

LECTURE 1.1



The Keynesian Multiplier

ECON42550 Macroeconomics

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ECON42550 Macroeconomics

- New Keynesian economics is an **iterated philosophy**, informed by the failures and gaps in previous models and answerable to data.
- Evidence suggests **innovation** governs supply, and supply is what drives growth — and there has been innovation in every period of recorded history.
- The short run **fluctuates** because demand adjusts faster than supply, and crises rhyme rather than repeat — which is why each one teaches us something new about how we manage the economy.

The Short Run and the Long Run

$$\underbrace{y_t}_{\text{actual output}} = \underbrace{y_t^*}_{\text{long-run trend}} + \underbrace{(y_t - y_t^*)}_{\text{short-run deviation}} \quad (1)$$

- y_t : the log of real output in period t
- y_t^* : the log of potential output

A Star Marks a Long-Run Value

A **star** marks a long-run or equilibrium value — where a variable settles when nothing is pushing it.

Roadmap

1. Short-Run Fluctuations

1.1 The Keynesian Multiplier

1.2 Introducing IS-MP-PC

1.3 Analysing IS-MP-PC

1.4 The Zero Lower Bound

1.5 Banks, Runs, the Cycle

2. NK Building Blocks

2.1 Expectations, Investment

2.2 Consumption, Fiscal Policy

2.3 Sticky Prices and the NKPC

3. Long-Run Growth

3.1 Growth Facts, Solow

3.2 The Fundamental Causes

3.3 Endogenous Growth

3.4 Schumpeterian Growth

Lecture Plan

1 Syllabus.

What we cover, how we cover it, how you are assessed.

2 New Keynesian Economics.

What it keeps from Keynes, and what it adds.

3 The Keynesian Multiplier.

The case for fiscal intervention.

SECTION 1

Syllabus

1. Syllabus
2. New Keynesian Economics
3. The Keynesian Multiplier

Learning Outcomes

By the end of the module you should be able to:

- **Build and solve** models that describe the economy, using mathematics to describe how they evolve over time.
- **Confront** those dynamics with data, and judge whether they hold up in real life.
- **Adapt** the model when the data reject it.

More Structured, Less Dogmatic

New Keynesian macroeconomics is more structured than the analysis you have met before. It is also less dogmatic than other schools, because it adapts to data.

Timetable

Week	No.	Lecture	Set due*	Weight
1	1.1	The Keynesian Multiplier	—	—
2	1.2	Introducing IS-MP-PC	—	—
3	1.3	Analysing IS-MP-PC	Set 1	5%
4	1.4	The Zero Lower Bound	Set 2	5%
5	1.5	Banks, Runs, the Cycle	Set 3	5%
6	—	Midterm	—	30%
7	2.1	Expectations, Investment	—	—
8	2.2	Consumption, Fiscal Policy	Set 4	5%
9	2.3	Sticky Prices and the NKPC	—	—
10	3.1	Growth Facts, Solow	Set 5	5%
11	3.2	The Fundamental Causes	—	—
12	3.3	Endogenous Growth (Romer)	Set 6	5%
—	—	Final exam	—	45%

* Best five of the six problem sets count.

Assessment

- **Problem Sets:** Six, 5% each, best five count. Issued at class end, due before the next.
- **Submission:** Through the online portal, timestamped, with a sharp cut-off.
- **Midterm:** Week 6, one hour, in person, on paper. 30%.
- **Final:** Two hours, in person, on paper. 45%.

No Extensions

The best-five-of-six rule is the flexibility. It absorbs one missed set without anyone having to ask.

Tutorials

- **Six Tutorials:** One per problem set, reviewing it after submission closes.
- **What It Is For:** You find out how you did, not what to write.
- **What to Bring:** The set you submitted, to compare your working against the worked answer.

Estimated Workload

Most of your own time goes on the **problem sets**. They ask you to solve, explain and draw model dynamics. They also ask you to amend the model on your feet. The exams ask for the same, so the sets are rewarded preparation.

35

hours of contact: class and tutorials

8

hours a week on your own, including assignments

Materials

Your primary source of information is the lecture notes:

- **Parts 1 and 2:** Whelan's *Lecture Notes on Macroeconomics*, free online (Whelan, 2023).
- **Part 3:** Whitta-Jacobsen and Sørensen, and Acemoglu.

The essential journal articles are supplementary, on Brightspace and in each deck's references. The toy models are free in the browser at sam-deegan.com.

Detail in the Appendices

More detailed derivations and asides are in each deck's appendix. Direct links to every source are in the references at the end.

Using AI

I expect you will use AI to help with the assignments. The practice is unavoidable, for better or worse, and it carries a cost:

- **Your Exams Decide Your Grade:** In person, on paper, with derivations like the sets.
- **Outsourced Sets Leave You Unprepared:** The exams ask you to think on your feet.
- **Use AI as a Study Tool:** Not as a replacement, and do not trust its output.

Motivation

- **Postgraduate Material:** Harder than anything you have done before, deliberately.
- **Heavy Notation:** Most students find the first month hard, and adjust by the midterm.
- **Front-Loaded:** Deliberately so, to take pressure off you around the finals.
- **Serious Synergies:** Micro and econometrics use largely the same mathematical tools.
- **Ask Early:** After the lecture, in the tutorial, or at office hours.

SECTION 2

New Keynesian Economics

1. Syllabus
2. New Keynesian Economics
3. The Keynesian Multiplier

Keynesian Economics

Keynesian economics argues for government intervention, through fiscal policy, to stabilise the economy:

- **Supply** determines the productive capacity of the economy in the long run.
- **Demand** decides deviations, so an economy can sit below capacity for years.
- **Policy** therefore leans on fiscal intervention to push output back to trend.

“New” Keynesian

New Keynesian economics derives from the observed differences between Keynes's theories and how economies actually behave. It adds:

1. **Microfoundations.** Households and firms optimise, and learn the system they are operating in.
2. **Price and Wage Rigidities.** Slow adjustment gives the model its dynamics through time.
3. **Monetary Policy.** A second tool for managing inflation and stabilising output.

Price and wage rigidities are what let a rate cut raise real output. Without them a rate cut leaves real output unchanged. A model without rigidities has nothing to say about monetary policy.

Why This Is the Orthodox Framework

- **Microfoundations:** Coefficients come from optimisation, not from a past regime.
- **It Explains What Flexible-Price Models Cannot:** A rate cut raises real output.
- **It Fits the Data:** About as well as an atheoretical time-series model (Galí & Gertler, 2007; Woodford, 2009).
- **It Is the Common Language:** The ECB, the Bank of England and most central banks.

What Are the Limits of Our Approach?

- **We Cannot Replicate Real Life:** A few realistic assumptions get us a nugget of truth.
- **Surviving the Data:** Change the assumptions and see whether the conclusions hold.
- **Testability:** Robustness is a test you can run, and the problem sets ask for it.

Good Theory Is Not Sensitive to Its Assumptions

“All theory depends on assumptions which are not quite true. That’s what makes it theory. The art of successful theorizing is to make the inevitable simplifying assumptions in such a way that the final results are not very sensitive.” — Robert Solow

Acknowledgements

- These slides are built on **Karl Whelan's** lecture notes, which are also your main reading for Parts 1 and 2.
- The module's structure and a good deal of its material come from **Oana Peia**, who taught ECON42550 before me — and who originally taught me this course.
- Any errors that remain are mine.

What Determines the Short Run? The Long Run?

The Short Run

The Long Run

SECTION 3

The Keynesian Multiplier

1. Syllabus
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How Much Output Does a €25bn Stimulus Buy?

A government announces a **€25bn** stimulus package. Households spend a fraction of each extra euro of after-tax income they receive.

Question

By how much does output rise? **More** than €25bn, **exactly** €25bn, or **less** than €25bn?

Demand and Expenditure

Output is the sum of all expenditure. Two words for it, and they are not quite the same thing:

- **Aggregate Expenditure (AE):** What all sectors actually spent, an accounting total.
- **Aggregate Demand (AD):** What buyers *planned* to spend.

In Balance, Plans Are Realised

When the economy is in balance nobody is caught out, so $AD = AE$. That balance is the condition the model solves for.

What Is Output?

$$Y = AE = C + I + G + \underbrace{(X - M)}_{\text{net exports}} \quad (2)$$

- Y : output in euros (a level, not the log y_t)
- C : consumption
- I : investment
- G : government spending
- X : exports
- M : imports

Closing the Economy

$$Y = C + I + G + \cancel{(X - M)} \quad (3)$$

We set net exports to zero and work with

$$Y = C + I + G \quad (4)$$

Trade Adds a Leakage, Not a New Idea

Imports leak spending abroad, which shrinks the multiplier. Ireland is the worst possible place to pretend trade does not matter.

Fixing Investment and Government Spending

Investment and government spending are **exogenous**: set outside the model. Neither rises when income rises. A bar says a variable is held fixed.

$$Y = C + \bar{I} + \bar{G} \quad (5)$$

- **Not a Realistic Assumption:** Investment and government spending come out of income.
- **Imports** are already gone, because we closed the economy.
- **Savings** go into banks, which lend them to investment: $S \approx I$.
- **Taxes** come back out as spending within the period: $T \approx G$.

Consumption

Consumption has two parts: what a household must spend, and what income buys.

$$C = c_0 + c_1 \underbrace{(Y - T)}_{\text{after-tax income}}, \quad T = t \underbrace{Y}_{\text{taxable income}} \quad (6)$$

- c_0 : **autonomous consumption**
- c_1 : the **marginal propensity to consume**
- T : taxes, levied at rate t on income

Consumption Rises by Less Than Income

$0 < c_1 < 1$: out of an extra euro a household spends c_1 and saves the rest. After-tax income therefore splits as $Y - T = C + S$.

Solving for the Keynesian Multiplier

We want the output at which production equals planned spending. We have the identity and the consumption function, with $T = tY$ substituted:

$$Y = C + \bar{I} + \bar{G}, \quad C = c_0 + c_1(1 - t)Y \quad (7)$$

Consumption goes in where C was, so that output appears on both sides:

$$Y = c_0 + c_1(1 - t)Y + \bar{I} + \bar{G} \quad (8)$$

Collecting the Output Terms

Take the Y term over to the left-hand side:

$$Y - c_1(1 - t) Y = c_0 + \bar{I} + \bar{G} \quad (9)$$

Factor Y out:

$$Y [1 - c_1(1 - t)] = c_0 + \bar{I} + \bar{G} \quad (10)$$

Divide through by the bracket:

$$Y = \frac{1}{1 - c_1(1 - t)} (c_0 + \bar{I} + \bar{G}) \quad (11)$$

The Multiplier

$$Y = \underbrace{\frac{1}{1 - c_1(1 - t)}}_{\text{multiplier}} \times \underbrace{(c_0 + \bar{I} + \bar{G})}_{\text{autonomous spending}} \quad (12)$$

Why the Multiplier Exceeds One, by Construction

$c_1 < 1$ and $t < 1$, so $c_1(1 - t)$ lies between zero and one. Dividing by $1 - c_1(1 - t)$ therefore makes the multiplier exceed one.

Round by Round

The government spends €25bn. That is income to whoever receives it, and they spend $c_1(1 - t)$ of it. That is income to somebody else, who spends $c_1(1 - t)$ of *that*, and so on.

$$\Delta Y = \left(1 + c_1(1 - t) + [c_1(1 - t)]^2 + \dots \right) \Delta \bar{G} \quad (13)$$

- Every round is $c_1(1 - t)$ of the round before, and $c_1(1 - t) < 1$, so they shrink.
- A sum built this way is a **geometric series**, with a closed form.

The Geometric Series

A Shrinking Series Has a Finite Sum

Each term is a fixed multiple a of the one before. Add the first $n + 1$ terms and the total is $\frac{1-a^{n+1}}{1-a}$. When $0 < a < 1$, a^{n+1} shrinks to nothing as n grows, so the infinite sum is finite:

$$1 + a + a^2 + a^3 + \dots = \sum_{k=0}^{\infty} a^k = \lim_{n \rightarrow \infty} \frac{1 - a^{n+1}}{1 - a} = \frac{1}{1 - a}$$

Here $a = c_1(1 - t)$, so the rounds sum to the multiplier we already reached by algebra:

$$\Delta Y = \frac{1}{1 - c_1(1 - t)} \Delta \bar{G} \quad (14)$$

What the Multiplier Is Worth

Apply the multiplier to a change in government spending:

$$\frac{\Delta Y}{\Delta \bar{G}} = \frac{1}{1 - c_1(1 - t)} > 1 \quad \Rightarrow \quad \Delta \bar{G} < \Delta Y \quad (15)$$

The rounds are $1 + 0.38 + 0.14 + 0.05 + 0.02 + \dots$, and they sum to 1.6. So a €25bn package raises output by roughly **€40bn** — more than the package.

0.55

marginal propensity to consume, Ireland 2022

0.31

effective tax rate on income

The Cross, Drawn

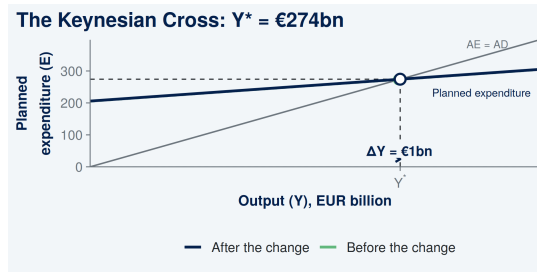


Figure 1: Planned expenditure against output, with the 45-degree line where $Y = AD$.

The Crossing Is the Solution

The two lines cross once, and that crossing is the Y we just solved for.

What the Cross Leaves Out

1 Investment and Government Spending Are Exogenous.

We fixed them by hand, and both plausibly rise with income.

2 There Is No Supply Side.

Prices are fixed, so a central bank has nothing to target — and we would expect stronger demand to raise prices.

3 There Are No Time Dynamics, and the Economy Is Closed.

Neither is addressed in this module.

Question

What else do you think we have left out?

Before Lecture 1.2

1 Play:

The multiplier app, raising c_1 from 0.55 to 0.75.

2 Apply:

Work out the multiplier by hand at $c_1 = 0.75$, then check the app.

3 Review:

Whelan, chapter 1, before Lecture 1.2 (Whelan, 2023).

Next Week

Next week we do not adapt the cross — we **replace** it. IS-MP-PC is a different model:

- **Demand:** Today's expenditure logic, with an interest rate added: the IS curve.
- **Supply:** New — a positive output gap raises inflation.
- **Policy:** Also new — the bank raises its rate when inflation rises.

Thank you

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BACKUP

Appendix

References

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