistic assumption, given the variations in the rates of capacity utilisation of capital stocks. Consequently, swings in the rates of capacity utilisation are picked up by the residual productivity measure, ie MFP.

MFP is the final productivity index that can be calculated. The technology parameter that represents disembodied technological change (or MFP) cannot be observed directly. By rearranging the production function equation, we can show that the technology parameter can be derived residually as the difference between the growth in an index of outputs and an index of inputs:

$$A(t) = V / f(L,K)$$

Certain assumptions must be met for MFP to be a measure of disembodied technology change. We assume the production function exhibits constant returns to scale, and all inputs are assumed to be included in scope of the production function.

In practice, these conditions will not be met and our customers need to interpret the resulting MFP residual with caution. Given the importance of technological progress as an explanatory factor in economic growth, attention often focuses on the MFP measure as though it was a

measure of technological change. However, this is not always the case. When interpreting MFP, the following should be noted.

- Not all technological change translates into MFP growth. Embodied technological change, such as advances in the quality of capital or improved human capital, are captured in the measured contributions of the inputs, provided they are measured correctly (ie the volume input series includes quality change).
- MFP growth is not necessarily caused by technological change. Other non-technological factors are picked up by the residual, including economies of scale, cyclical effects, inefficiencies, and measurement errors.

Calculating labour, capital, and MFP therefore relies on appropriate output indexes, and labour, capital, and total input indexes to be created. The steps we take to calculate those indexes are described below.

Output series methodology

Output is defined as constant-price value added. The annual value added for the measured sector is derived by following the same procedures used to derive constant-price GDP (as a chain-volume Laspeyres volume index of the constant-price value added of the industries making up the measured sector).

Labour series methodology

The labour volume series

The labour volume series (LVS) is an estimate of paid hours (ordinary time plus paid overtime) for all employed people engaged in producing goods and services in the measured sector in New Zealand. We compile the series using a number of data sources, from which the best characteristics of each are used for productivity measurement.

The **primary data sources** are the Quarterly Employment Survey (QES), Business Demography Data (BDD), and Linked Employer-Employee Data (LEED, from 2000 onwards). The first two sources are establishment-based, and are supplemented with census and Household Labour Force Survey (HLFS) data for working proprietors and for industries excluded from the QES. LEED is an administrative data source that uses data from our Business Register and administrative taxation sources.

Throughout the LVS, three components are summed to an industry level:

- employees in industries covered by employment surveys
- employees in industries out of scope of employment surveys
- working proprietors.

For each of these components, the LVS is constructed by estimating:

- job/worker counts
- weekly paid hours per job/worker.

These are multiplied to give total weekly paid hours for the measured sector. We calculate an annual (March year) average of the weekly paid hours at the industry level. It is aggregated to the measured-sector level, as published in tables 1.03, 2.03, and 3.03 of this release.

Quality assurance of the industry labour volume series

As quality assurance for the industry productivity measures, the employee job/worker counts and weekly paid hours series that feed into the measured sector LVS, are subject to several coherency adjustments.

The main data sources we use in constructing the LVS are sourced independently of the estimates of compensation of employees (CoE) from the national accounts. CoE estimates are primarily derived from the Annual Enterprise Survey, while we compile LVS estimates using a number of different sources. Current-price CoE estimates are deflated using the QES average hourly earnings measure to provide an implicit LVS. This provides a benchmark for comparing against the LVS at an industry level.

For years in which the LVS showed a significantly different movement to the deflated CoE series, we compared both movements to alternative labour volume data sources. Adjustments were then made to the industry LVS where we deemed it appropriate.

Rating forward the LVS to calculate the latest values

LEED employee count data was available for all quarters including March 2014, due to the later release in 2015. Working-proprietor count data was unavailable for the last year of the series. Therefore, we used actual working-proprietor count data, rated forward. Working-proprietor counts were rated forward using HLFS movements. We made adjustments where necessary. We calculate average hours worked per industry as for previous years.

The labour input index

The industry volume series are aggregated to the measured-sector level by means of a chained Törnqvist index. The quantity relatives in the index are two-period ratios of industry labour volumes. Industry two-period mean shares of measured-sector nominal labour income form the exponential weights.

Composition-adjusted labour input

Composition-adjusted productivity measures account for the effect of changes in the skill composition of workers. These are theoretically better measures of productivity as they allow us to also explain output growth by changes in labour composition, thereby reducing the contribution of the residual (ie MFP) to growth.

Composition-adjusted labour is calculated by adjusting the LVS using movements in a labour composition index, which estimates changes in skill composition using proxies for skill (education attainment and work experience). We calculate this index by using the HLFS to estimate the proportions of each skill category of worker, while we use the New Zealand Income Survey (NZIS), an annual supplement to the HLFS, to compile income shares for each group. Due to the availability of NZIS data, the composition-adjusted series runs from 1998.

See [Accounting for changes in labour composition in the measurement of labour productivity](#) for further background on composition-adjustment, and details on the methodology.

Capital input series methodology

The capital services input index measures the flow of capital services generated by using the stock of capital assets for a given March year. The capital services measure starts with the

chain-volume productive capital stock series from the national accounts, supplemented by estimates of eight other assets: inventories (which include estimates of livestock and timber before 1980), and seven different types of land (commercial, industrial, mining, agricultural, forestry, residential, and other).

We assume capital service flows to be proportional to the productive capital stock of each asset. These flows are aggregated to industry-level using a Törnqvist index, with weights based on asset-specific implicit rental prices (user costs). The industry-level flows are then aggregated to the measured-sector level using industry shares of the measured-sector current-price capital income as weights.

Productivity statistics do not account for changes in capacity utilisation of capital, as we assume capital assets to be used at a constant rate throughout the growth cycle and over their life. Growth in capital input may be understated when capacity utilisation is increasing and capital productivity may be overstated.

Furthermore, capacity utilisation adjustment has minimal impact on long-term growth, leading to marginally lower capital input growth and higher MFP growth at the measured sector level. In the short term, the effects of adjusting productivity statistics for variable capacity utilisation are more significant, leading to less volatile MFP estimates.

See [Adjusting productivity statistics for variable capacity utilisation: Working harder or hardly working?](#) for detailed explanation on this subject.

Capital and labour income shares

We calculate the measured-sector capital and labour nominal-income shares as the ratio of capital and labour income, respectively, to total income. Capital and labour nominal-income totals are calculated at the industry level, and are derived from the income measure of GDP within the national accounts.

The **income measure of GDP** is calculated as CoE, plus gross operating surplus, plus taxes on production and imports, less subsidies (taxes less subsidies are known as net taxes). Included within gross operating surplus is the income of working proprietors, which is termed mixed income. Mixed income is split into labour and capital components by calculating the labour income of working proprietors directly, and deriving the capital income of working proprietors residually. In calculating the labour income of working proprietors, we assume that the average hourly wage rate of a working proprietor in a given industry is equivalent to that of an employee.

Net taxes on production and imports are split into labour and capital components according to existing industry income shares.

Labour income is calculated as the sum of compensation of employees, labour mixed income, net taxes on production and imports attributable to labour. Capital income is calculated as the sum of gross operating surplus, capital mixed income, net taxes on production, and imports attributable to capital.

Weights within productivity

Capital and labour income shares are used as weights within the productivity series. We use mean two-period industry income shares to weight the capital and labour input indexes from the industry level to the measured-sector level. Mean two-period measured-sector income shares

are then used to weight capital and labour when deriving the total inputs index, which is used in calculating MFP. Capital and labour income shares are also used to weight the contribution of capital input and labour input, respectively, within the growth accounting framework.

We also use the capital income share to weight the contribution of capital deepening within the growth accounting for labour productivity equation.

Annual current price income data are only available up to 2012, the latest year for which we've completed the national accounts supply-use balancing process. Therefore, labour and capital income shares are held constant from 2012 to 2014.

Total input series methodology

We construct a composite total input index by combining the labour and capital input indexes at the measured-sector level. The total inputs index is a Törnqvist index, with the industry factor income shares providing the weights.

Calculating the productivity indexes

The construction of output, labour input, capital input, and composite total input indexes then allows us to calculate the labour productivity, capital productivity, and MFP measures, using the formula under 'Productivity measurement'.

Growth accounting decomposition

The growth accounting technique examines how much of an industry's output growth can be explained by the growth rate in different inputs (labour and capital). we determine the additional output growth – known as MFP – residually. Under the composition-adjusted approach, changes in output can also come from a change in the skill composition of labour.

The growth accounting decomposition for output (ie value added, or real GDP) is presented as follows.

$$V = (L \wedge W L) \times (K \wedge W K) \times MFP$$

V = the change in value added (over one period)

L = the change in labour input (over one period)

K = the change in capital input (over one period)

MFP = the change in MFP (over one period)

W L = labour's share of total income

W K = capital's share of total income.

As can be seen, the changes in labour input and capital input are exponentially weighted by their respective shares of total income. This gives the contribution of labour input and capital input, respectively, to output growth.

Under the composition-adjusted approach, we decompose output growth into an additional variable – the skill composition of labour. This is presented in the equation below.

$$V = (L \wedge W L) \times (S \wedge W L) \times (K \wedge W K) \times MFP$$

S = the change in skill composition (over one period).

To obtain the contribution of skill composition towards output, it also needs to be exponentially weighted by labour's share of total income.

The growth-accounting technique also examines how much of an industry's labour productivity growth can be determined by growth in the amount of capital available per worker. Again, we determine the additional labour productivity growth residually – it is MFP.

Expression base

The productivity indexes for the measured sector now have an expression base of the year ended March 1996=1000, while the former measured sector used March 1978=1000, consistent with the first year of the series. The composition-adjusted productivity indexes have an expression base of the year ended March 1998=1000, also the first year of the series.

Estimating growth cycles

This release contains productivity data presented as annual averages within growth cycles. While our productivity model assumes no differences (across industry and time) in the asset capacity utilisation rates, in reality capacity utilisation of capital varies across a cycle. The cycles are identified as 'peak to peak', determined where output growth and/or MFP growth are at their highest deviation from trend. The final growth cycles selected also take into account economic events throughout the time period.

Please note that the latest period (2008–14) is not a complete cycle. We advise caution when comparing the latest period with other cycles. This is because productivity growth within an incomplete cycle can be biased; it will not fully reflect the ups and downs in capacity utilisation as a complete cycle would.

[Extracting growth cycles from productivity indexes](#) has more detail on the methodology and associated economic commentary used for determining the growth cycles.

Industry coverage – the measured sector

Our productivity measures do not cover the entire economy. The statistics cover a subset of the economy known as the 'measured sector'. It covers industries that mainly contain enterprises that are market producers. This means they sell their products for economically significant prices that affect the quantity that consumers are willing to purchase.

We include two major aggregates with this information release. These are the measured sector and the former measured sector. The measured sector productivity series is available from 1996 to 2014, and covers 77.3 percent of the economy. The former measured sector has narrower industry coverage but a longer time series (from 1978 to 2014 and covering 58.1 percent of the economy). The measured and former measured sectors are comparable directly with the Australian Bureau of Statistics market industries and selected industries series, respectively.

We exclude the following industries: ownership of owner-occupied dwellings (LL2), public administration and safety (OO1 and OO2), education and training (PP1), and health care and

social assistance (QQ1). The table below shows industry coverage as a proportion of GDP under ANZSIC06.

Industry coverage under ANZSIC06	
ANZSIC06 industry	Proportion of GDP⁽¹⁾, percent
Primary sector	9.0
AAZ - Agriculture, forestry, and fishing	6.9
BB1 - Mining	2.1
Goods-producing sector	21.3
CCZ - Manufacturing	12.1
DD1 - Electricity, gas, water, and waste services	3.4
EE1 - Construction	5.8
Service sector ⁽²⁾	47.0
FF1 - Wholesale trade	5.5
GH1 - Retail trade	4.4
GH2 - Accommodation and food services	2.2
II1 - Transport, postal, and warehousing	5.0
JJ1 - Information media and telecommunications	3.2
KK1 - Financial and insurance services	5.9
LL1 - Rental, hiring, and real estate services ⁽³⁾	7.1
MN1 - Professional, scientific, and technical services ⁽³⁾	7.7
MN2 - Administrative and support services ⁽³⁾	2.2
RS1 - Arts and recreation services	1.6
RS2 - Other services ⁽³⁾	2.1
Total former measured sector⁽⁴⁾	58.1
Total measured sector⁽⁵⁾	77.3
OO1 - Local government administration	0.6
OO2 - Central government administration, defence, and public safety	4.2
PP1 - Education and training	5.2
QQ1 - Healthcare and social assistance	6.4
Ownership of owner-occupied dwellings	6.4
Total non-measured sector	22.7
Total all industries	100.0
<p>1. Proportion of current price GDP in 2012.</p> <p>2. Service sector differs from national accounts service sector, due to industries that are excluded.</p> <p>3. Not included in the former measured sector. Industry series available from 1996.</p> <p>4. Former measured sector includes ANZSIC06 industries AA1-KK1 and RS1. Series available from 1978.</p> <p>5. Measured sector includes ANZSIC06 industries AA1-MN2 (except LL2), RS1, and RS2. Series available from 1996.</p>	
Source: Statistics New Zealand	

Comparing New Zealand's productivity statistics with Australia

Official New Zealand productivity data can be compared against official Australian numbers. Both countries use the same industrial classification, Australian and New Zealand Standard Industrial Classification 2006 (ANZSIC06), so the measured sectors are comparable.

However, there are differences between New Zealand and Australia's productivity data series:

- Australian Bureau of Statistics (ABS) data is based on a June year; Statistics NZ data is based on a March year.
- ABS productivity series excludes private landlords, but these are included in our series.
- Growth cycles cannot be compared, due to each country having slightly different peaks in their cycles.

ABS market sector and selected industries estimates can be compared with our measured sector and former measured sector productivity estimates.

ABS selected industries dates back to 1974 and can be compared with our former measured sector, which dates back to 1978. Similarly, ABS market industries aggregate can be used to compare against our measured sector, with data available for comparison dating back to 1996.

In 2012, both the Australian selected industries series and New Zealand's former measured sector covered around 60 percent of their respective economies. The ABS market industries series and our measured sector covered approximately 80 percent of their economies.

The ABS series are available on their website, www.abs.gov.au.

See [Taking on the West Island: How does New Zealand's labour productivity stack up?](#) and

[Taking on the West Island: Steps towards levelling the playing field](#) for has more details on the comparisons between Australia and New Zealand's labour productivity.

More information

Statistics in this release have been produced in accordance with the [Official Statistics System principles and protocols for producers of Tier 1 statistics for quality](#). They conform to the Statistics NZ Methodological Standard for Reporting of Data Quality.

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Revisions

Updates in data sources and ongoing methodology improvements led us to making revisions to the previously published productivity series.

Please refer to tables 1.07, 1.08, 2.07, and 2.08 in the downloadable Excel spreadsheets for the magnitude and direction of these revisions.

Regular revisions (due to updates in data sources) arose from the following:

- revised constant-price GDP data, feeding into the output series
- revised current-price national accounts data, feeding into the industry income-based weights
- revised current- and constant-price productive capital stock data, feeding into the capital input series
- revised labour data, feeding into the labour volume series
- adding linked employer-employee data, to replace survey-based data for working-proprietor counts for the March 2013 year, and employee counts for the March 2013 quarter, feeding into the labour input series.

Additional revisions in the 2015 release affect the labour input and labour volume time series:

- corrected industry classification for the linked employer-employee data
- corrected industry classification for the quarterly employment survey
- rebase of the household labour force survey to the 2013 Census

Additional revision in the 2015 release affects the capital input series and output:

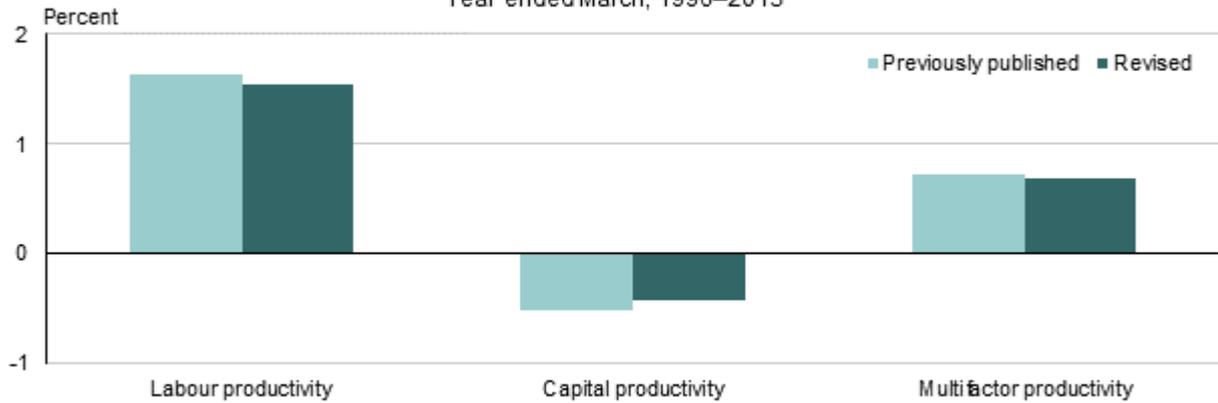
- introducing international standards of 2008SNA
- rebase of the chain volume GDP series to 2009/10 prices, previously expressed in 1995/96 prices

Follow-on effects:

- Nominal unit labour costs (ULC) is directly affected by the levels in the chain volume GDP estimates and shows also as a level shift in nominal ULC. Movements are similar to previous published series.
- Real ULC show some revision, due to revised current price GDP from updated international standards and revision to the labour inputs.

Revisions to the measured sector's productivity

Average annual percentage change
Year ended March, 1996–2013



Source: Statistics New Zealand

Revisions to the measured sector's inputs and output

Average annual percentage change
Year ended March, 1996–2013



Source: Statistics New Zealand

Due to the amount of provisional data used in productivity calculation for the most recent years, data for the last two years of the series are provisional.

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Next release

Productivity Statistics: 1978–2015 will be released on 23 March 2016.