



# MATHEMATICS IN CAREERS

Investigation - Exploring changes in the cash rate and its effect on the economy

Key career focus for this investigation: Economics, commerce Related career areas: Finance, statistics and data science



# THINKING ABOUT CAREERS

- Brainstorm the tasks done in the economics and commerce professions, and think where maths is frequently used. The Explore Economics pages at: <u>rba.gov.au/education/explore-economics</u> can be used to discover more about what economists do and the broad range of fields and careers economics can lead to. Think about: *How is maths used in these scenarios? What maths is used in these scenarios?*
- This task focuses on how maths is used in economics and commerce through investigating changes in the cash rate and its effect on the economy.
- The task specifically looks at supply and demand.
- For a more extensive list of careers related to this task, with a maths / science focus, refer to the table at the end of the task and explore the maths used in these jobs.

# MATHEMATICS IN EVERYDAY LIFE AND CAREERS

#### Mathematical focus for this investigation

- Representing word problems with simple linear equations and solving them to answer questions
- Solving simple equations arising from formulas
- Re-arranging expressions to make a specified variable the subject
- Associating the solution of simultaneous equations with the coordinates of the intersection of their corresponding graphs.

Linear equations use one or more variables where one variable is dependent on the other. Many people use linear equations every day, even if they do the calculations in their head or just draw a line graph.

Almost any situation where there is an unknown quantity can be represented by a linear equation, like figuring out income over time, calculating mileage rates, or predicting profit.

Brainstorm and share scenarios where this mathematics may be used in commerce and economics to solve problems.





# INVESTIGATION BACKGROUND

It is the responsibility of the Reserve Bank of Australia (RBA) to set interest rates in a way that best contributes to price stability, full employment, and the economic prosperity and welfare of the people of Australia.

To achieve price stability, the RBA's inflation target is to keep consumer price inflation between 2–3%, on average, over time. This target is flexible and allows for temporary fluctuations in inflation above or below the target. To achieve this goal, the RBA sets the cash rate to influence economic activity and inflation. A reduction in the cash rate typically stimulates spending and inflation and an increase in the cash rate typically dampens spending and inflation.

# YOUR INVESTIGATION

It is the year 2025 and you are an economist at the RBA. The role of your team is to analyse how changes in the economy (in particular changes to the aggregate demand and supply of goods and services) can lead to inflation being pushed away from the inflation target. If inflation is pushed away from its inflation target the RBA can change the cash rate to influence economic activity and inflation.

Together with your team, you have been asked to look at possible changes in aggregate demand and supply and to advise your manager what effect these changes have on inflation under different scenarios.

Furthermore, the next meeting of the Reserve Bank Board is coming up. In this meeting, the Board will decide on the appropriate level of the cash rate to meet the inflation target. You have also been asked to offer recommendations to the Board on how to set the cash rate in the scenarios you considered.

#### A model for aggregate demand and supply

To study the effect a change in aggregate demand or supply has on inflation and how monetary policy should respond you will use a mathematical model. Using a model will help your team think about how changes in the demand for goods and services by households (consumption) or firms (investment) interact with what can be produced in the economy to influence inflation. The model will also help you think through, and assess, how the cash rate influences the economy.

For your analysis, your department has developed a set of algebraic expressions for you to use. This model describes the quantity of goods and services demanded (aggregate demand) and produced (aggregate supply) in the Australian economy as the intersection between two functions:

- Supply of all goods and services  $Q_s$ : the quantity of goods and services that firms produce, which is increasing in the average price p; and
- **Demand for all goods and services Q**<sub>p</sub>: the quantity of goods and services that households want to purchase, which is decreasing in *p*.

(Think about why the quantity of goods and services households want to purchase increases as prices decrease.)

#### We will assume that these two functions are:

 $Q_s = a_s + b_s \times p \quad \text{and} \\ Q_p = a_p - b_p \times p$ 











where  $a_{S}, b_{S}, a_{D}$  and  $b_{D}$  are (the intercept and slope) parameters satisfying

 $a_D > a_S > 0, b_S > 0$  and

 $b_{\rm D}$  > 0 (these parameters should be thought of as fixed values).

Prices can be expected to move to the level that makes supply equal demand, i.e.  $Q_s = Q_p$ . (Think about why.) We say that when supply equals demand, the economy is in *equilibrium*. Denote the equilibrium price level as  $p^*$  and the equilibrium quantity supplied and demanded as  $Q^*$ .

The RBA can influence aggregate demand by changing the cash rate. One way to illustrate this in our model is to assume that a decline in the cash rate affects the intercept of the demand function  $a_D$ . Your team have looked at the data around the last times when the cash rate has been changed and have observed that the relationship between  $a_D$  and the cash rate cr can be approximated by the following function:

$$a_D = 12.5 - \frac{1}{3} \times cr.$$

### **YOUR TASKS**

Your manager would like to know how equilibrium prices and equilibrium demand and supply depend on the parameters of the model.

### PART 1

Express  $p^*$  and  $Q^*$  as functions of only the parameters  $a_s, a_p, b_s$  and  $b_p$ .

# PART 2

Plot  $Q_s$  and  $Q_d$  on a graph that has p on the x-axis and  $Q_s$  and  $Q_d$  on the y-axis (the slopes and intercepts do not need to be to scale). Identify  $p^*$  and  $Q^*$  on the graph.

### PART 3

Assume that  $a_s$  = 2, and  $b_s$  = 0.6 and  $b_p$  = 0.4. The cash rate is currently set to 1.5% (so *cr* = 1.5). What is the equilibrium price level  $p^*$  and the equilibrium quantity produced and demanded  $Q^*$ ?

### PART 4

Your manager would now like to understand what effect a decrease in the cash rate would have on supply and demand, and on prices.

How could a decrease in the cash rate affect the supply or demand functions in the graph? In which direction do  $Q^*$  and  $p^*$  move in general if the cash rate decreases?

# PART 5

Your manager would now like to know what the effects on prices and the quantity demanded and supplied would be if the cash rate were to be reduced by 1 percentage point to 0.5%.

In this case what are the new Q<sup>\*</sup> and  $p^*$ ? What is the inflation rate between the new price level  $p_1^*$  and the old price level  $p_0^* = 10$ ?









# PART 6

Now assume that the cash rate is still at cr = 1.5, but there is a change to the production side of the economy, so that  $a_s$  changes to  $a_s = 2.25$ .

Show in your graph what happens to  $Q^*$  and  $p^*$  in this case. What are the new values for  $Q^*$  and  $p^*$ ? If the RBA wants the price level to be stable (no inflation), how should it set the cash rate? [Hint: The RBA can still influence demand by changing the parameter  $a_D$ . At what cash rate is inflation equal to zero?]

### **REFERENCE MATERIAL**

- Modules for Years 9 and 10: The Nature of the Economy
- Modules for Years 9 and 10: Reading and Interpreting Charts
- Explainer: Australia's Inflation Target
- Explainer: The Transmission of Monetary Policy
- <u>Explainer: Inflation and its Measurement</u>
- <u>Explore Economics</u>

# CAREERS RELATED TO THIS INVESTIGATION

### **ECONOMICS**

| Career description  | Key skills required   | More information   |
|---|---|--|
| Economics is the study of how society<br>uses its limited resources. Economics<br>is a social science that deals with<br>the production, distribution, and<br>consumption of goods and services.<br>Economics focuses heavily on the four<br>factors of production, which are land,<br>labour, capital, and enterprise. Careers<br>in economics includes:<br>Economist<br>Financial risk analyst<br>Economic researcher | <ul> <li>Data analysis</li> <li>Mathematics</li> <li>Quantitative reasoning</li> <li>Critical thinking</li> <li>Knowledge of how markets operate</li> <li>An understanding of business</li> </ul> | https://www.glassdoor.com/blog/<br>guide/best-jobs-for-economics-ma-<br>jors/<br>https://myfuture.edu.au/bullseyes/de-<br>tails/9economics |
| COMMERCE  |   |  |
| Career description  | Key skills required   | More information   |
| Commerce is the conduct of trade<br>among economic agents. Generally,<br>commerce refers to the exchange of<br>goods, services, or something of value,<br>between businesses or entities. Careers<br>in commerce include:<br>• Investment banker<br>• Investment banker<br>• Investment analyst<br>• Management analyst<br>• Budget analyst   | <ul> <li>Numeracy skills</li> <li>Good communication</li> <li>Reasoning and problem solving</li> <li>Leadership skills</li> <li>Good ICT skills</li> </ul>  | https://www.mindler.com/blog/ca-<br>reer-options-commerce-students/  |



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# CAREERS RELATED TO THIS INVESTIGATION

#### FINANCE

| Career description   | Key skills required  | More information  |  |  |  |
|--|--|---|--|--|--|
| <ul> <li>Finance relates to matters regarding<br/>the management, creation, and study<br/>of money and investments. Careers in<br/>finance include:</li> <li>Financial advisor</li> <li>Financial planner</li> <li>Commercial banker</li> <li>Mortgage broker</li> <li>Wealth management</li> <li>Insurance broker</li> </ul>  | <ul> <li>Interpersonal skills</li> <li>Numeracy and problem-solving skills</li> <li>Analytical skills</li> <li>Technologically savvy</li> <li>Desire to innovate</li> <li>Relationship management skills</li> </ul>  | https://www.glassdoor.com/blog/<br>guide/jobs-finance-majors/   |  |  |  |
| ACCOUNTING   |  |   |  |  |  |
| Career description   | Key skills required  | More information  |  |  |  |
| <ul> <li>Accountants handle financial<br/>information for a company or<br/>individual clients. The accounting<br/>process includes summarising,<br/>analysing, and reporting transactions<br/>to oversight agencies, regulators, and<br/>tax collection entities. Careers in<br/>accounting include: <ul> <li>Chartered Accountant (CA)</li> <li>Certified Public Accountant<br/>(CPA)</li> <li>Business accountant and taxation</li> <li>Cost accountant</li> </ul> </li> </ul> | <ul> <li>Good communication</li> <li>Organisation and attention to detail</li> <li>Analytical and problem-solving skills</li> <li>Time management</li> <li>Mathematical and deductive reasoning skills</li> <li>Proficiency with Microsoft Office suite</li> </ul> | https://www.glassdoor.com/blog/<br>guide/accounting-skills/   |  |  |  |
| OTHER RELATED CAREERS  | S TO EXPLORE   |   |  |  |  |
| <ul><li>Actuary</li><li>Market researcher</li><li>Futures trader</li></ul>   | <ul><li>Account manager</li><li>Bookkeeper</li><li>Accounting clerk</li></ul>  | <ul><li>Investment banking analyst</li><li>Payroll administrator</li><li>Accounting associate</li></ul> |  |  |  |
| For an overview of economics being a priority industry and sector, visit:<br>https://djpr.vic.gov.au/priority-industries-sectors/professional-services   |  |   |  |  |  |









# **CAREERS ACTIVITIES**

| THE 10 BEST RATED JOBS OF 2021 |                              |               |                  |  |  |
|--------------------------------|------------------------------|---------------|------------------|--|--|
| Rank                           | Career                       | Median salary | Projected growth |  |  |
| 1                              | Data Scientist               | \$98 230      | 33%              |  |  |
| 2                              | Genetic Counsellor           | \$85 700      | 21%              |  |  |
| 3                              | Statistician                 | \$92 270      | 35%              |  |  |
| 4                              | Medical Services Manager     | \$104 280     | 32%              |  |  |
| 5                              | Mathematician                | \$110 860     | 33%              |  |  |
| 6                              | University Professor         | \$80 790      | 9%               |  |  |
| 7                              | Operations Research Analyst  | \$86 200      | 25%              |  |  |
| 8                              | Information Security Analyst | \$99 730      | 31%              |  |  |
| 9                              | Actuary                      | \$111 030     | 18%              |  |  |
| 10                             | Software Engineer            | \$110 140     | 22%              |  |  |

Data from <u>Careercast.com</u>.

Select one of the careers, from either of the tables above, that interests you and find out:

- What are the tasks involved in this career? What may a typical day look like?
- What level of education or qualifications do you need to do this career?
- What are some other similar or related careers?
- What mathematics skills would be used in this career?
- Where does the career you have selected, to investigate, rank according to careercast.com?
- How many people in Australia are currently employed in this career (or field)?

Alternatively, or additionally, look at the table <u>www.rba.gov.au/education/resources/economics/pdf/find-your-career-path.</u> <u>pdf</u> or the graph <u>www.rba.gov.au/publications/bulletin/2018/sep/does-it-pay-to-study-economics.html</u> (both based on Australian data) and answer the above six questions specifically for an economist.











### **INDUSTRY PARTNER**

This project was produced collaboratively between The Mathematical Association of Victoria (MAV) and the Reserve Bank of Australia (RBA).

The Reserve Bank has the following roles and functions:

#### Monetary policy

The Reserve Bank conducts monetary policy to achieve its goals of price stability, full employment and the economic prosperity and welfare of the Australian people.

#### **Operations in financial markets**

The Reserve Bank operates in domestic and international financial markets. This is to implement monetary policy, help ensure the smooth functioning of payments and manage Australia's foreign exchange reserves.

#### **Financial stability**

The Reserve Bank is responsible for overall financial system stability. It does this by managing and providing liquidity to financial institutions, monitoring risks and cooperating with other organisations as part of the Council of Financial Regulators.

#### Payments and financial markets infrastructure

The Reserve Bank has responsibility for ensuring the stability, efficiency and competitiveness of the payments system. It also has a regulatory and operational role in ensuring that the payments infrastructure promotes financial stability.

#### Banknotes

The Reserve Bank is responsible for producing and issuing Australia's banknotes. Its goal is to produce banknotes that everyone can trust, both as a means of payment and a store of value.

#### **Banking services**

The Reserve Bank provides a range of banking services to the Australian Government and overseas central banks. Payments and transactions often relate to the everyday lives of Australians, such as social security benefits and emergency payments to people affected by natural disasters.

www.rba.gov.au www.rba.gov.au/education/ www.rba.gov.au/careers/









# FURTHER CAREER REFERENCES

### Australian Jobs Report 2021

www.nationalskillscommission.gov.au/australian-jobs-report

An overview of trends in the Australian labour market to support job seekers and employment service providers, career advisers, those considering future training and people interested in labour market issues.

### **Business Victoria Future Industries**

<u>https://business.vic.gov.au/grants-and-programs/future-industries</u> Future Industries is about supporting investment in high-growth industries through industry excellence and development projects, including establishing collaborative networks and building supply chain readiness capabilities.

# Career Education

<u>www.education.vic.gov.au/school/teachers/teachingresources/careers/Pages/default.aspx</u> Career Education teaching resources to help teach students to make informed career decisions and equip themselves for the world of work.

# CEAV Online Learning Resources

https://ceav.vic.edu.au/media/250615/careers-in-the-construction-technology-industries-student-resource.pdf Designed to enable students to attend a virtual Industry Immersion Experience, these online resources will help students discover more about Victoria's priority growth industries and give them the opportunity to reflect on their skills, interests and undertake career planning and exploration.

### Jobs Victoria

www.jobs.vic.gov.au

### JobOutlook

www.joboutlook.gov.au Relevant and current labour market trends and career information.

# **MyFuture**

<u>www.myfuture.edu.au</u> A database of over 600 careers.

# National Careers Institute

#### www.dese.gov.au/nci

The National Careers Institute (NCI) ensures Australians have access to reliable and accurate careers information, resources, and support.









