



THE UNIVERSITY OF
SYDNEY

ECON1002: INTRODUCTORY MACROECONOMICS

LECTURE 4: BUSINESS CYCLES: SPENDING AND OUTPUT

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Based on slides by Wills, Melatos and Bernanke, Olekalns and Frank

Chapter 5

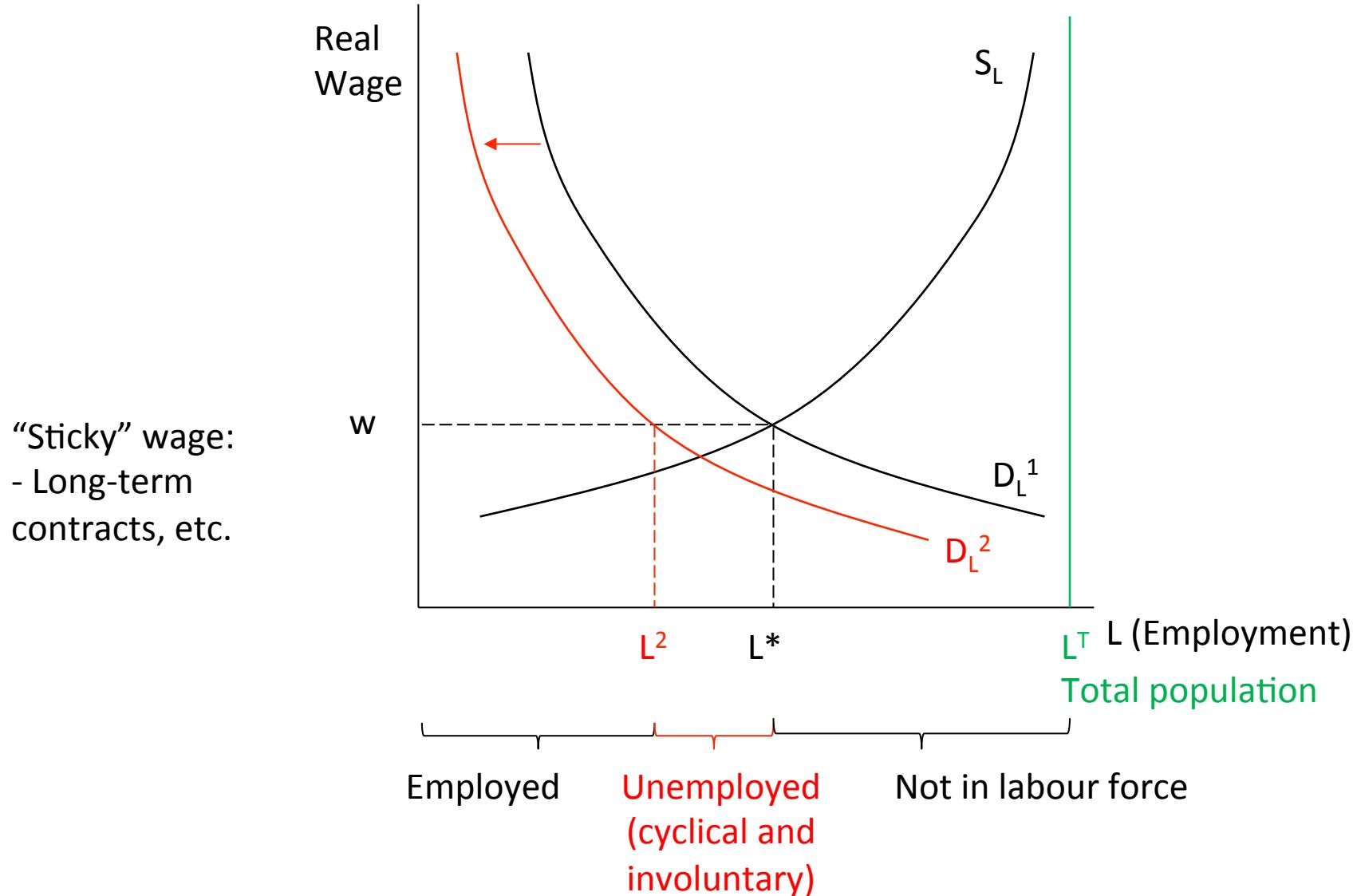
Spending and output in the short run

Learning Objectives

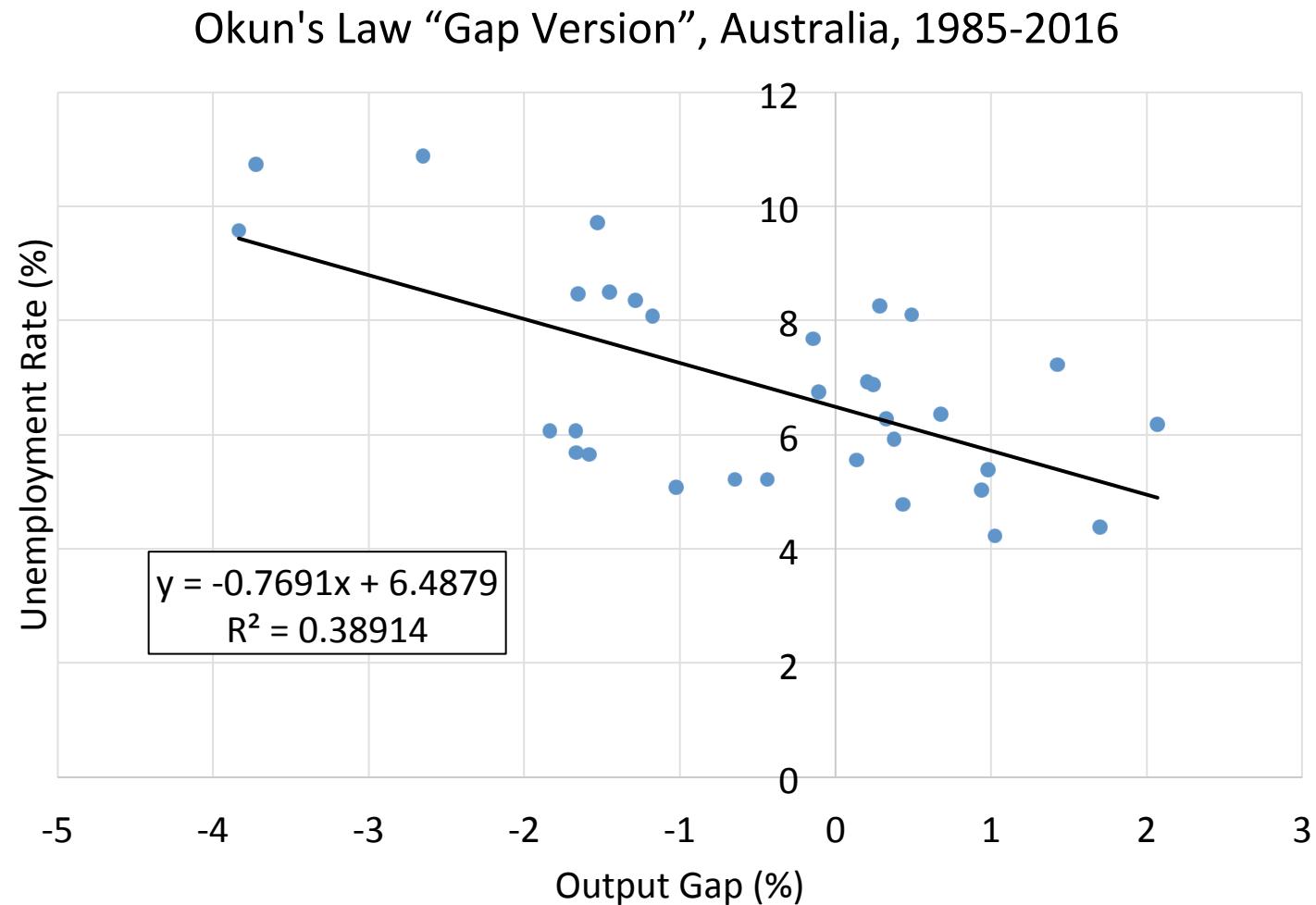
- 5.1 What is the key assumption of the basic Keynesian model?
- 5.2 What are the four components of the economy's planned aggregate expenditure?
- 5.3 What is the consumption function?
- 5.4 In what way is planned aggregate expenditure linked to aggregate output?
- 5.5 What is meant by equilibrium output?

Putting everything in context

Cyclical unemployment can happen if there is A) a fall in aggregate demand (and therefore labour demand) and B) sticky wages/prices

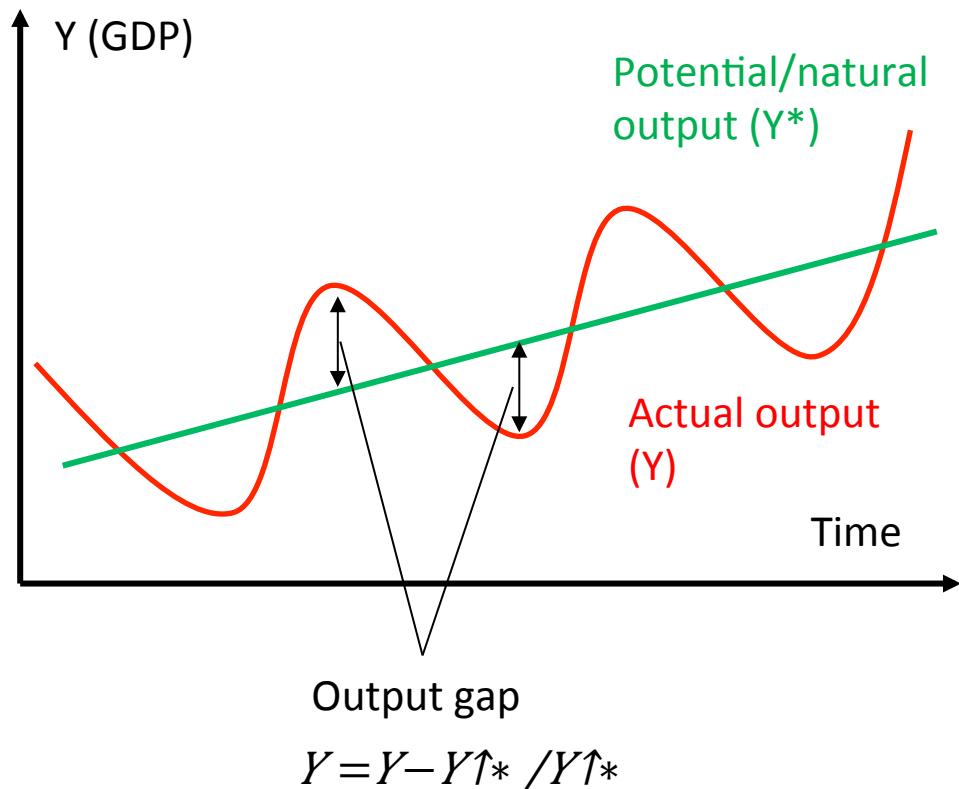


Last lecture we also learned that cyclical unemployment is just the flip side of a negative output gap (Okun's Law).



Source: OECD

A negative output gap is when “actual” is below “natural” output (and cyclical unemployment is when “actual” is below “natural” employment)



Potential/Natural Output

- Varies less than actual output
- Depends on capital stock (number of machines etc), real interest rates, population, skills, technology, natural resources
- Can jump up (new technology, discover oil) or fall (drought)
- Unemployment = natural level

Actual Output

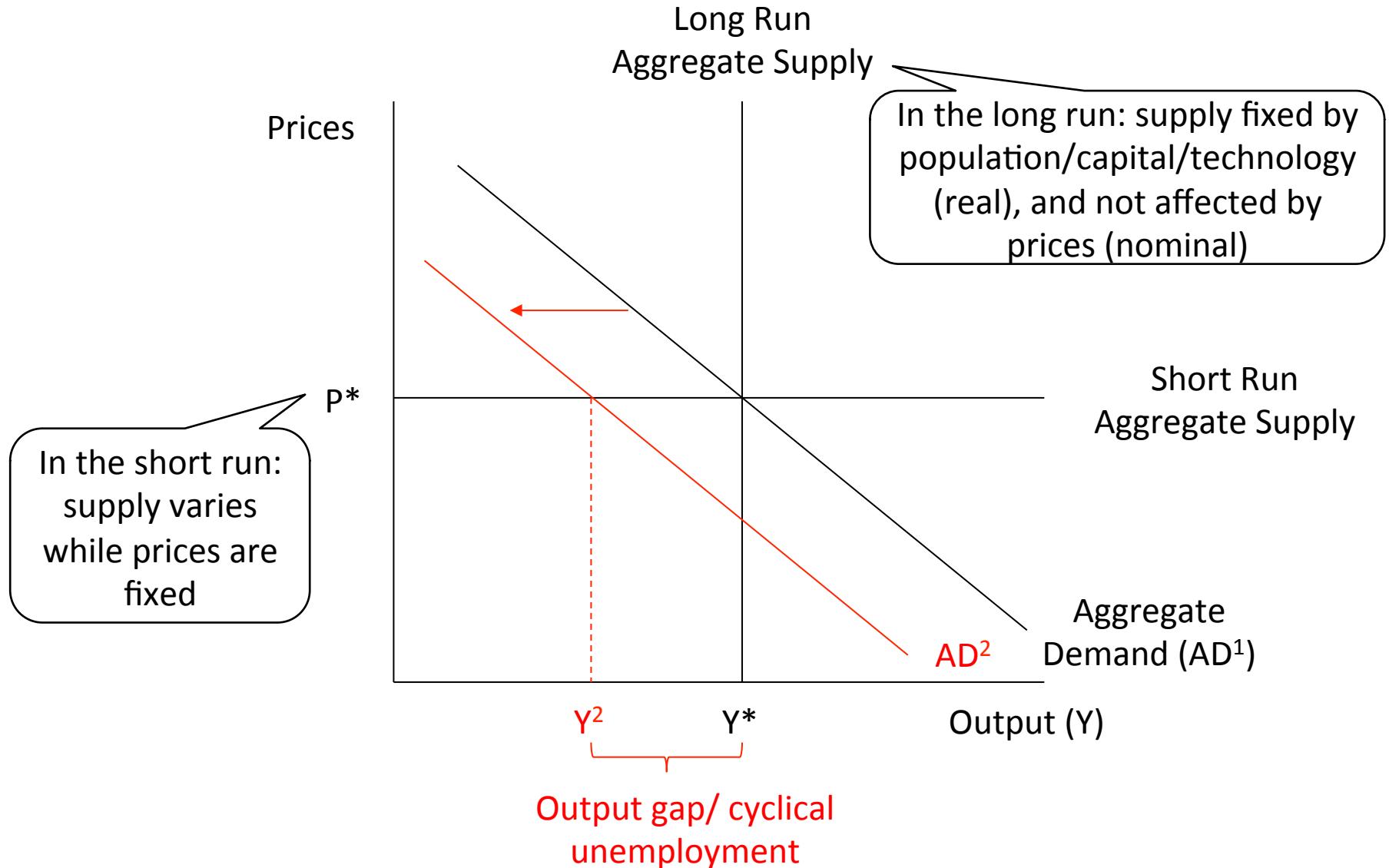
- Can be below potential output (contraction/unemployment) or above potential output (expansion/ overtime/ inflation). Both cause problems.
- Depends on nominal interest rates, aggregate demand, government spending

For the next few lectures we will think about what causes a negative output gap (and unemployment) and what can be done to fix it



Soup kitchen queue for unemployed men during the Great Depression, 1929-1939, USA.

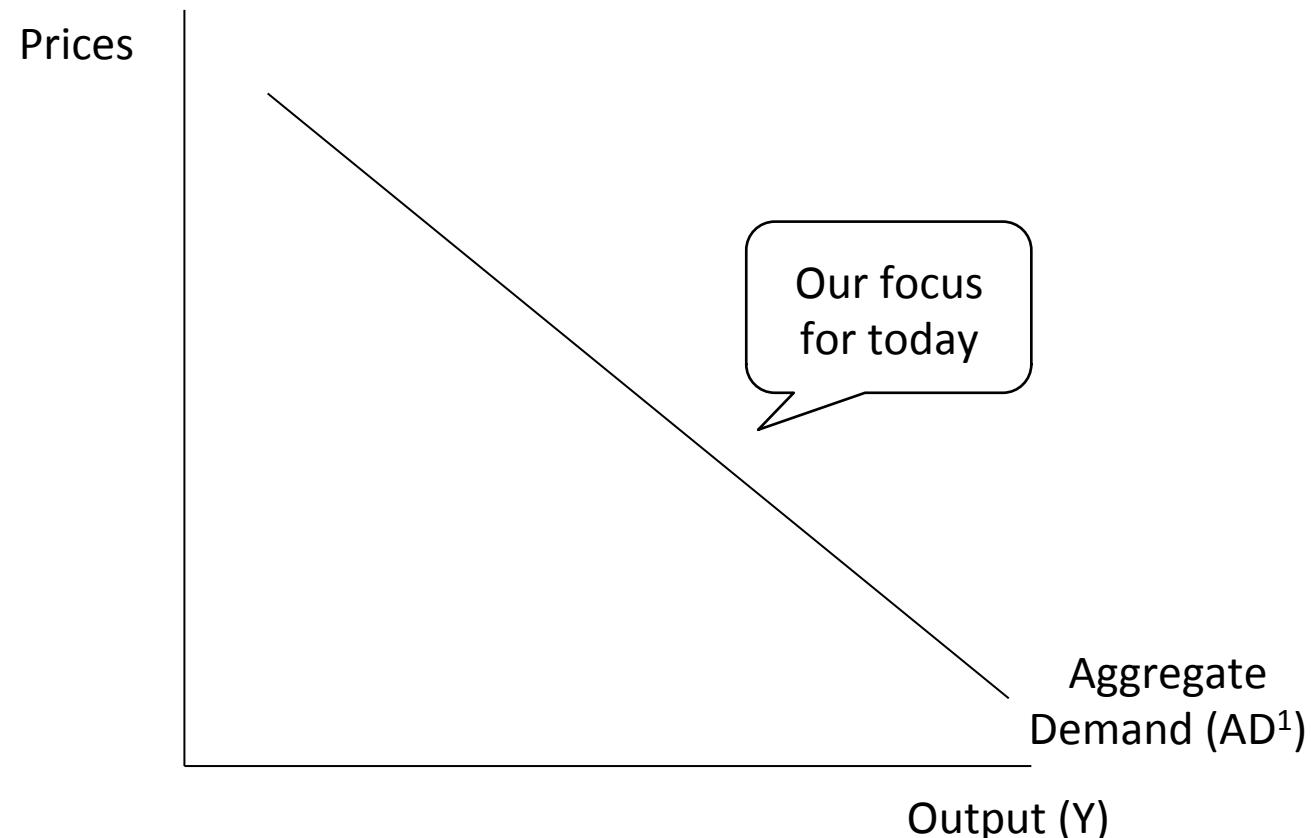
We will eventually (chapter 9) study the output gap by looking at “aggregate demand” and “aggregate supply”



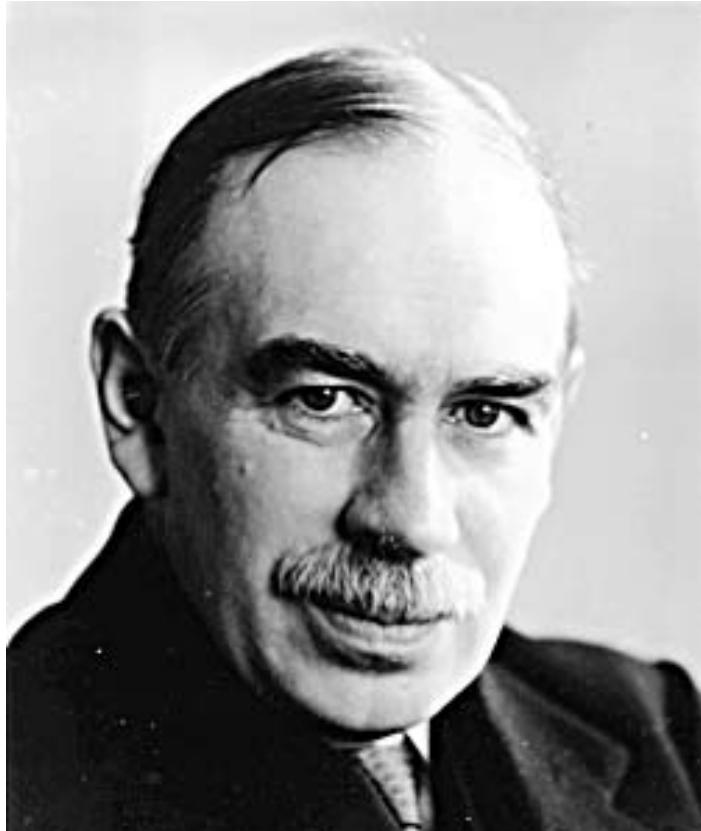
Why are prices not fully flexible?

- Price rises involve ‘menu’ costs, which are the costs involved in changing prices and informing customers of those changes.
- Firms typically set a price and meet the demand at that price for a period of time.
- Sustained changes in demand will make firms change their prices eventually, to bring production back to normal capacity.

This lecture we will “deep dive” on what causes aggregate demand (or “aggregate expenditure”) to move around.



Keynes was one of, if not, the most influential economist of the 20th Century



John Maynard Keynes, 1883-1946

Life:

- Educated: Eton and Kings College, Cambridge
- Worked: India Office, Cambridge U, UK Treasury, Advisor to UK Gov't after WWI

Key Ideas:

- Aggregate demand determines the overall level of economic activity
- Aggregate demand can fluctuate based on “confidence” and “expectations”
- Free markets therefore won’t always provide full employment in the short run
- The Gov’t policies that affect the level of spending can be used to reduce or eliminate output gaps
- The Keynesian model is only applicable to the relatively short period during which firms meet the demand at preset market prices
- “We’re all Keynesians now” – Richard Nixon/ Milton Friedman (~1970, after US left Gold Standard)

Aggregate expenditure

1. Simple model: 2 sectors

2. Simple model: alternative

3. Detailed model: 4 sectors

First, let us start from first principles using the GDP identity. This describes “actual output”, or “actual expenditure”

$$Y = C + I + G + NX$$

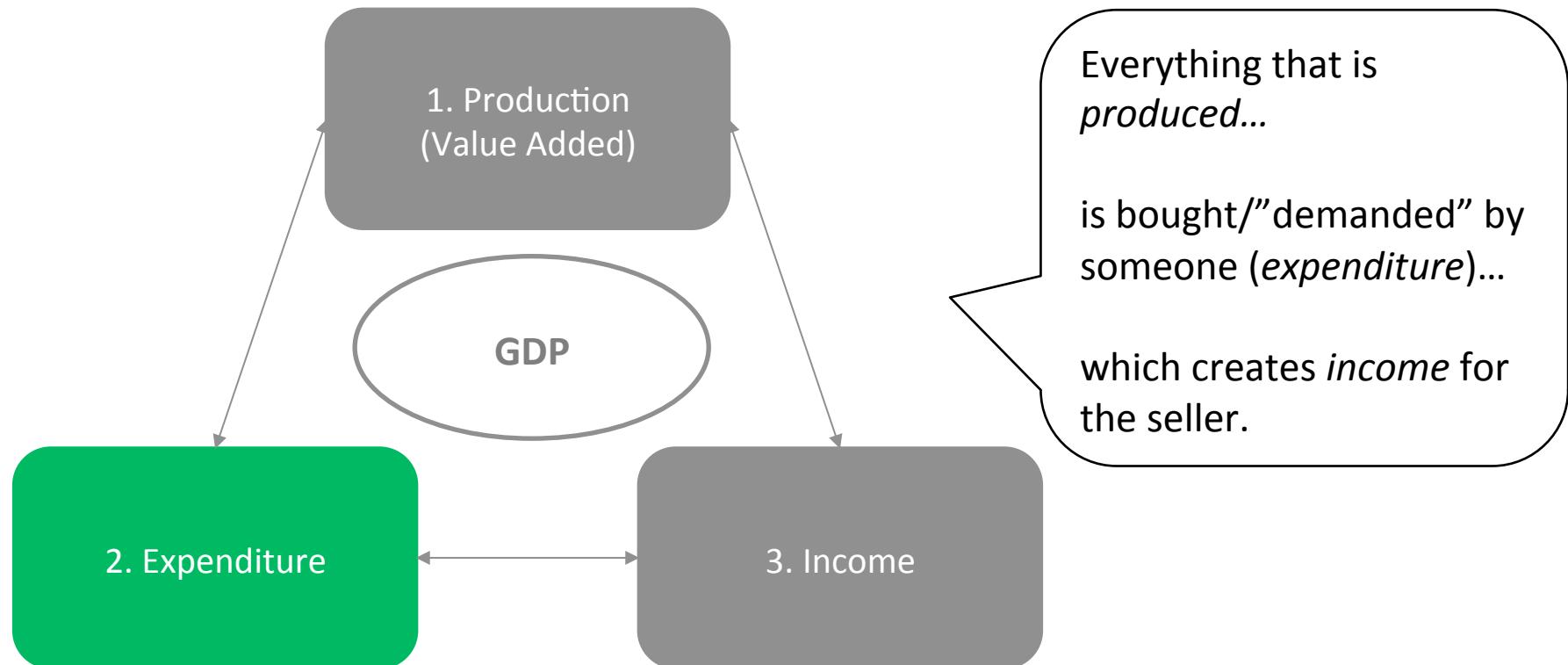
Actual GDP *Household consumption* *Investment* *Government spending* *Net Exports
(Exports – Imports)*

$(C_G + I_G)$ $(X - M)$

We are interested in aggregate demand so we will be talking about GDP from the “expenditure” perspective

The three ways of thinking about GDP

- Remember from Lecture 1: $\text{GDP} = \text{Output}/\text{Production} = \text{Expenditure} = \text{Income}$



Now, let us introduce a distinction between “actual” and “planned” aggregate expenditure/output. “Planned” is based on fixed prices.

Actual Aggregate Expenditure

$$Y = C + I + G + NX$$
$$(C_G + I_G) \quad (X - M)$$

Planned Aggregate Expenditure

$$PAE = C + I^P + G + NX$$
$$(C_G + I^P_G) \quad (X - M)$$

Planned investment
based on fixed prices

Planned versus actual expenditure

- Planned expenditure can differ from actual spending due to inventory investment.
 - Inventory refers to goods produced by firms left unsold and is part of the firm's investment.
- Some of this inventory investment may be planned, and some unplanned.
 - A firm's actual investment in inventory is comprised of planned inventory investment and unplanned inventory investment.

Actual and planned investment

- Let I^P denote the firm's planned investment including a level of planned inventory investment.

- If sales were less than expected, unsold stock remained in the warehouse, causing actual investment (I) to exceed planned investment (I^P).

$$I > I^P$$

- If sales were more than expected, there is a run-down of stocks in the warehouse, causing actual investment (I) to fall below planned investment (I^P).

$$I < I^P$$

Consumer spending and the economy

- Consumption function: $C = \underline{C} + c(Y - T)$
 - Exogenous consumption, \underline{C} , is the level of consumption independent of the income but related to wealth.
 - Induced consumption, $c(Y - T)$, is the level of extra consumption induced by extra disposable income.
 - Disposable income, $(Y - T)$, is the after-tax income.
 - The parameter, c , is marginal propensity to consume (MPC) or a measure showing how each extra dollar would be partly spent and partly saved.

A consumption function

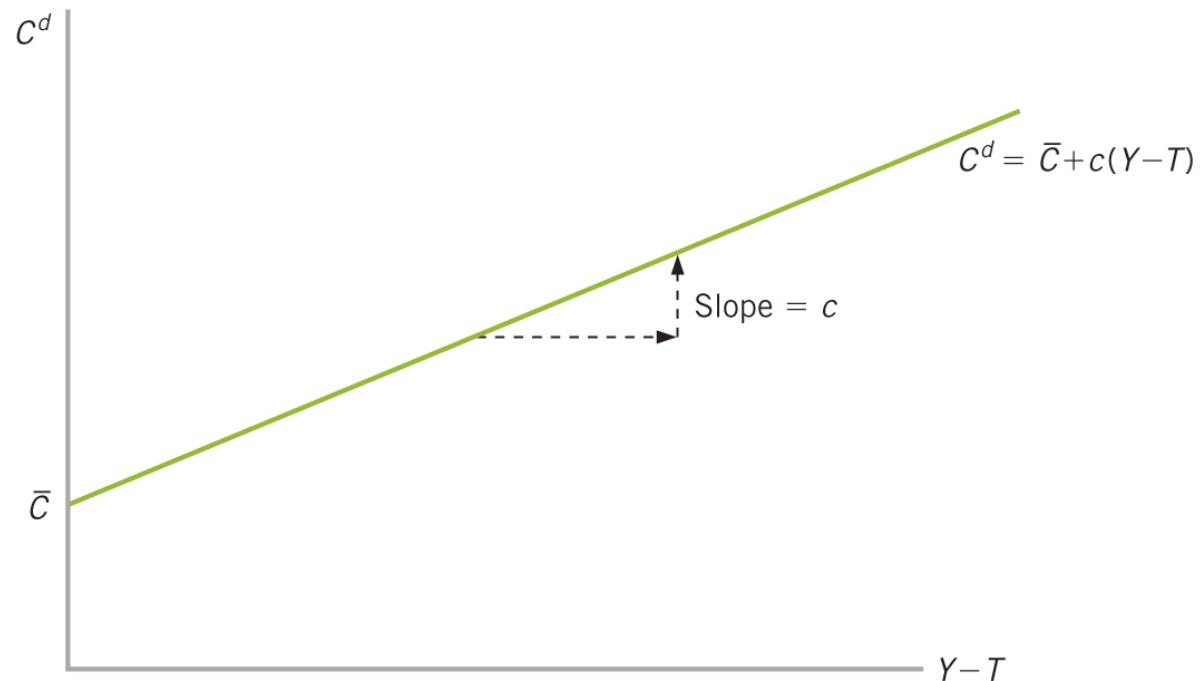


Figure 5.1 A consumption function The consumption function relates households' consumption spending, C^d , to disposable income, $Y - T$. The vertical intercept of this consumption function is the exogenous component of consumption, \bar{C} , and the slope of the line equals the marginal propensity to consume, c .

Planned aggregate expenditure and output

Example:

What is the consumption function if $\bar{C} = 620$, $c = 0.8$ and $T = 250$?

$$C = 620 + 0.8(Y - T)$$

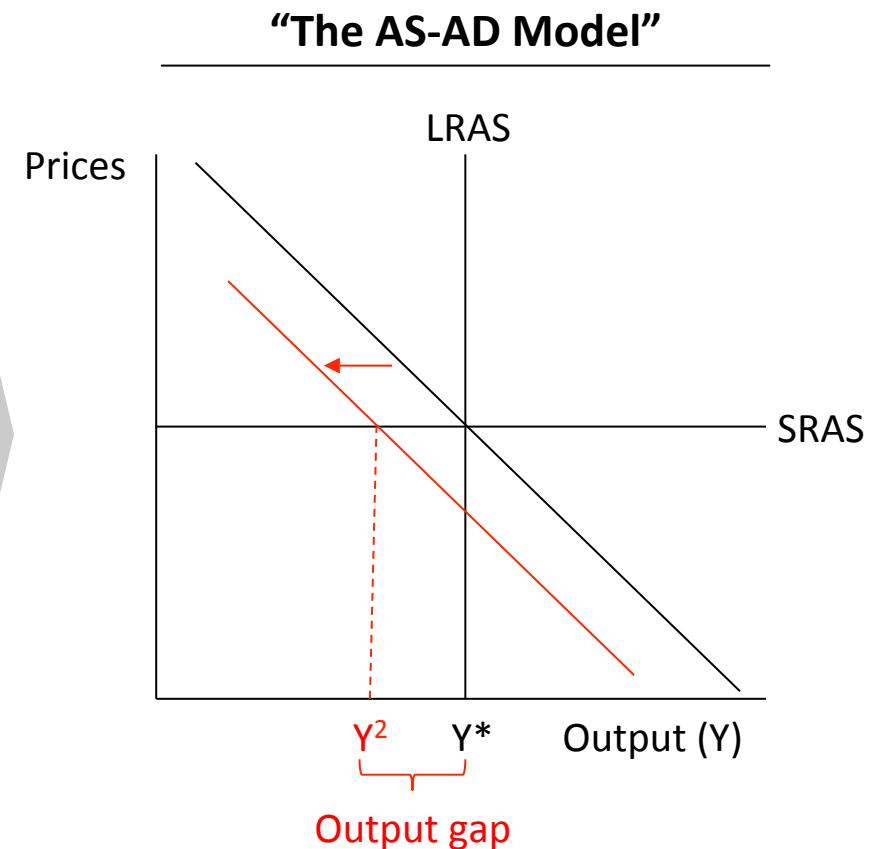
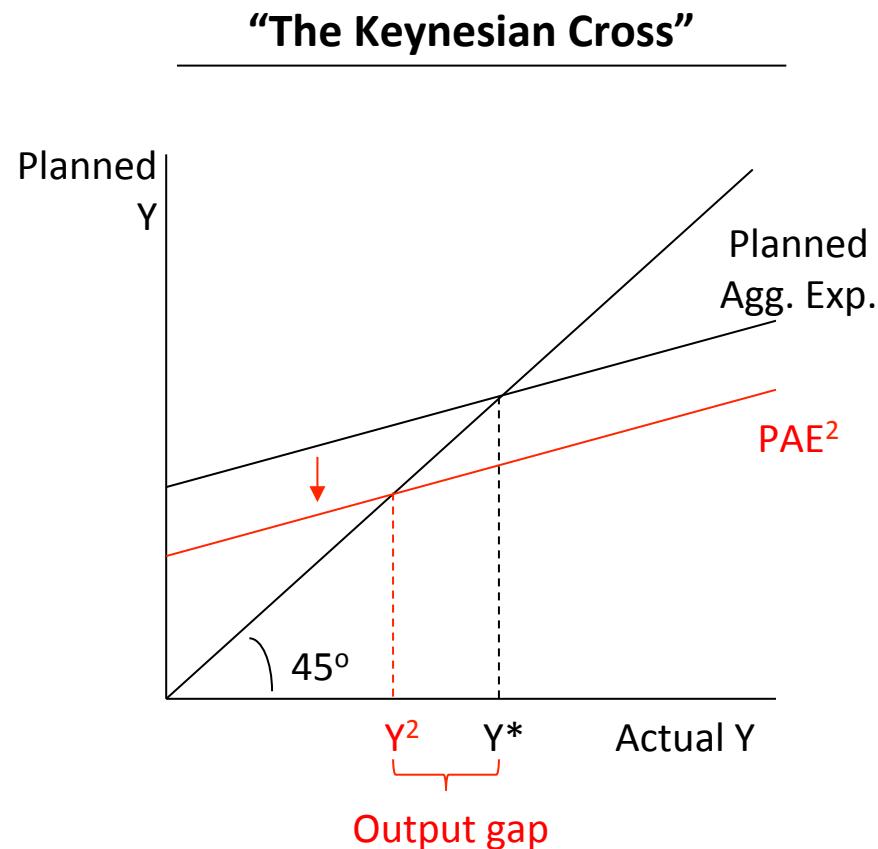
Now $I^P = 220$, $G = 300$, $X = 40$, what is the PAE function?

$$\begin{aligned} \text{PAE} &= C^d + I^P + G + X \\ &= [620 + 0.8(Y - 250)] + 220 + 300 + 40 \\ &= (620 - 200 + 220 + 300 + 20) + 0.8Y \\ &= 980 + 0.8Y \end{aligned}$$

Planned aggregate expenditure and output

- Exogenous expenditure refers to the portion of planned aggregate expenditure that is independent of output.
- Induced expenditure refers to the portion of planned aggregate expenditure that depends on output.
- Example: $PAE = 980 + 0.8Y$
 - The exogenous expenditure is 980.
 - The induced expenditure is $0.8Y$.

By the end of the lecture we will learn how to use the “Keynesian Cross” to analyse aggregate expenditure, which will feed into the AS-AD model



- The Keynesian cross studies how “planned expenditure” can differ from “actual output”, which underpins the movements in aggregate demand which cause negative output gaps (“recessions”)

In the short run, prices are slow to adjust. Technology may help, but it is difficult for businesses to know when prices should change.

Prices are slow to adjust...



Technology may help, but won't solve the problem.



A screenshot of an eBay search results page for 'iPhone 7'. The search bar at the top shows 'iPhone 7'. The left sidebar has filters for 'Categories' (Phones & Accessories, Mobile Phones), 'Format' (All listings, Auction, Buy It Now), 'Lock Status' (Factory Unlocked, Network Unlocked, Not specified), 'Model' (iPhone 7, iPhone 7 Plus, Not specified), and 'Colour' (Silver). The main search results show two items: 'GRADE A Apple iPhone 7 PLUS | 256GB | Silver | Unlocked | in Box' for AU \$1,099.99 and 'Apple iPhone 7 BRAND NEW SEALED - 32GB - Silver Smartphone' for AU \$998.00. Both items have 'Buy It Now' options and show the number of watchers.

Aggregate expenditure

1. Simple model: 2 sectors

2. Simple model: alternative

3. Detailed model: 4 sectors

For simplicity let's assume that it is a closed economy with no government (for now)

Four sectors

$$PAE = C + I^P + G + NX$$

Two sectors

$$PAE = C + I^P$$

Consumption

Households will consume a fixed amount (basic living expenses) and then a share of whatever else is produced. T=0

*Actual output/
income/expenditure*

$$\bar{C} = \bar{C} + cY$$

*Baseline
consumption
(planned)*

*Marginal propensity
to consume*

Planned Investment

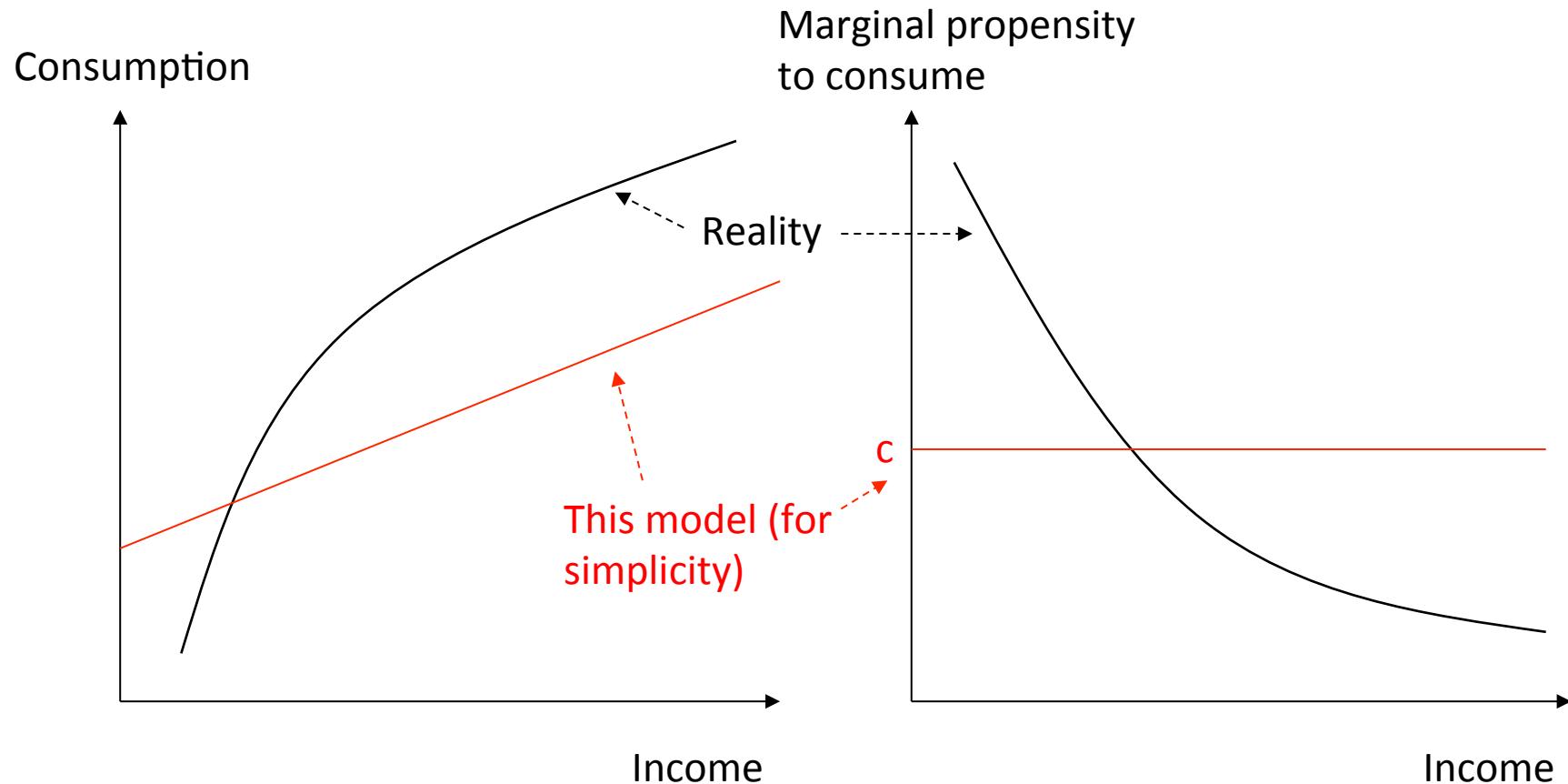
Planned investment will be based on existing (fixed) prices, and interest rates

If actual output is higher than planned expenditure, then firms will build up ("invest in") inventories more than planned, and vice versa (see upcoming diagram).

$$Y > PAE \rightarrow I > I^P$$

$$Y < PAE \rightarrow I < I^P$$

An aside: in practice the marginal propensity to consume falls with income



This is a good reason for redistributing income from the rich to the poor: it stimulates the economy because they will spend it.

Savings in the two-sector model

- In a two-sector model the savings function can be derived from the consumption function:

$$\begin{aligned} S &= Y - C \\ &= Y - (\bar{C} + cY) \\ &= Y - \bar{C} - cY \\ &= -\bar{C} + (1 - c)Y \end{aligned}$$

- The intercepts of \bar{C} and $-\bar{C}$ can be thought of like this: if no income was being earned in the economy, a certain level of consumption, C , would occur, funded through running down savings.

Two-sector consumption and savings functions

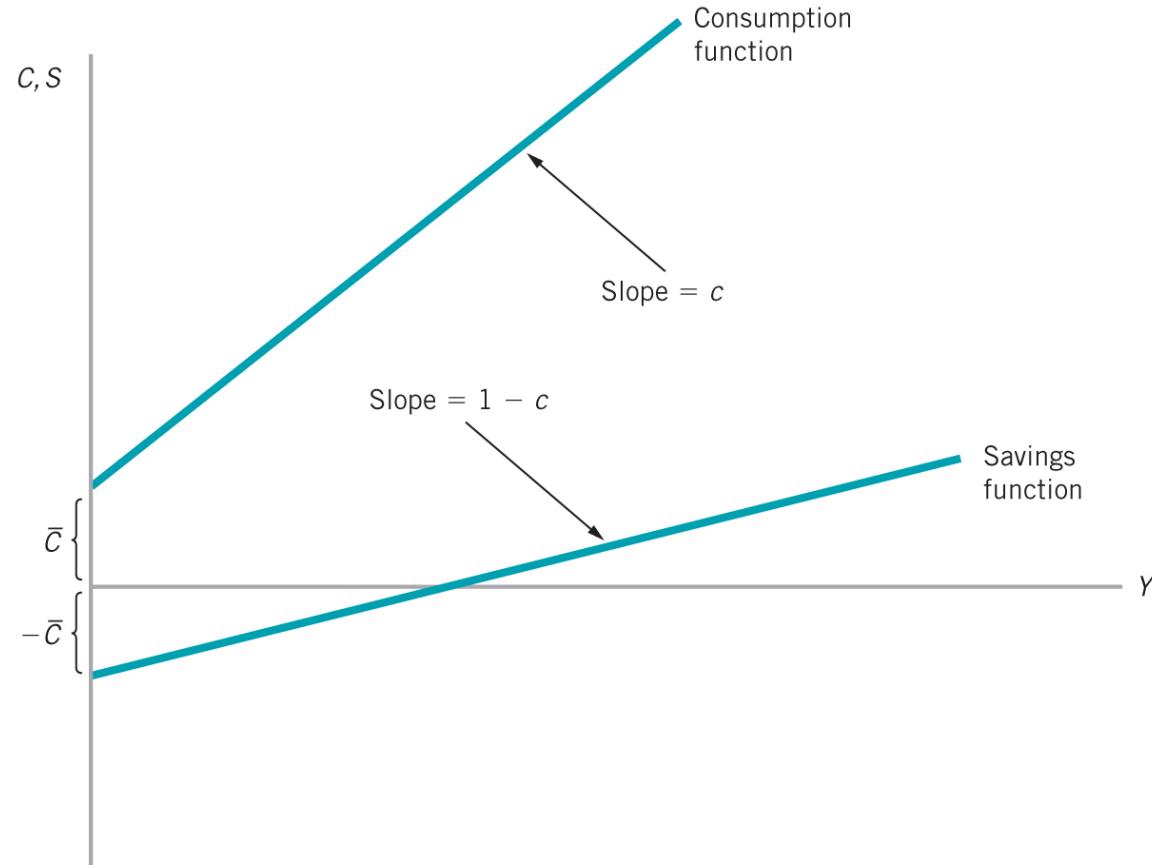


Figure 5.3 **The two-sector consumption and saving functions** In the two-sector model, consumption and saving depend on GDP.

The 45-degree diagram

- The 45-degree diagram, or Keynesian cross diagram, is a diagrammatic representation of the economy over the short run (the period in which prices do not adjust in response to demand), enabling the identification of the equilibrium level of GDP.
 - The 45-degree line marks equal distances along the axis for GDP and the axis for PAE.
- The point where a given PAE line cuts the 45-degree line represents $Y = PAE$.
 - At this point, planned expenditure is equal to actual expenditure; there is no reason to increase or decrease the level of production.

The 45-degree line

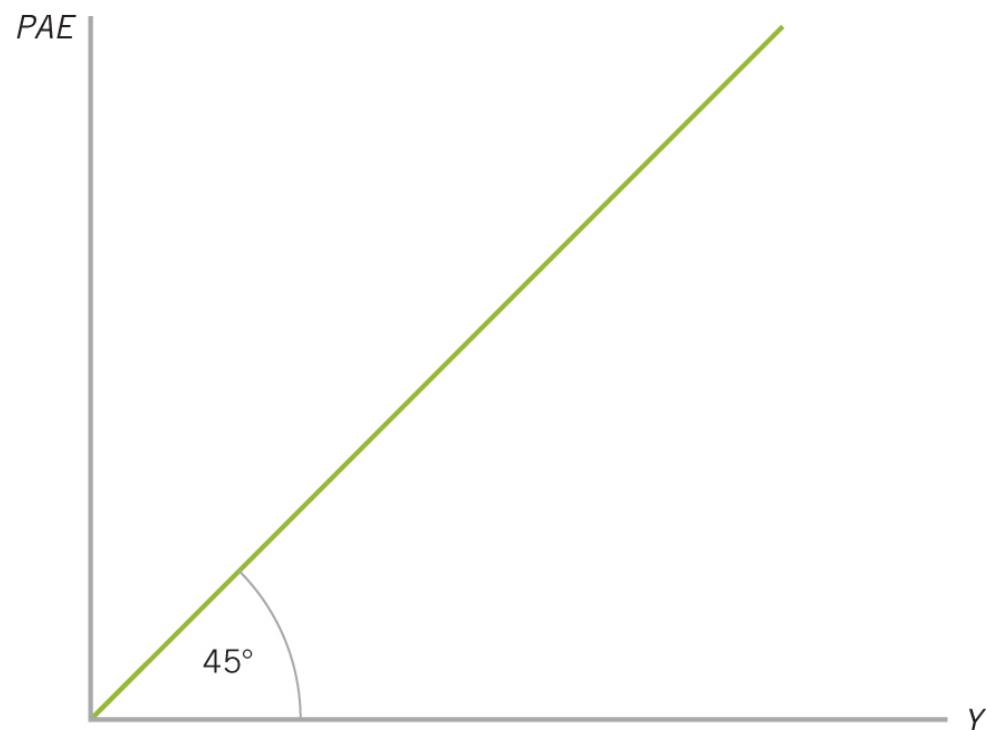


Figure 5.5 The 45-degree line The 45-degree line traces all the economy's points of equilibrium where planned aggregate expenditure equals GDP.

The components of PAE (two-sector economy)

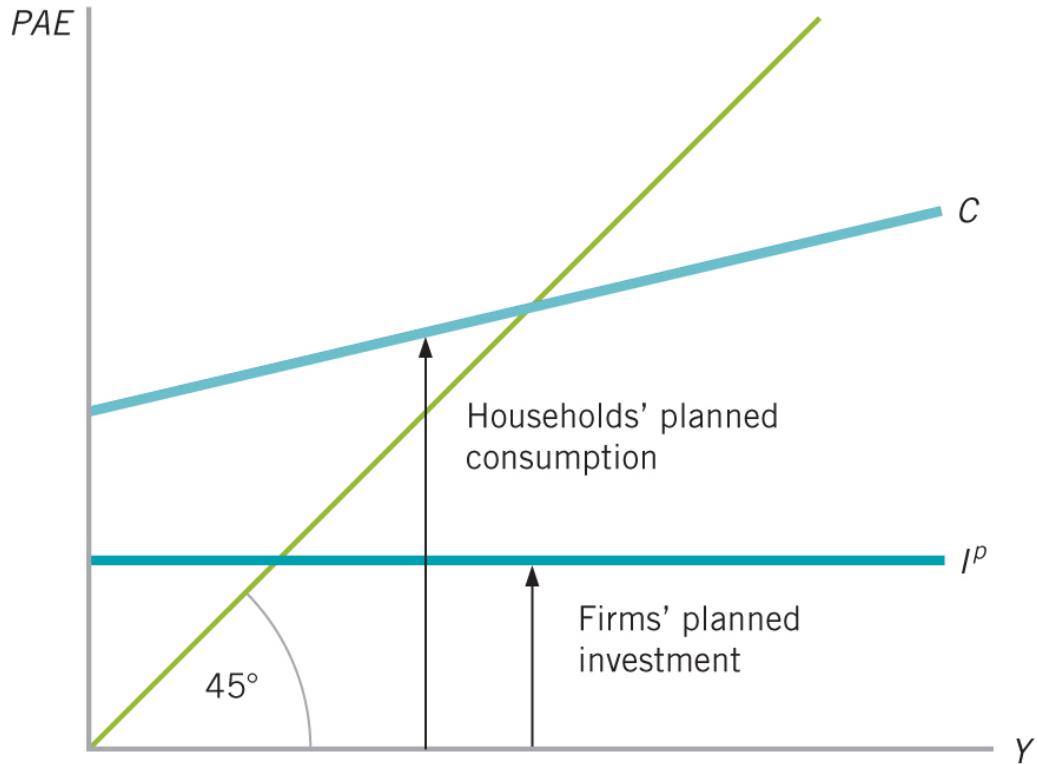
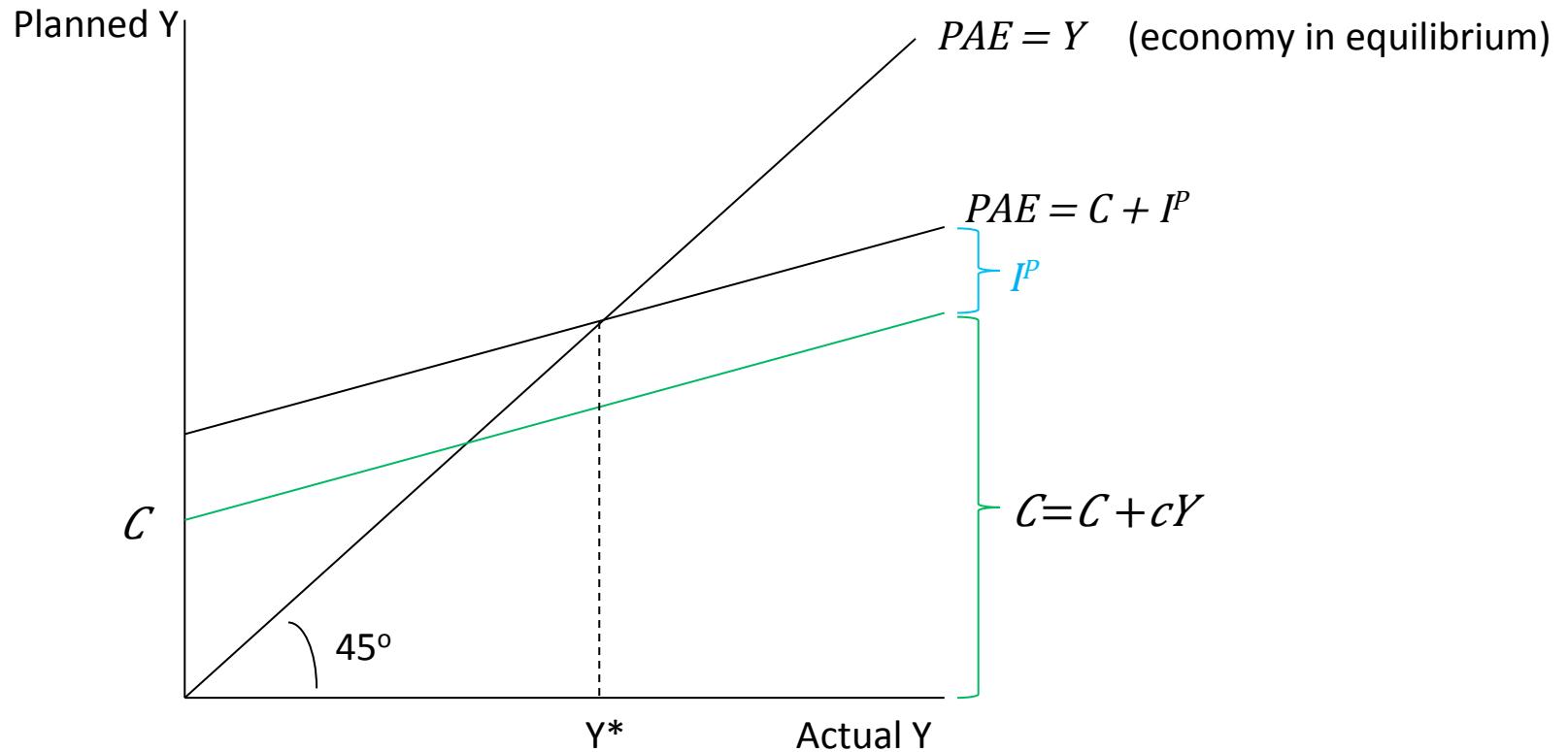


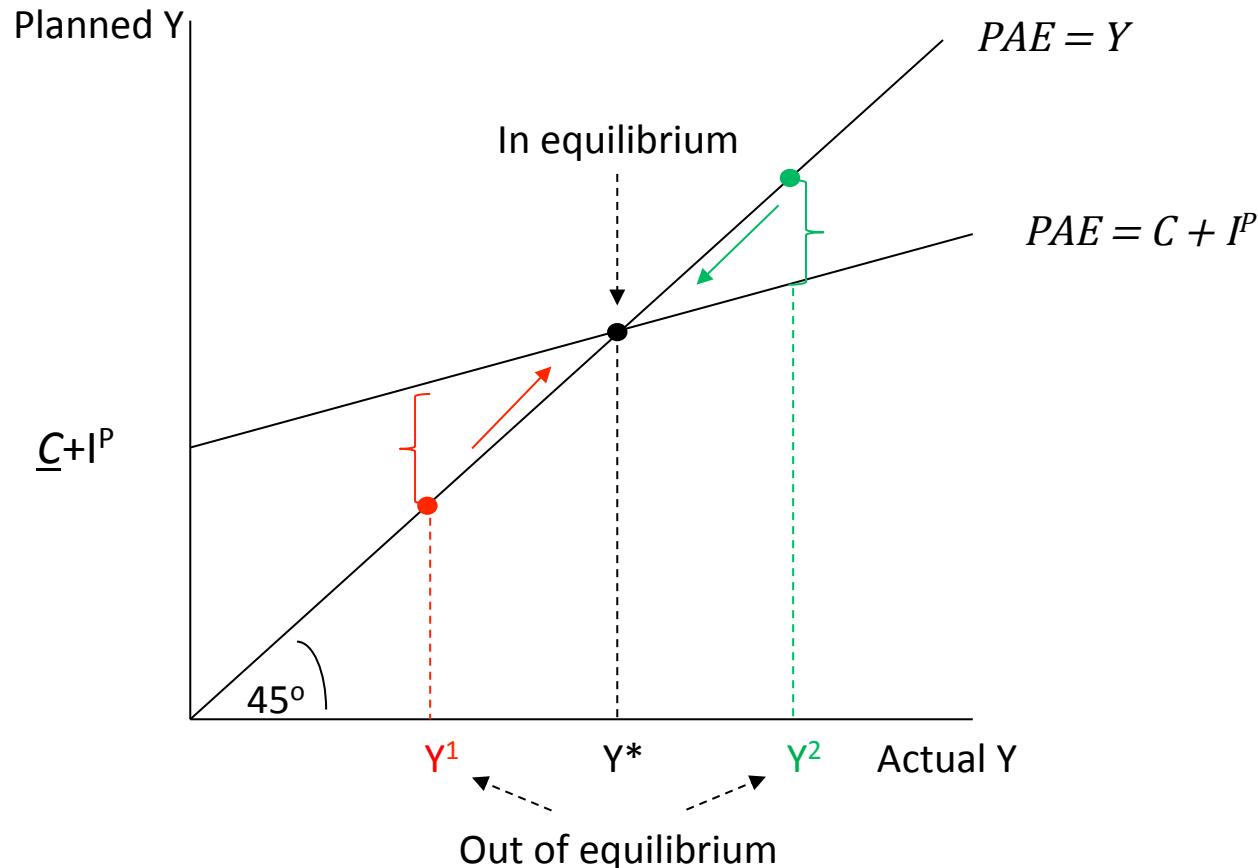
Figure 5.6 The components of PAE (two-sector economy) In the two-sector economy, PAE consists of households' consumption expenditure and firms' investment expenditure.

In this case planned expenditure is just consumption plus planned investment, which can be expressed on the Keynesian Cross



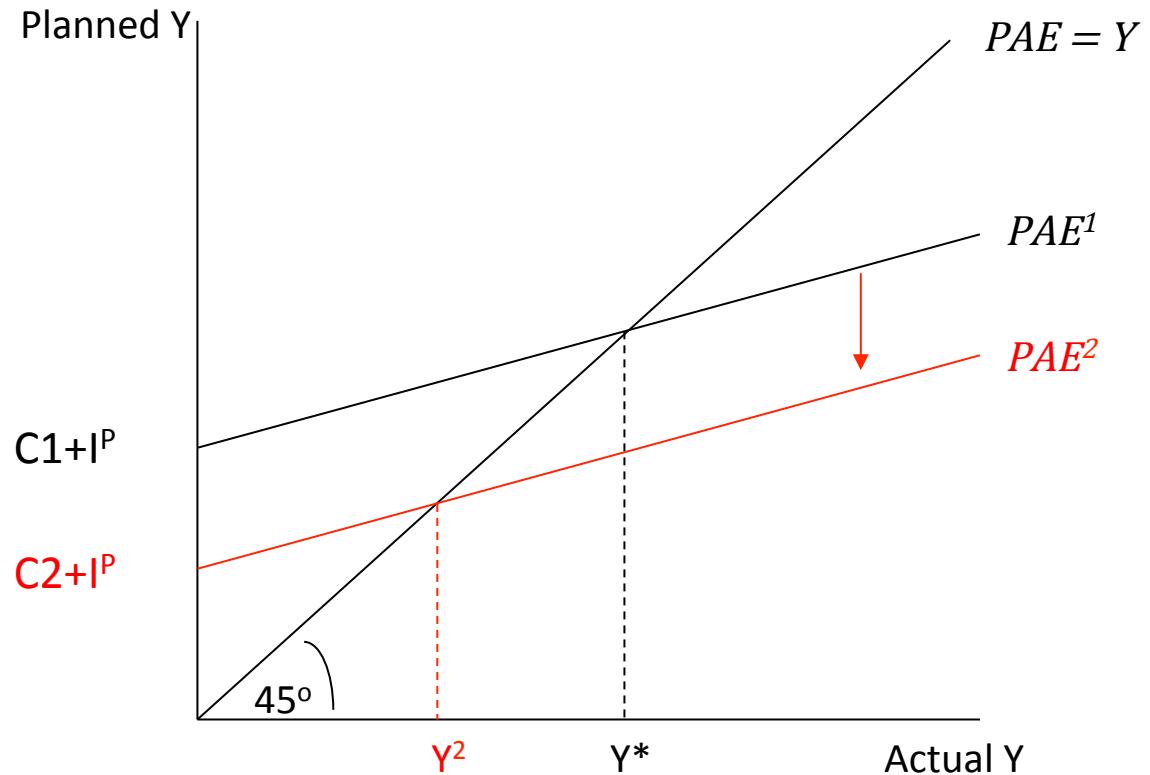
C and I^P are “exogenous” variables (pre-determined outside the model)
 C is an “endogenous” variable (determined within the model)

If actual output is above planned output, firms will accumulate inventories (investment), until the economy is in equilibrium again.

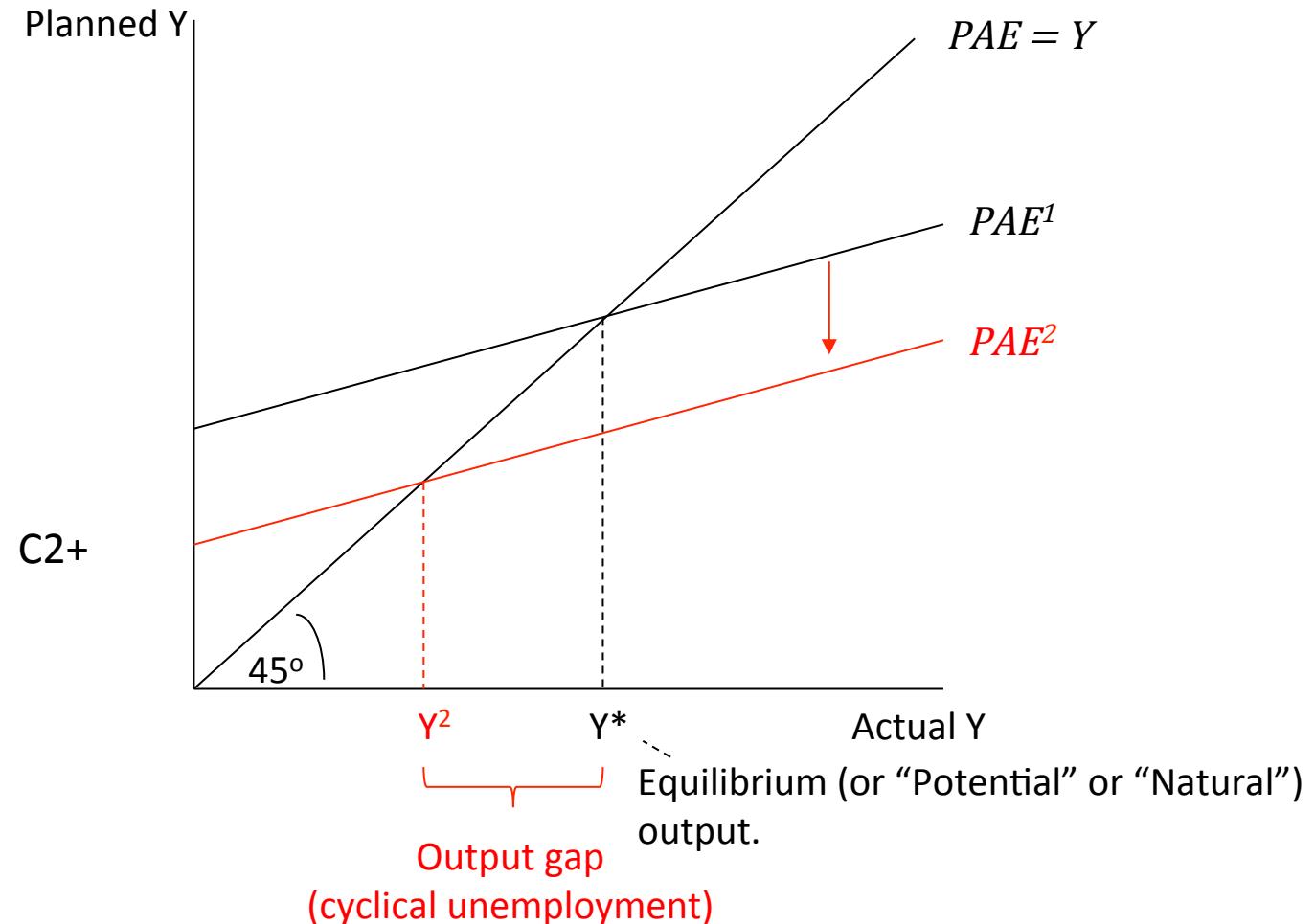


- If $Y > PAE$: firms produce more than was planned. The extra output will be stored in inventories, which counts as higher-than-planned investment, $I > I^P$. Firms will therefore produce less, providing less income to households, so they consume less (C falls), until the economy is back in equilibrium.
- If $Y < PAE$: firms produce less than was planned. The opposite happens.

Planned expenditure might fall because interest rates rise (I^P), house prices/household wealth falls (C), or consumer confidence falls (C).



As prices are sticky, a collapse in planned expenditure creates a contraction (and unemployment)



The effect on output is larger than the initial fall in consumption, because of the Keynesian Multiplier

The Keynesian Multiplier

A fall in exogenous consumption of A causes a larger fall in aggregate output B, because it also reduces household income (Y), which in turn reduces endogenous consumption:

$$PAE = C + cY + I^P$$

Along the 45° line:

$$PAE = Y$$

Therefore:

$$Y = C + cY + I^P$$

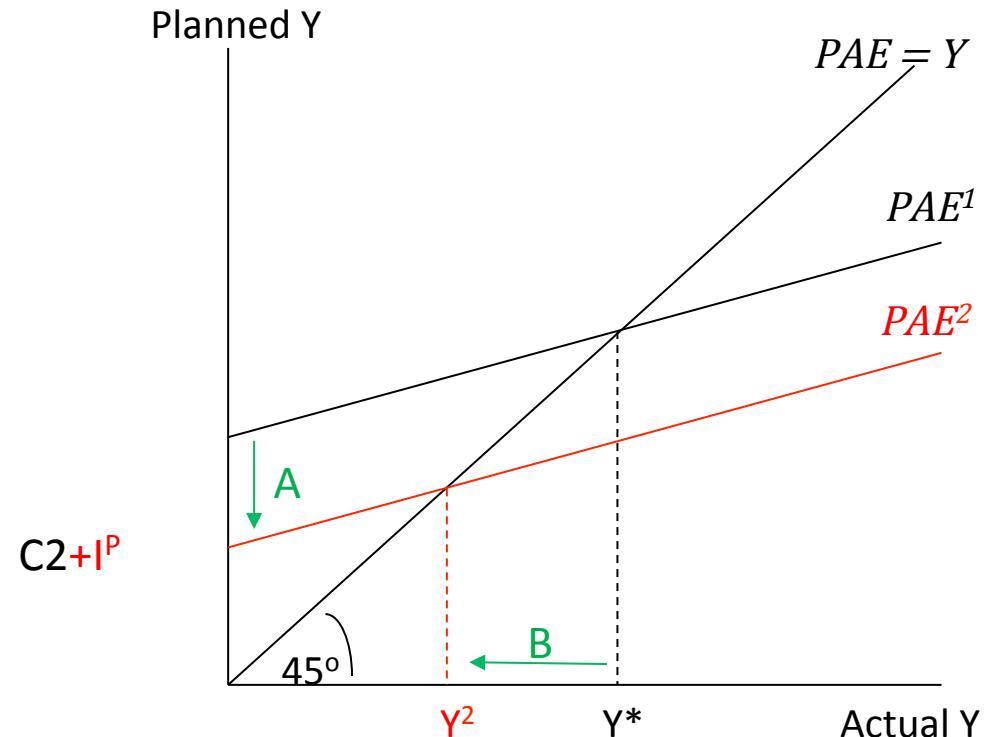
$$(1-c)Y = C + I^P$$

$$Y = \frac{1}{(1-c)} (C + I^P)$$



Multiplier (> 1)

Illustration



$B > A$

The multiplier process works over time: each year a proportion of income is spent (MPC), which becomes income for the next period

The multiplier process, 2 sector example, MPC = 0.8

Period	Current Y	Cumulative Y
1	1	1
2	$(0.8)^1 = 0.8$	1.8
3	$(0.8)^2 = 0.64$	2.44
4	$(0.8)^3 = 0.512$	2.952
5	$(0.8)^4 = 0.4096$	3.3616
...

$$1 + 0.8 + (0.8)^2 + (0.8)^3 + \dots = \frac{1}{1 - 0.8} = 5$$

If everyone spontaneously (exogenously) starts saving, output will contract, so total savings won't change (Keynes' "Paradox of Thrift")

The Paradox of Thrift

Savings is income that isn't consumed:

$$S = Y - C$$

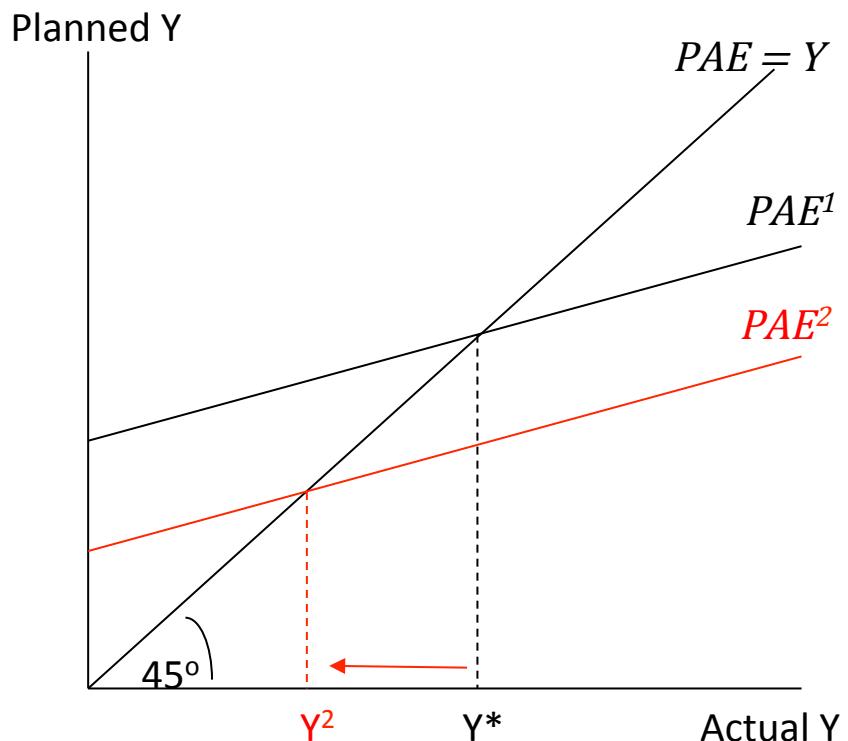
However, income is just consumption plus investment:

$$Y = C + I^P$$

Therefore, in this closed economy savings must equal investment:

If C falls, both output (Y) and consumption (C) fall by the same amount, so aggregate savings doesn't change because I^P doesn't change.

Illustration



Aggregate expenditure

1. Simple model: 2 sectors

2. Simple model: alternative

3. Detailed model: 4 sectors

We can also express exactly the same ideas in a different way, in terms of withdrawals (e.g. savings) and injections (e.g. investment) of expenditure

Planned Aggregate Expenditure

$$PAE = C + I^P$$

$$S^P = PAE - C$$

$$W^P = I^P \quad \text{Injections (Planned)}$$

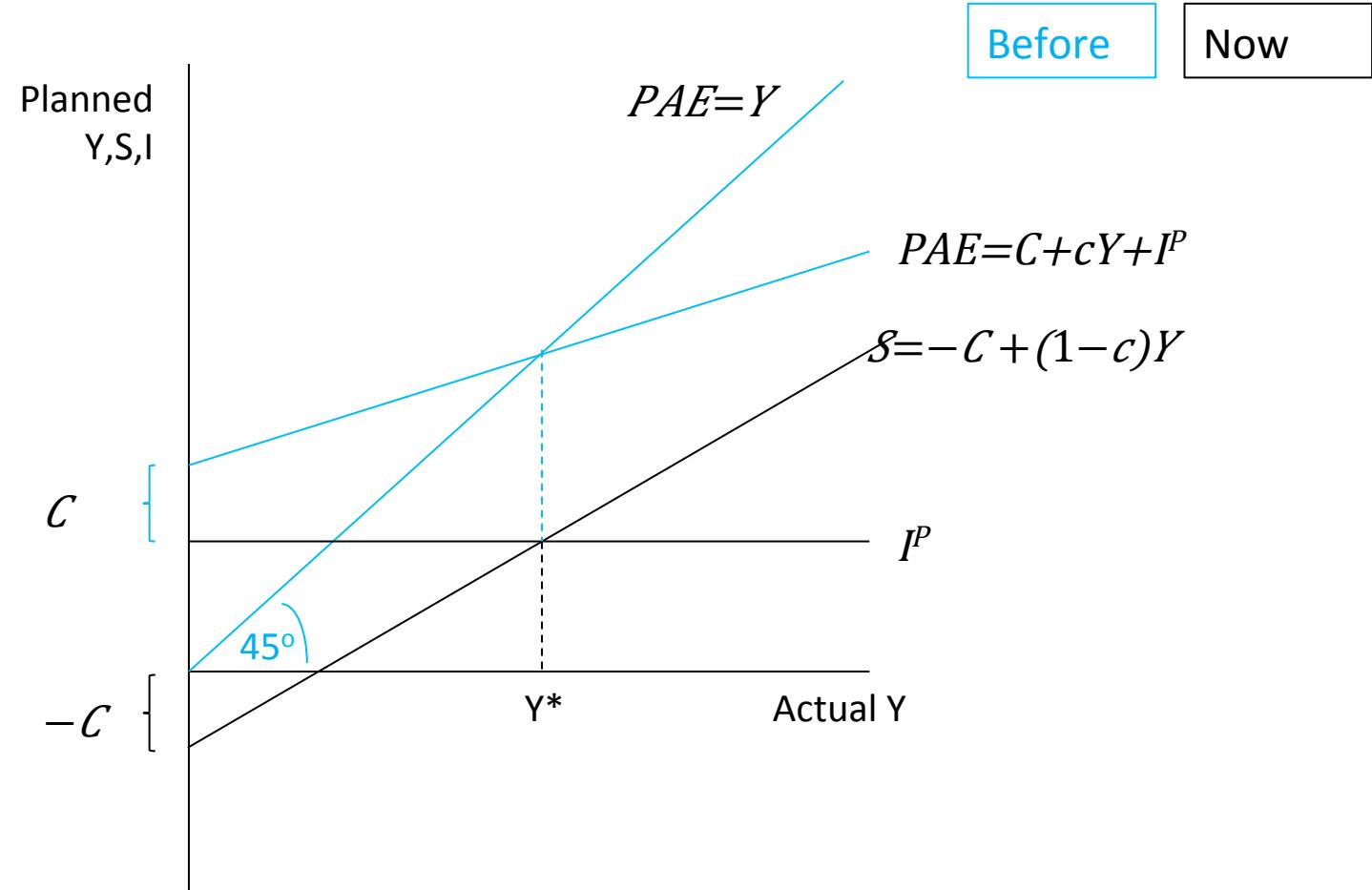
Actual Aggregate Expenditure

$$Y = C + I^P$$

$$S = Y - C$$

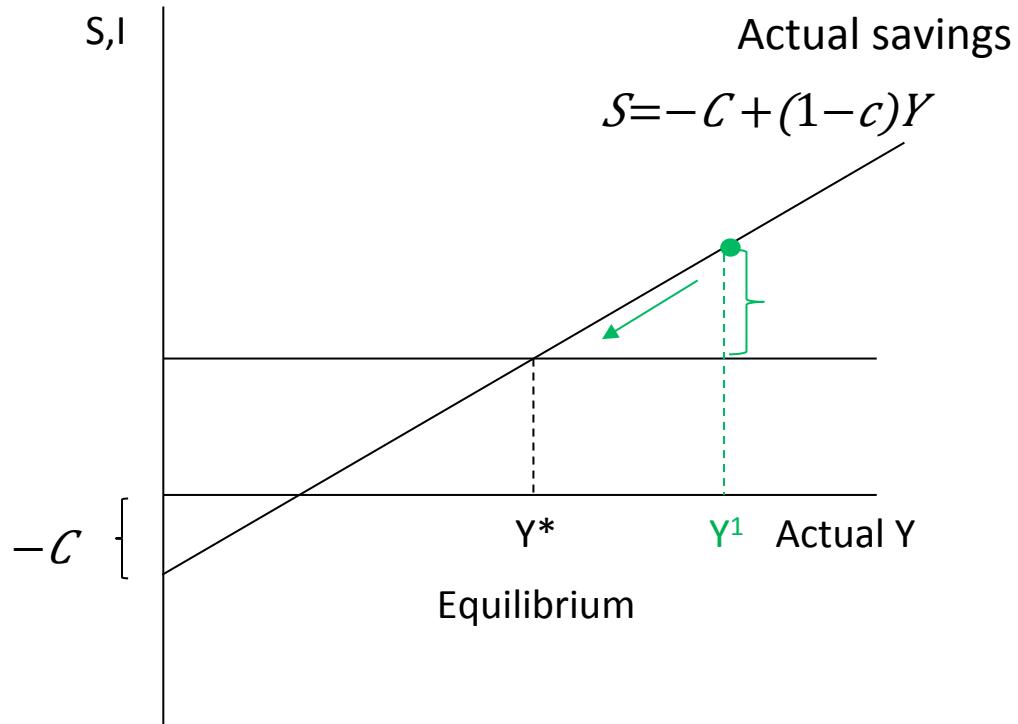
$$W = I \quad \text{Injections (Actual)}$$

The Keynesian Cross can also be expressed in terms of savings and investment



The economy is in equilibrium when $Y = PAE$, or when withdrawals = injections. Otherwise the economy is out of equilibrium.

Illustration



Explanation

If $Y > PAE$, output is above equilibrium:

- More is produced than planned
- Extra output will be accumulated in inventories
- S and $I > I^P$
- Withdrawals $>$ Injections
- Output will fall back to equilibrium

...Exactly the same as before.

The economy's equilibrium (two-sector economy)

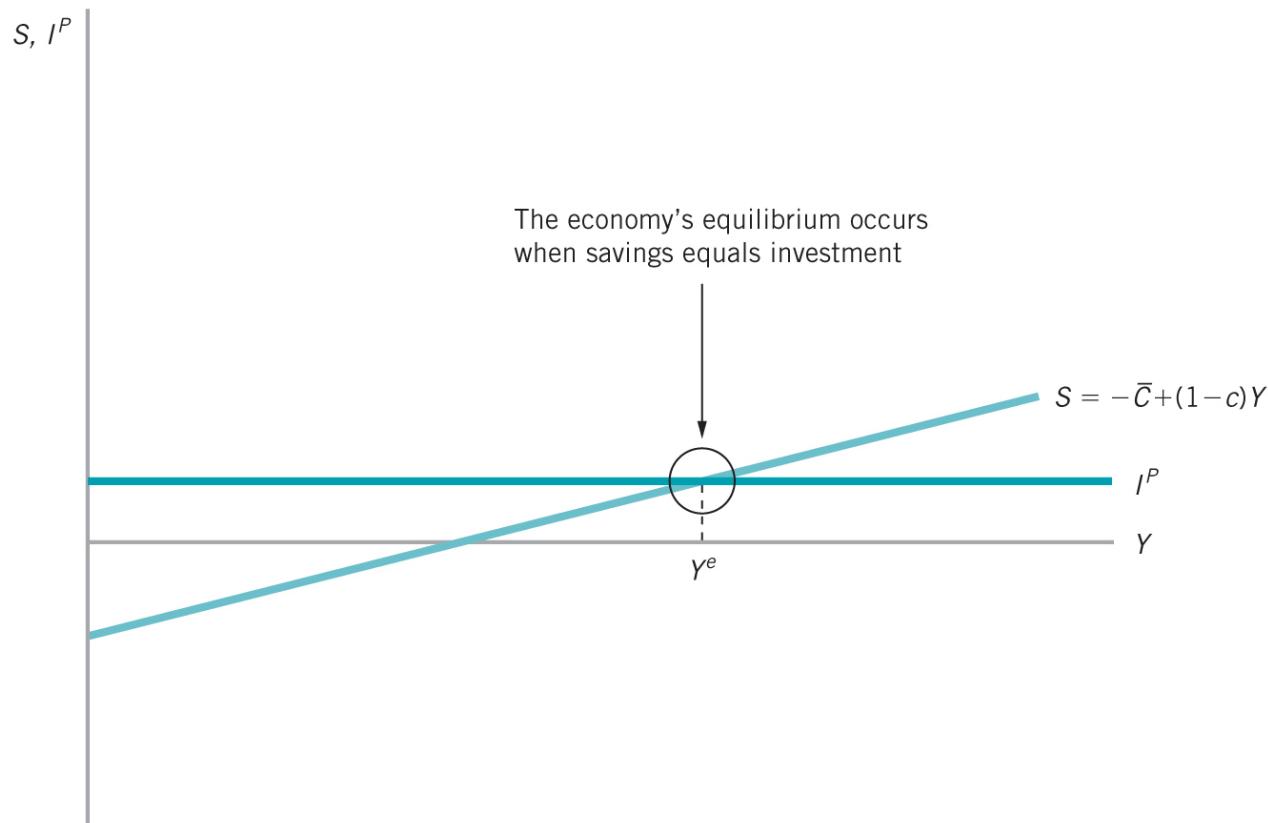


Figure 5.8 The economy's equilibrium (two-sector economy) The economy will be in equilibrium when savings equals investment. The level of GDP associated with this equilibrium is Y^e .

The economy's equilibrium (two-sector economy)

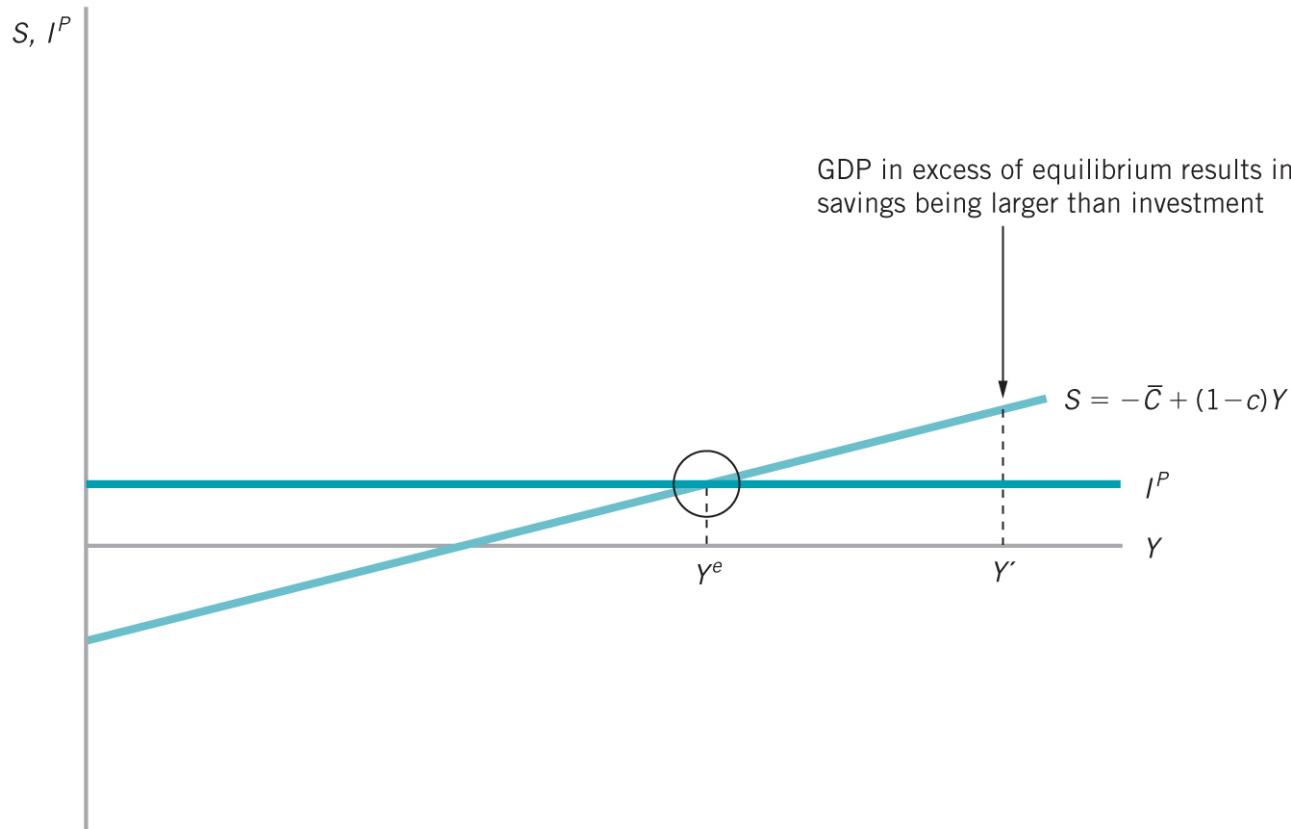


Figure 5.9 The economy out of equilibrium (two-sector economy) The economy will be in equilibrium when savings equals investment. However, here we have disequilibrium, where savings are larger than investment.

continued

The economy out of equilibrium (two-sector economy)

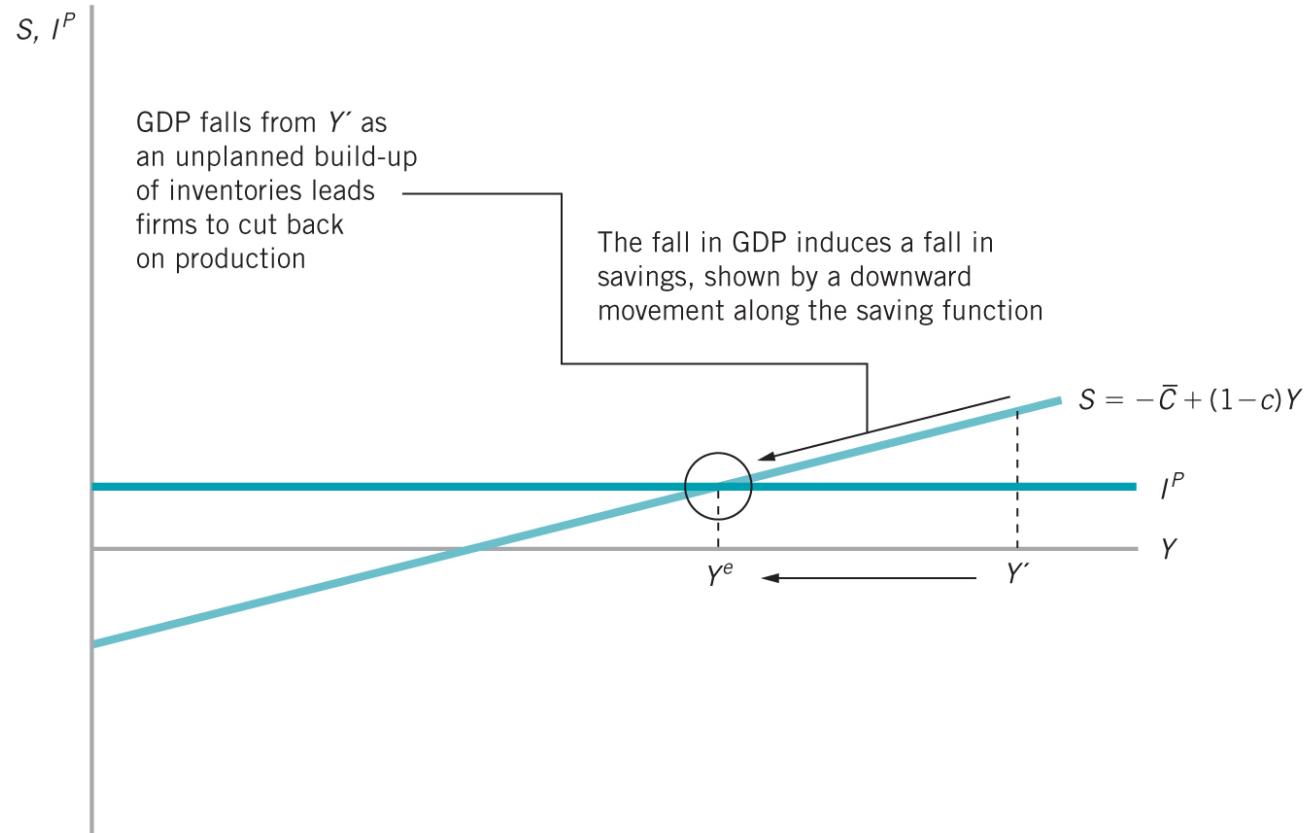


Figure 5.10 The economy out of equilibrium (two-sector economy) The economy will be in equilibrium when savings equals investment. To get to this point, when actual GDP is larger than the GDP associated with equilibrium, firms respond to a build-up of unsold inventory by cutting back on production.

Aggregate expenditure

1. Simple model: 2 sectors

2. Simple model: alternative

3. Detailed model: 4 sectors

Now, we return to the GDP identity and include government spending (G) and net exports (NX=X-M)

Actual Aggregate Expenditure

$$Y = C + I + G + NX$$
$$(C_G + I_G) \quad (X - M)$$

Planned Aggregate Expenditure

$$PAE = C + I^P + G + NX$$
$$(C_G + I^P_G) \quad (X - M)$$

Planned investment based on fixed prices

The 4-sector model can also be rearranged in terms of “withdrawals” and “injections” of expenditure in the economy

Actual Aggregate Expenditure

Let us assume investment is fixed, $I = I^P$, and the govt only consumes, $G = C_G$, $I_G = 0$.

GDP identity:

$$Y = C + I^P + G + X - M$$

Define total savings (Actual):

$$S = Y - C - G$$

Introduce taxes:

$$S = (Y - C - T) + (T - G)$$

Split into private and gov't savings:

$$S = S_P + S_G$$

Rearrange GDP identity:

$$Y - C - G + M = I^P + X$$

Substitute savings into GDP identity:

$$S_P + S_G + M = I^P + X$$

Withdrawals *Injections*

Note: The textbook (equation 5.11) writes it as $S + T + M = I^P + G + X$, and by “ S ” means private savings (S_P in these lecture notes):

Injections and withdrawals

- For equilibrium to occur, any injections of expenditure into the economy are exactly matched by any withdrawal of expenditure from the economy.
 - Injections (INJ^P) refer to all sources of exogenous expenditure in the economy.
 - Withdrawals (WD) refer to that part of income not used for consumption purposes.
- The economy's national income which can be equivalently measured using the production, expenditure or income approaches.
- Short-run equilibrium output:

$$INJ^P = WD$$

$$I^P + G + X = S + T + M \text{ or } I^P + X = S_p + S_G + M$$

To model aggregate expenditure we will now incorporate endogenous taxes into the model

GDP identity:

$$Y = C + I^P + G + X - M$$

Let us define domestic consumption, C^d , as consumption of things produced in Australia

Aggregate consumption equals domestic consumption plus imports:

$$C = C^d + M$$

Substitute into GDP identity:

$$Y = C^d + I^P + G + X$$

Let us assume C^d depends on after-tax income:

$$C^d = C + c(Y - T)$$

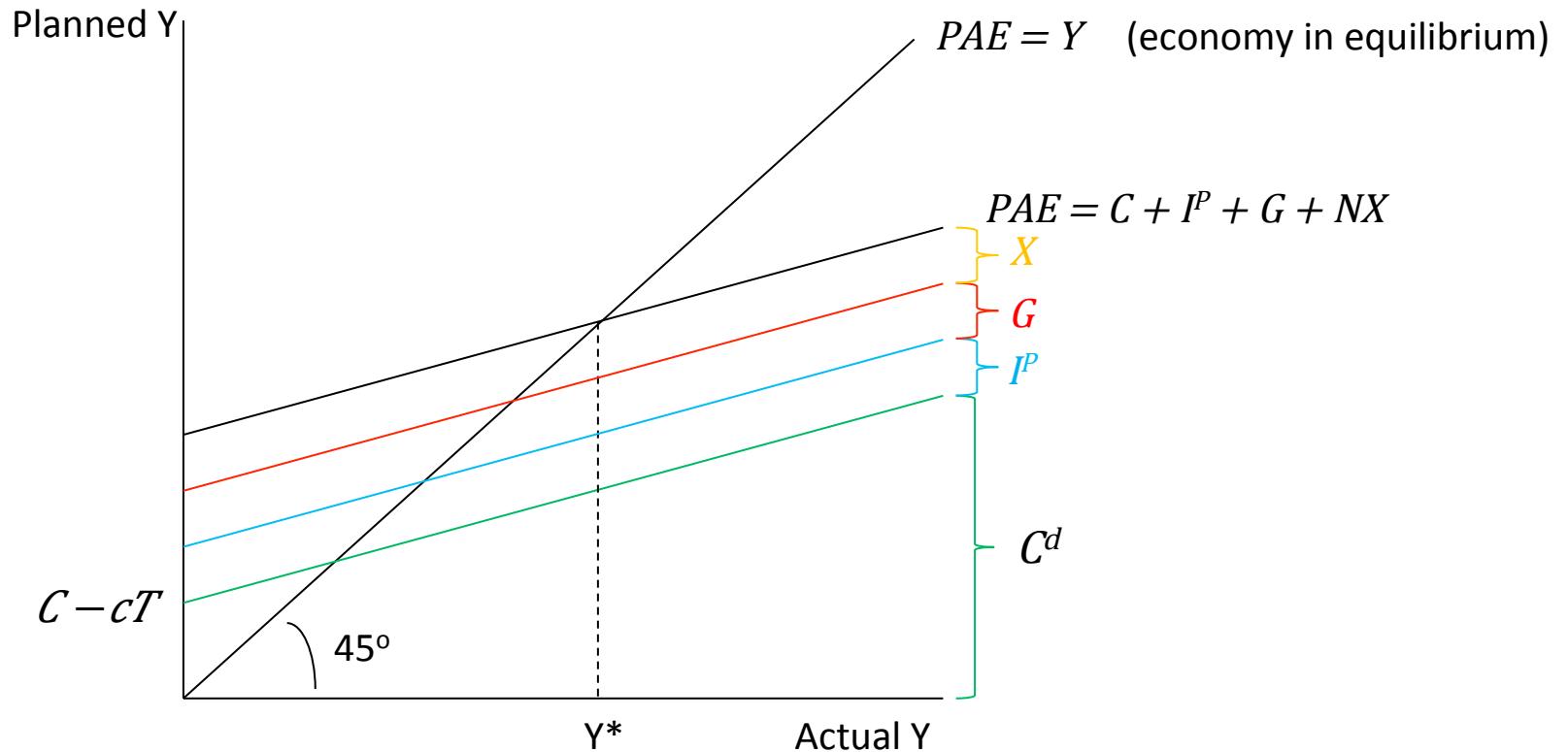
..and taxes depend on output:

$$T = T + tY$$

So, substituting in to C^d

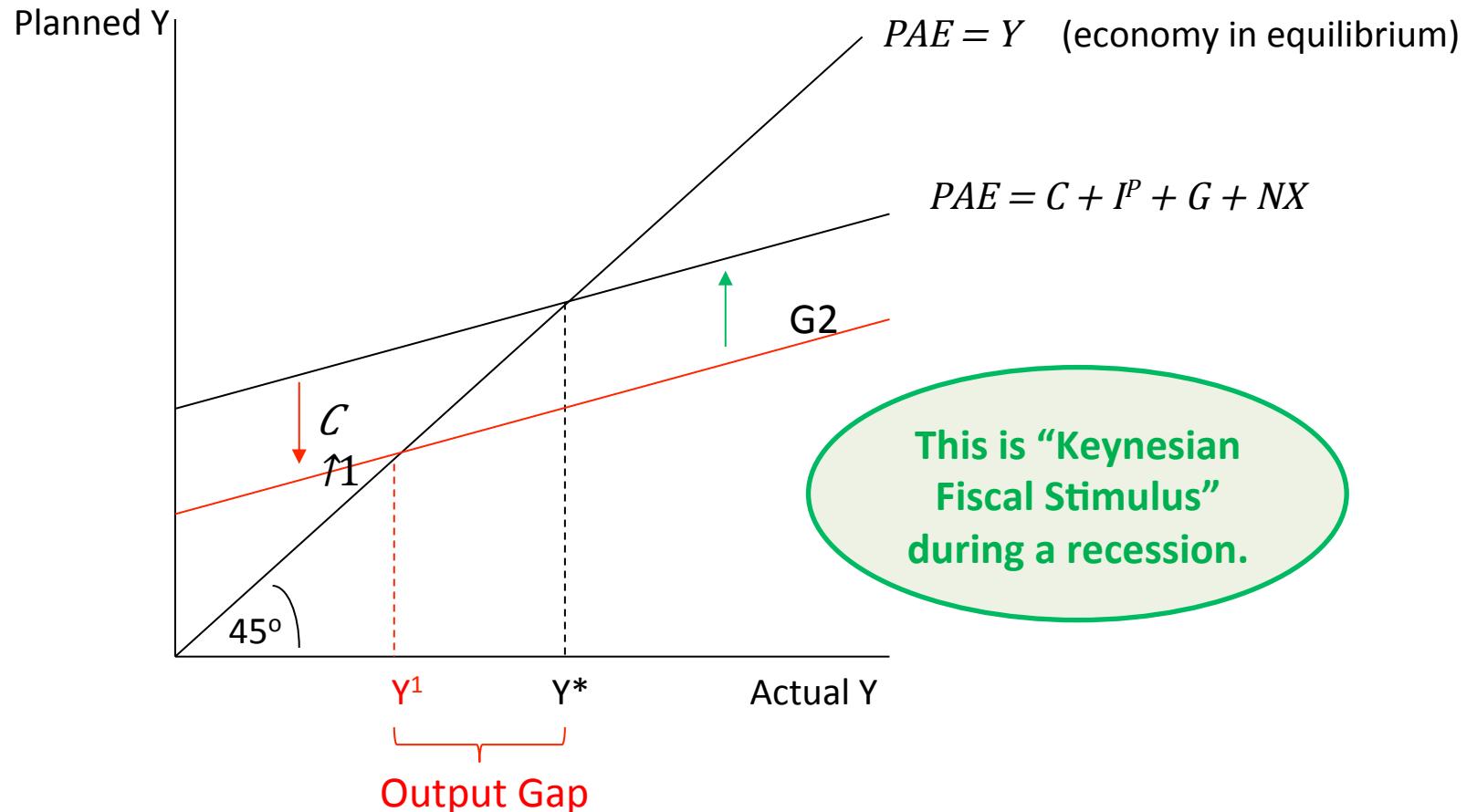
$$C^d = C - cT + c(1-t)Y$$

We can also express the 4-sector model on the Keynesian Cross



C, T, I^P, G and X are “exogenous” variables (pre-determined outside the model)
 C is an “endogenous” variable (determined within the model)
 c and t are parameters

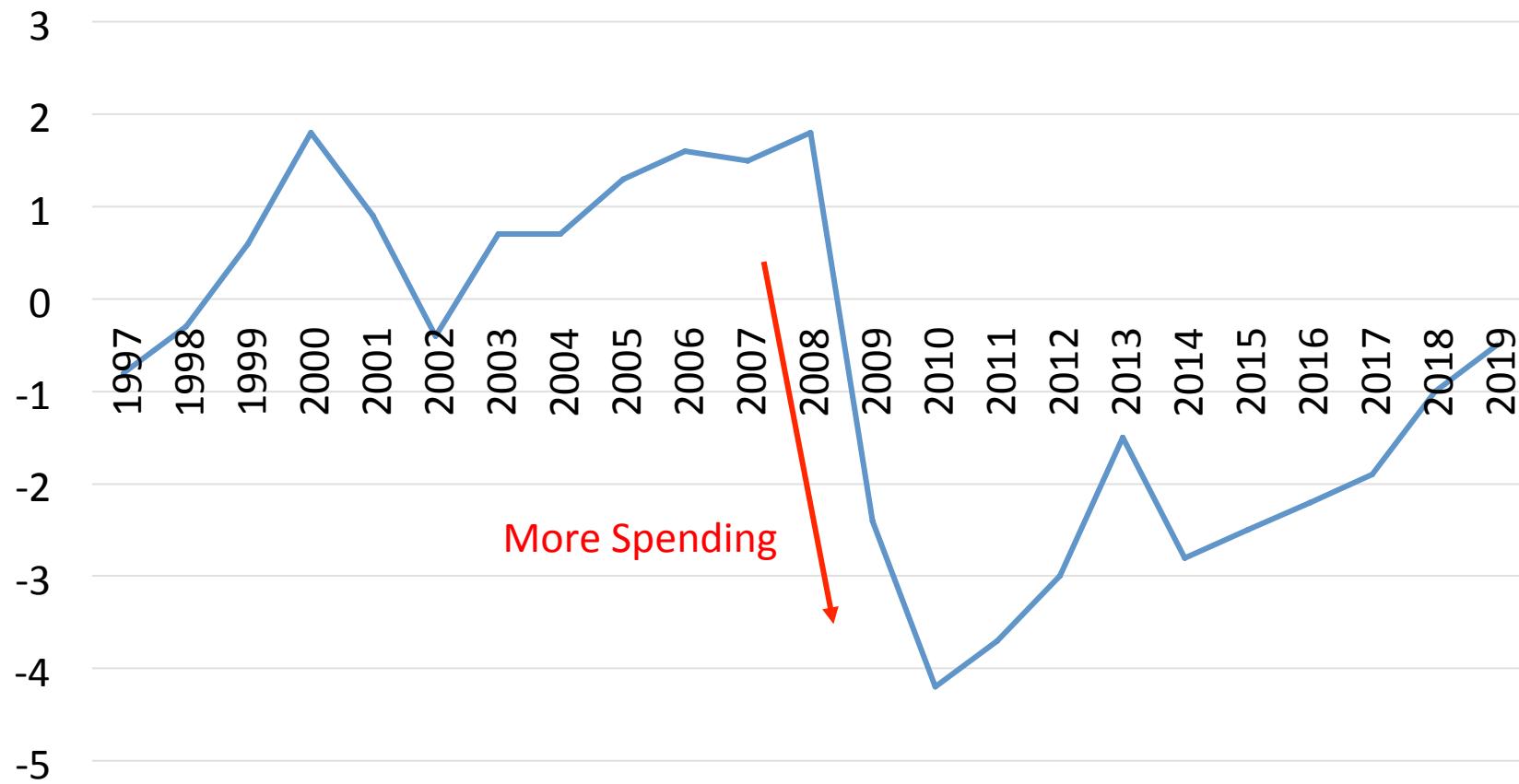
If there is a collapse in private demand, which causes a contraction, government can spend more to fill the gap in demand



Note, government spending has a multiplier effect on total output, $(Y^* - Y^1) > G^2$

This is exactly what the Australian Government did in 2009 during the global financial crisis

Fiscal Balance (Taxes – Spending), % of GDP

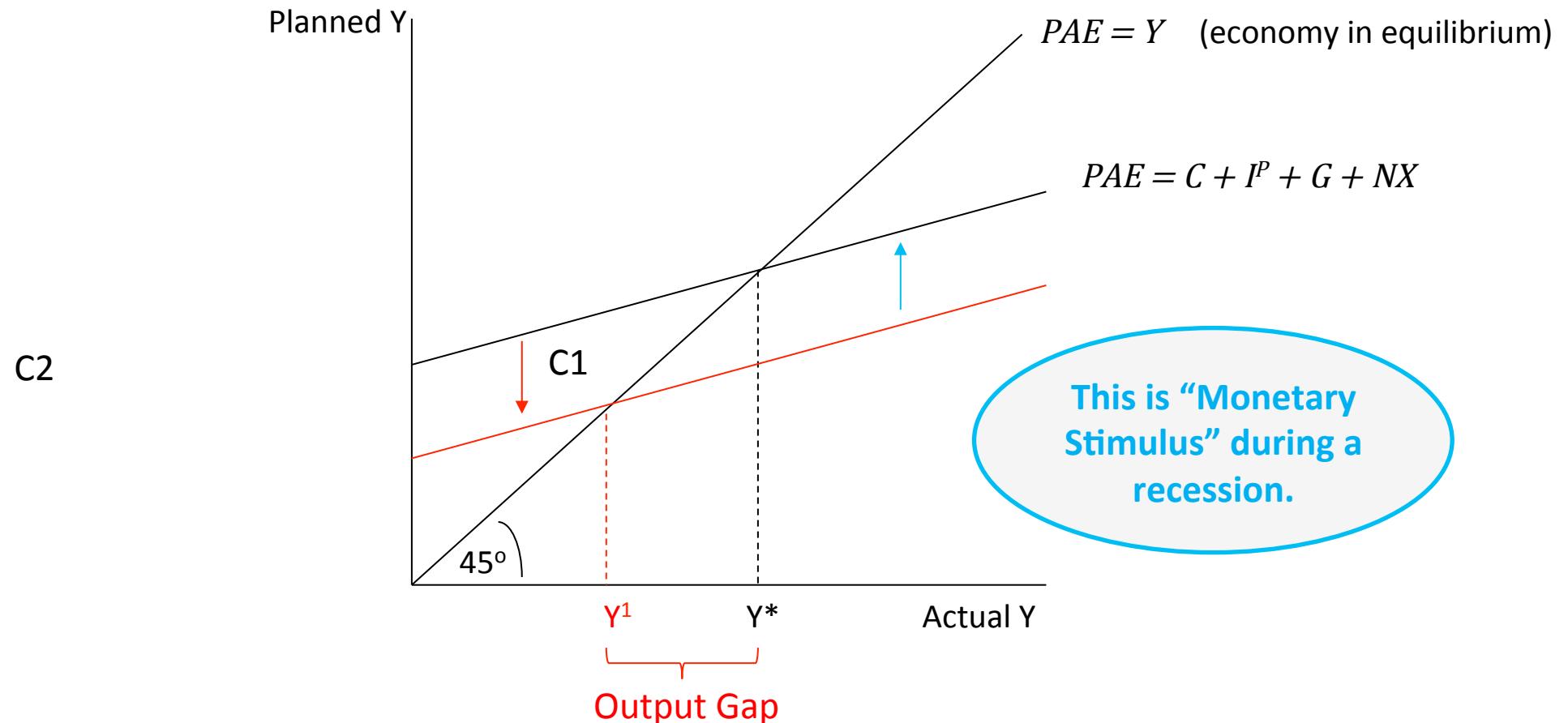


Source: www.budget.gov.au

For example, by building new school halls and sending everyone a \$900 cheque in the mail.

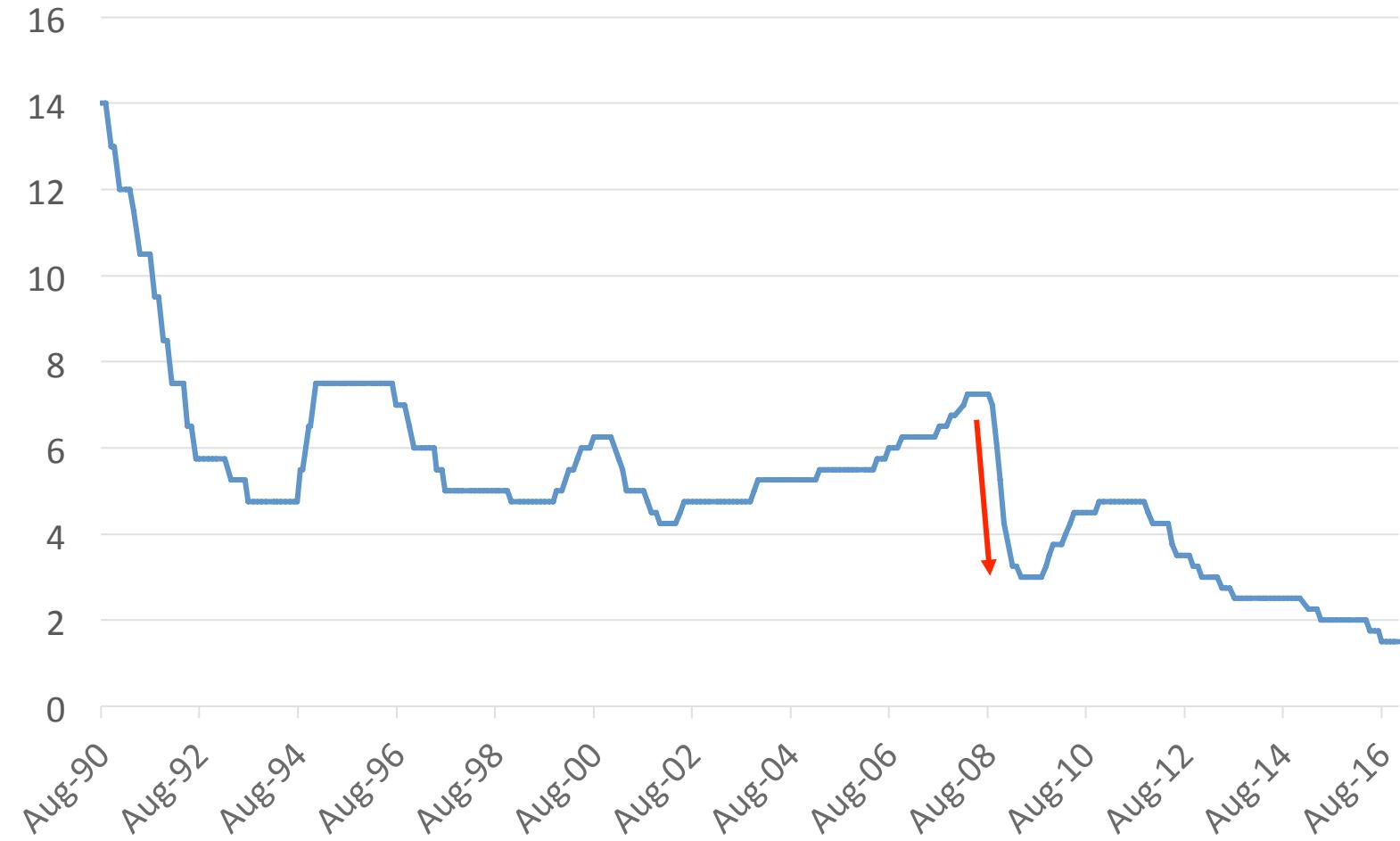


If there is a collapse in private demand, the central bank can also lower interest rates to boost consumption and investment



The RBA did this in 2009 as well

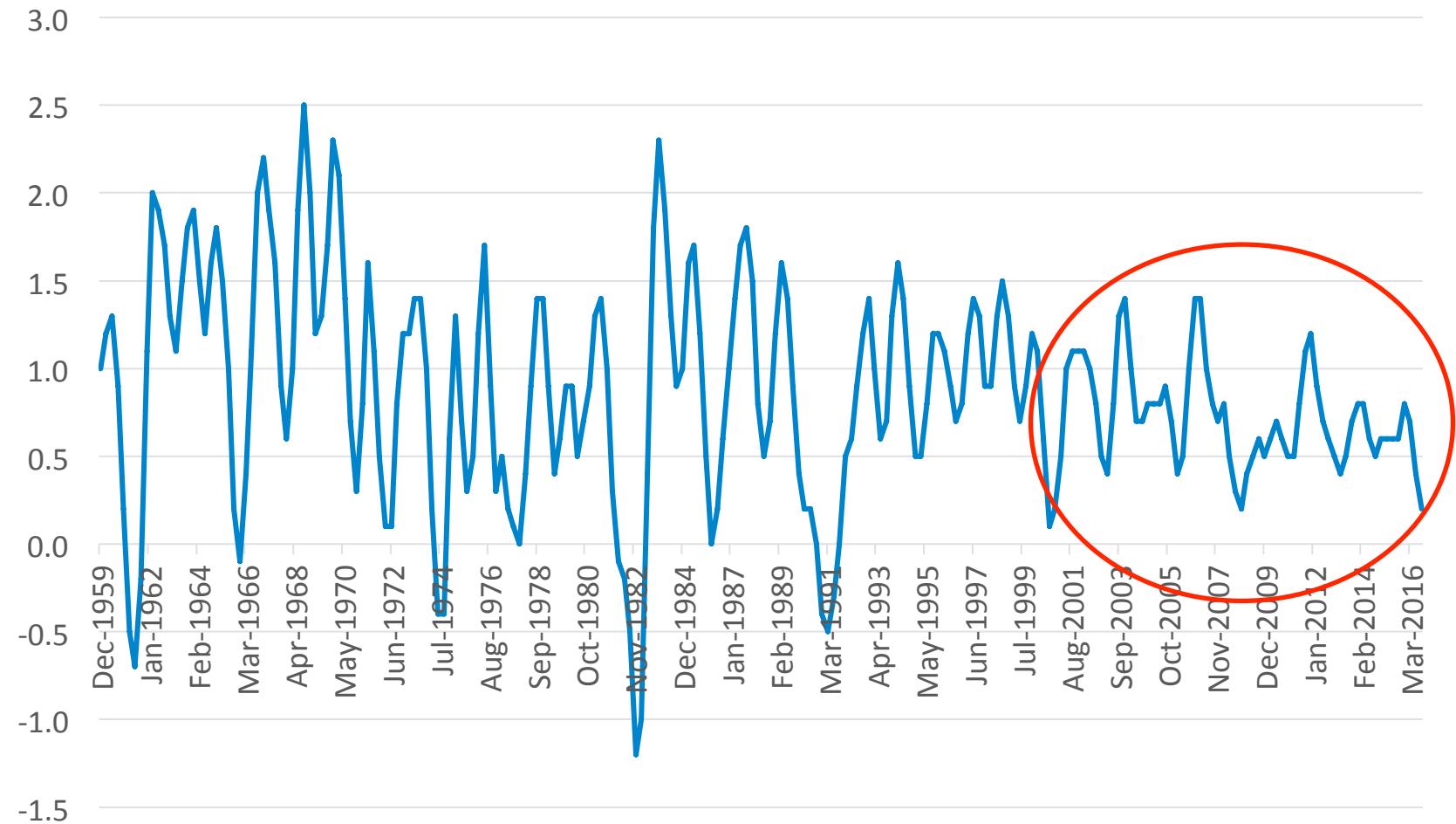
RBA cash rate, %



Source: RBA

Together, the Fiscal and Monetary Stimulus in 2009 made Australia the only OECD country to avoid the great recession

Real GDP growth (chain volume measure), trend, %



Source: ABS

Which received good reviews internationally

 INTERNATIONAL MONETARY FUND

AUSTRALIA

Australia: Staff Report for the 2010 Article IV Consultation¹

Prepared by Staff Representatives for the 2010 Consultation with Australia

Approved by Mahmood Pradhan and Tamim Bayoumi

October 12, 2010

Key Issues and Recommendations:

- **Context:** Australia avoided a recession in 2009 and is recovering on the back of a substantial policy stimulus and strong demand for its mining exports, especially from China.
- **Growth prospects:** Real GDP growth is projected to recover to 3–3½ percent in 2010 and 2011, led by commodity exports and investment in mining. Risks are tilted largely to the downside, as the global recovery could stall or renewed financial turmoil could raise the cost of capital. An

Source: <http://www.imf.org/external/pubs/ft/scr/2010/cr10331.pdf>

Summary

- Short-run equilibrium occurs when planned aggregate expenditure is equal to the level of output.
- Changes to consumption and planned investment ensures that an economy returns to its equilibrium over time.
- The size of the multiplier is a key determinant of equilibrium adjustment.
- Short-run equilibrium occurs when planned aggregate expenditure is equal to the level of output.
- Changes to consumption and planned investment ensures that an economy returns to its equilibrium over time.
- The size of the multiplier is a key determinant of equilibrium adjustment.