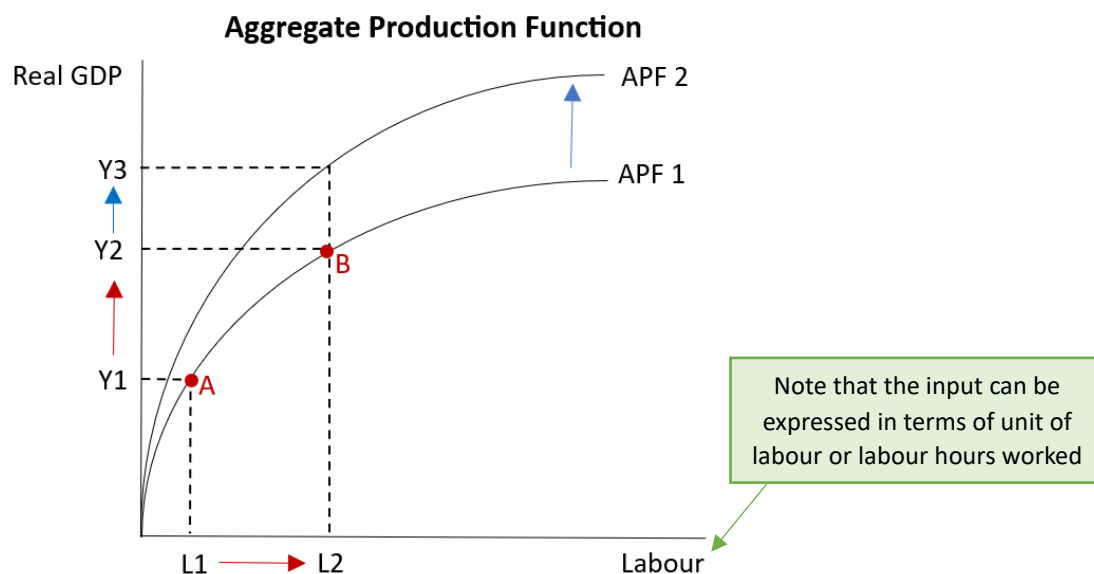


Labour Productivity and the Aggregate Production Function

Productivity is the efficiency to which productive inputs are transformed into output. It is often measured in terms of labour productivity which is output per unit of labour, or output per hour worked.

Labour productivity can be improved through both an increase in the level of physical capital stock (capital deepening) and factors that improve the quality of productive inputs, such as an increase in human capital and/or technological progress. Basically, if one of these aspects increase, then labour productivity will increase, and more output will be produced per hour worked. Capital deepening measures the capital to labour ratio. If the amount of capital per worker increases, there will be an increase in capital deepening, which will translate to an increase in the productivity of labour. In addition to this, an increase in labour productivity could be driven by factors other than an increase in the quantity of physical capital, that is, an efficiency increase caused by an improvement in the quality of resources. This can occur due to factors such as an increase in technology, such as a faster microchip or better machinery, or education and training which increases the skills of labour, improving human capital. As the quality of resources is improved, the efficiency of production can increase which will increase the amount of output that can be produced per hour, thus increasing labour productivity.

An increase in labour productivity will lead to an increase in the efficiency to which output is produced, which will lead to an increase in economic growth (measured in terms of Real GDP). Efficiency improvements driven by an increase in productivity means that more output can be produced with the same level of input, or the same level of output can be produced with less inputs.



The above aggregate function shows that an increase in the quantity of labour input will increase the level of real GDP, but at a diminishing rate. There will be a certain point where adding more labour

inputs will not increase output further. As the input of labour increases from L1 to L2, the level of Real GDP will increase from Y1 to Y2 and there will be a movement from A to B along the Aggregate Production Function 1 (APF 1).

An increase in labour productivity however, which could be caused by an increase in physical capital (capital deepening), an improvement in human capital and/or technological progress, will cause an entire upward shift of the aggregate production function from APF 1 to APF 2. The increase in efficiency in production means that a higher level of output can now be produced with the same level of inputs. This is illustrated on the above model as Real GDP increases from Y2 to Y3 using the same level of labour input, L2.

What does Australia's productivity growth look like?

The below media release was published by the Productivity Commission in the September 2023 quarterly productivity bulletin on 10 October 2023.

Productivity goes backwards as Australians 'running to stand still'

Productivity decreased by 2% in the June 2023 quarter, as record-high growth in hours worked outpaced output growth, according to the Productivity Commission's latest Productivity Bulletin.

"Our unemployment rate remains low. Australians worked more in the June quarter as cost-of-living pressures continue to bite. But even though hours worked rose, the rise in output was more modest, and that shows up as a reduction in labour productivity," Acting Chair Alex Robson said.

The report finds that while output was up 0.4%, hours worked for the whole economy and the market sector increased by 2.4% and 2.2% respectively – the largest quarterly increase on record outside the COVID-19 pandemic.

"Productivity growth is about working smarter, not working longer or working harder. Negative productivity growth means that on average, Australians worked more hours just to produce and buy the same amount of goods and services. In other words, Australians have been running to stand still."

The report suggests that while demand for labour may taper off as interest rates rise and the economy slows, we can't rely on short term fluctuations in hours worked as a source of long-term productivity growth. "Our productivity challenge has been urgent for many years. We will only see sustainable, long-term productivity growth if we increase investment and innovation," Dr Robson said.

The research finds that 15 out of 19 industries experienced a decline in labour productivity over the 2023 June quarter.

The arts and recreation services industry saw the largest decline in productivity (-7.6%), as hours worked increased by 9.3% while output rose only 0.9%. However, three industries drove about 46% of the overall labour productivity decline: mining; electricity, gas, water and waste services; and information, media and telecommunications. The mining industry alone made up around one-third of the total labour productivity decline, as hours worked increased while output significantly declined. The decline in mining output was mainly driven by a decrease in iron ore mining and oil and gas extraction, as adverse weather and planned maintenance reduced production capacity.

Source: *Productivity goes backwards as Australians 'running to stand still.'* (2023, October 10). Australian Government Productivity Commission. Retrieved December 4, 2023, from <https://www.pc.gov.au/ongoing/productivity-insights/bulletins/quarterly-bulletin-september-2023#media-release>

Activities

1. Define the concept of labour productivity and explain how it is measured.
2. Using the aggregate production function model, explain how a change in labour productivity will impact economic growth.
3. Using evidence from the media release, describe the change in productivity growth in Australia in the June quarter 2023.
4. Explain how an increase in 'investment and innovation' can lead to an increase in labour productivity.

Teacher Notes

Purpose

This 'bite' aims to examine the meaning of the Aggregate Production Function and its use in explaining the impact of an increase in labour productivity on economic growth

Prior Knowledge

From the Year 12 Economics ATAR Syllabus

Knowledge and Understanding

- the concept of labour productivity
- the factors affecting labour productivity growth, including human capital, physical capital (capital deepening), technological progress
- government policies designed to influence labour productivity and the achievement of economic growth
- the impact of changes in labour productivity using the AD/AS model and the Aggregate Production Function (APF)

Economic Skills

- use macroeconomic models to analyse and convey economic theory and reasoning in relation to Australia's economic policy and management, including the Aggregate Production Function (APF)

Answer Guide

Sample answer guide

1. Define the concept of labour productivity and explain how it is measured.

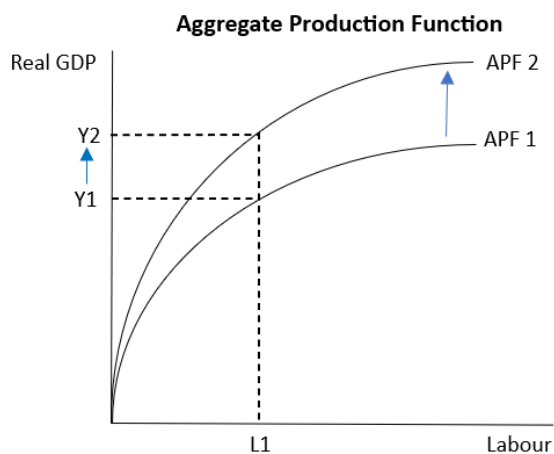
Answers could include but are not limited to:

- Labour productivity measures the efficiency of labour.
- Labour productivity is measured by output per worker or output per hour worked.
- Labour productivity is comprised of capital deepening (capital to labour ratio) and efficiency improvements measured by an increase in the quality of productive inputs such as through technological progress and/or increase in human capital.

2. Using the aggregate production function model, explain how a change in labour productivity will impact economic growth.

Answers could include but are not limited to:

- The aggregate production function illustrates the relationship between labour input and output, measured in terms of real GDP.
- The aggregate production function slopes upward showing that an increase in labour input will increase real GDP, but at a diminishing rate. This is because at a certain point, any further increases in labour input will not contribute to further increases in output.
- An increase in labour productivity means that efficiency in production has improved so more output can be produced for a given level of input.
- An increase in labour productivity is illustrated by an upward shift of the aggregation production function, showing that for the same level of labour input, L1, more output can be produced, indicated by an increase in real GDP from Y1 to Y2.



3. Using evidence from the media release, describe the change in productivity growth in Australia in the June quarter 2023.

Answers could include but are not limited to:

- Productivity growth in Australia declined by 2% in the 2023 June quarter (output increased by 0.4% but hours worked for the whole economy increased by 2.4%).
- Research by the Productivity Commission found that 15 out of 19 industries experienced a decline in labour productivity in the 2023 June quarter.
- The arts and recreation services industry experienced the largest decline in labour productivity with a decrease of 7.6%, however, the mining industry alone made up around one-third of the total labour productivity decline.

- The decrease in labour productivity in the mining industry was mainly due to a decrease in iron ore mining and oil and gas extraction, as adverse weather and planned maintenance reduced production capacity.

4. Explain how an increase in 'investment and innovation' can lead to an increase in labour productivity.

Answers could include but are not limited to:

- An increase in investment can be undertaken by the government which can include spending on hard infrastructure such as road and rail networks, or spending by private enterprise which can include spending on capital equipment such as machinery.
- Increased spending on investment can increase the capital to labour ratio (i.e. amount of capital available per worker) which leads to an increase in capital deepening and thus, an increase in labour productivity, *ceteris paribus*.
- An increase in innovation involves an improvement to existing technology or production processes which can boost efficiency in production.
- Innovation can improve the quality of productive inputs which leads to 'better', more efficient methods of production, thereby leading to an increase in multifactor productivity, and as a result, labour productivity.