

# Introduction to Macroeconomics

Robert M. Kunst  
robert.kunst@univie.ac.at

University of Vienna  
and  
Institute for Advanced Studies Vienna

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# Outline

Introduction

National accounts

The goods market

The financial market

The IS-LM model

The labor market

The AS-AD model















These slides follow the original slides of QUIJANO/QUIJANO that accompany the BLANCHARD textbook.

## AS-AD model: The idea

The joint equilibrium on the three markets for goods, for financial assets, and for labor can be expressed as the intersection point for two curves in a  $(Y, P)$  diagram:

- ▶ In the goods and financial markets, higher prices  $P$  have the same effect as a lower money supply, as real money experiences a contraction: a downward-sloping curve called the *aggregate demand* (**AD**) curve;
- ▶ In the labor market, higher output implies lower unemployment, which in turn benefits workers' bargaining power, wages will rise, and eventually prices: *aggregate supply* (**AS**) curve slopes upward.

## The AS curve

The aggregate supply relation captures the effects of output on the price level. It is derived from the behavior of wages and prices. Recall the equations for wage and price determination from the previous chapter (with  $A = 1$ ):

$$\begin{aligned}W &= P^e \cdot F(u, z) \\ P &= (1 + \mu)W\end{aligned}$$

Note that  $P = P^e$  is *not* assumed here. Rather,  $P^e$  is assumed as given exogenously.

## AS curve: prices depend on unemployment

Elimination of  $W$  from the wage and price determination equations yields:

$$P = (1 + \mu)P^e \cdot F(u, z)$$

In words, the price level  $P$  depends on the expected price level  $P^e$  and the unemployment rate  $u$ . We assume that  $\mu$  and  $z$  are constant.

The price level is a falling function of the unemployment rate  $u$ :  
Increasing unemployment impairs workers' bargaining power.  
Lower wages imply lower prices.

## Derivation of the AS curve

Now recall how the unemployment rate is represented as a function of output (using  $Y = AN$ ):

$$u = \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{AL},$$

or  $u = 1 - \frac{Y}{L}$  under assumption  $A = 1$ . This in turn implies

$$P = (1 + \mu)P^e \cdot F\left(1 - \frac{Y}{L}, z\right),$$

a positively sloping *aggregate supply* relation between  $P$  and  $Y$  for given  $(A,)$   $L$  and  $z$ . The price level  $P$  depends on the expected price level  $P^e$  and the level of output  $Y$ .

## AS: Higher output implies higher prices

An increase in output leads to an increase in the price level. This is the result of four steps:

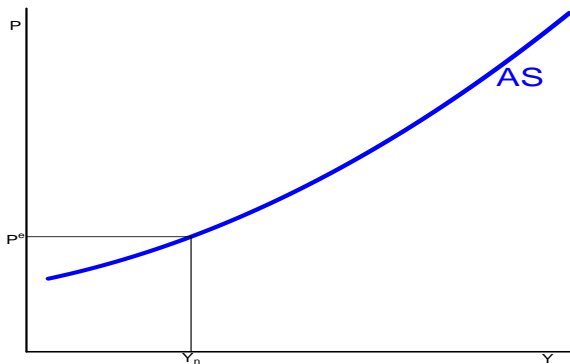
1. An increase in output leads to an increase in employment:  
 $Y \uparrow \Rightarrow N \uparrow$ ;
2. The increase in employment leads to a decrease in unemployment and therefore to a decrease in the unemployment rate:  $N \uparrow \Rightarrow u \downarrow$ ;
3. The lower unemployment rate leads to an increase in the nominal wage:  $u \downarrow \Rightarrow W \uparrow$ ;
4. The increase in the nominal wage leads to an increase in the prices set by firms and therefore to an increase in the price level:  $W \uparrow \Rightarrow P \uparrow$ .

## AS: Higher expected price implies higher actual price

An increase in the expected price level leads, one for one, to an increase in the actual price level. This effect works through wages:

1. If wage setters expect the price level to be higher, they set a higher nominal wage:  $P^e \uparrow \Rightarrow W \uparrow$ ;
2. The increase in the nominal wage leads to an increase in costs, which leads to an increase in the prices set by firms and a higher price level:  $W \uparrow \Rightarrow P \uparrow$ .

## The AS (aggregate-supply) curve: graph

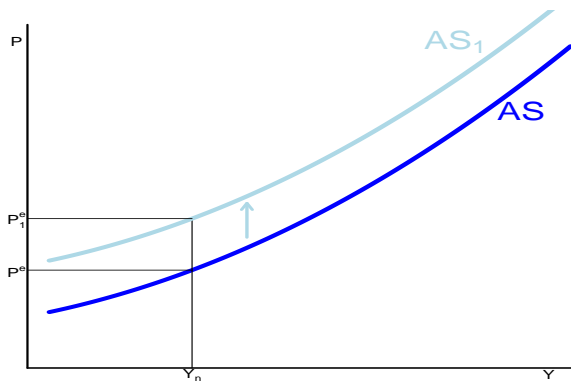




## Properties of the AS curve

- ▶ The aggregate supply curve is upward sloping: an increase in output  $Y$  leads to an increase in the price level  $P$ ;
- ▶ The aggregate supply curve goes through the point, where  $Y = Y_n$  and  $P = P^e$ ;
- ▶ An increase in the expected price level  $P^e$  shifts the aggregate supply curve up. Conversely, a decrease in the expected price level shifts the aggregate supply curve down.

## AS: increase in expected price level



An increase in the expected price level shifts the aggregate supply curve up.

## Aggregate demand relation

The **aggregate demand relation** captures the effect of the price level on output. It is derived from the equilibrium conditions in the **goods and financial** markets :

$$\text{IS relation: } Y = c_0 + c_1(Y - T) + I(Y, i) + G;$$

$$\text{LM relation: } \frac{M}{P} = Y \cdot L(i).$$

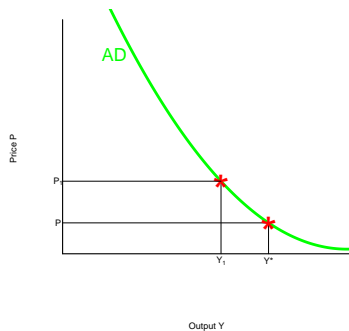
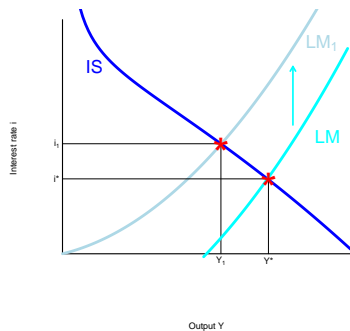
## Derivation of the AD (aggregate-demand) curve

A price increase works like a monetary contraction. It reduces real money  $M/P$  and shifts the LM curve in (up). Output  $Y$  falls, and  $i$  rises.

$$P \uparrow \Rightarrow \frac{M}{P} \downarrow \Rightarrow i \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow$$

This yields a downward-sloping curve in an  $(Y, P)$  diagram, the **AD curve**.

# Derivation of the AD curve: graphs



## Summary: three curves

The *IS curve* describes equilibria in the goods market for given  $G$  and  $T$  in an  $(Y, i)$  diagram. It is downward sloping.

The *LM curve* describes equilibria in the money market for given  $M$  and  $P$  in an  $(Y, i)$  diagram. It is upward sloping.

The *AD curve* describes equilibria in both markets for given  $M, G, T$  in an  $(Y, P)$  diagram. It is downward sloping.

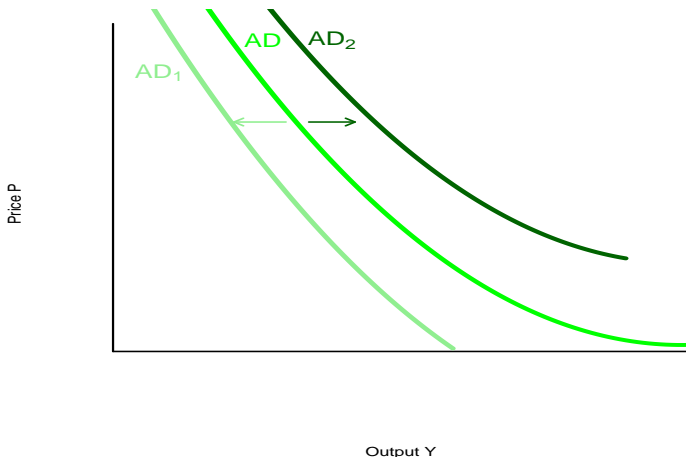
The equilibrium reaction in both markets can be represented schematically as a function

$$Y = Y\left(\frac{M}{P}, G, T\right).$$

(+, +, -)

This schematic function implies the downward-sloping relation between  $Y$  and  $P$  for given  $M, G, T$ , the AD curve.

## Shifts of the AD curve



Monetary or fiscal contractions shift the AD curve in (left), monetary or fiscal expansions shift the AD curve out (right).

## Summary: shifts of AS and of AD

The *AS relation* (equilibria in the labor market) is given by the equation

$$P = P^e(1 + \mu)F\left(1 - \frac{Y}{L}, z\right).$$

Changes in  $\mu$ ,  $L$ ,  $z$  and particularly in  $P^e$  shift the AS curve.

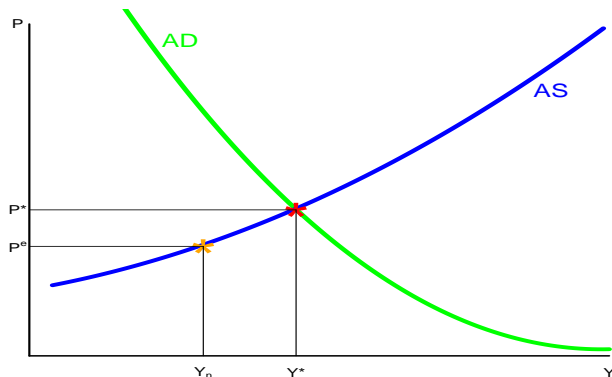
The *AD relation* (equilibria in the goods and financial markets) is given by the schematic function

$$Y = Y\left(\frac{M}{P}, G, T\right).$$

Monetary policy ( $M$ ) and fiscal policy ( $G, T$ ) shift the AD curve.



## AS and AD: equilibrium on three markets



The intersection of the  $AS$  and  $AD$  curves defines a short-run equilibrium on three markets.  $Y^*$  need not coincide with natural output  $Y_n$ .

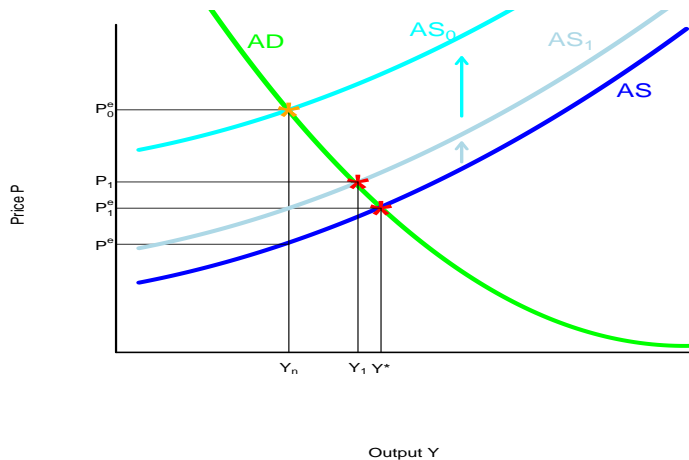
## Short-run and medium-run equilibrium

If  $Y > Y_n$  and  $P > P^e$ , this may be a valid short-run equilibrium. However, people may adjust their price expectations upward. If  $P^e$  increases, the AS curve will shift in.  $Y$  will fall, and  $P$  will rise.

This adaptation mechanism will proceed, until the AS curve goes through the point  $(Y_n, P^e)$ . In the **medium run**, output will be down at its natural level  $Y_n$ .

A similar mechanism occurs if  $Y < Y_n$  and  $P < P^e$ . The AS curve shifts out, and output increases iteratively to  $Y_n$ .

## Short-run and medium-run equilibrium: graph



If  $Y > Y_n$ , the AS curve shifts in until again  $Y = Y_n$ .

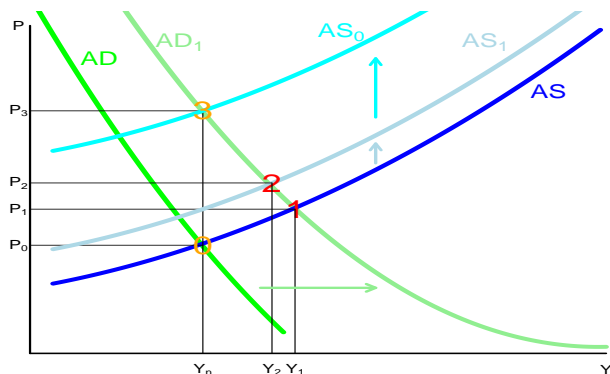


## Three experiments in the AS-AD world

Three experiments serve to understand the workings in the AS-AD world in more depth. Short-run and medium-run equilibria are analyzed in AS-AD and in IS-LM charts. IS-LM charts reveal the movements of the interest rate.

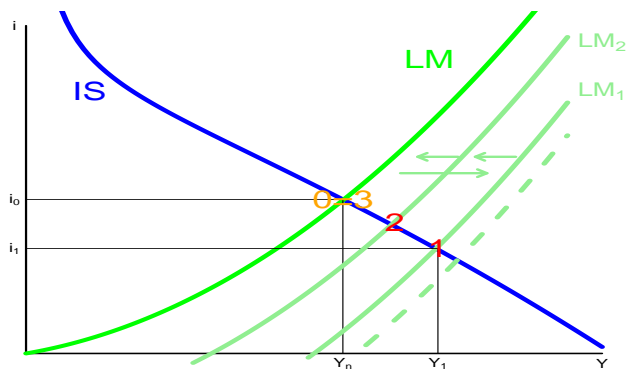
1. A monetary expansion;
2. A fiscal contraction;
3. An oil-price shock.

## Experiment 1: AS-AD graph



An initial outward shift of the AD curve by the expansion is counteracted by a gradual adaptation of price expectations and of prices, inward shifts of AS curves.

## Experiment 1: IS-LM graph



The initial outward shift of the LM curve is counteracted by a gradual monetary contraction due to higher prices. The dashed curve would correspond to the old fixed-price world. Eventually, the LM curve becomes the original one.

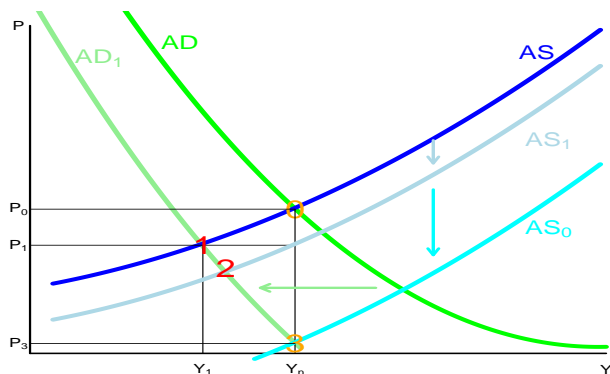
## The neutrality of money

In the *short run*, a monetary expansion leads to an increase in output, a decrease in the interest rate, and an increase in the price level.

In the *medium run*, the increase in nominal money is reflected entirely in a proportional increase in the price level. The increase in nominal money has no effect on output, on its composition, or on the interest rate.

The **neutrality of money** in the medium run does not mean that monetary policy cannot or should not be used to affect output. During the expansion episode, the economy enjoys lower unemployment, a lower interest rate, and higher output.

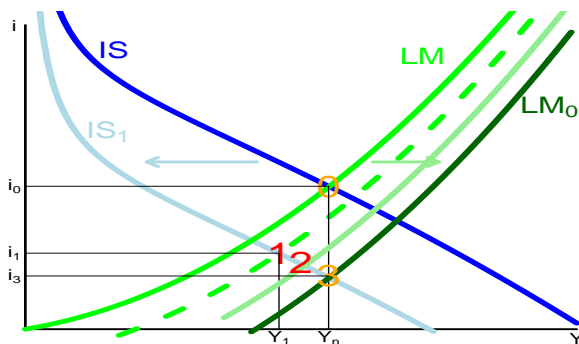
## Experiment 2: AS-AD graph



An initial inward shift of the AD curve by the fiscal contraction is counteracted by a gradual lowering of price expectations and of prices, outward shifts of AS curves.



## Experiment 2: IS-LM graph



An initial inward shift of the IS curve by the fiscal contraction is counteracted by gradual outward shifts of the LM curve reflecting the expansion of real money due to falling prices. Note the dashed LM curve shifted from its original position by an immediate fall in the price level.

## Fiscal policy: not quite neutral

In the new *medium-run equilibrium*, output  $Y_n$  and unemployment  $u_n$  are just as before the episode. However, the composition of output and the interest rate have changed.

If the fiscal contraction has used taxes  $T$ ,  $C$  will be lower and  $I$  will be higher in the new medium-run equilibrium;

If the fiscal contraction has used government spending  $G$ ,  $C$  will be identical and  $I$  will be higher in the new medium-run equilibrium.

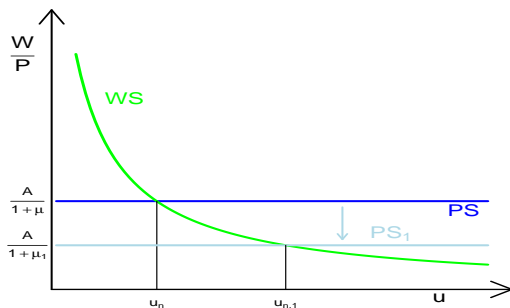
During the consolidation episode, output is lower than  $Y_n$  and unemployment is higher than  $u_n$ : the economy suffers real effects for a while.

## Experiment 3: the concept

The so-called OPEC shocks of the 1970s—sudden increases of prices of imported fuels—have affected industrialized economies for several years.

There is no oil price in the AS-AD model. It is assumed that the mark-up  $\mu$  can be used to model such effects. The rent arising from the mark-up is not modelled anyway: just assume it goes to OPEC.

## Remember the labor-market effects of higher $\mu$



An increase in  $\mu$  decreases the real wage and leads to an increase in  $u_n$ .

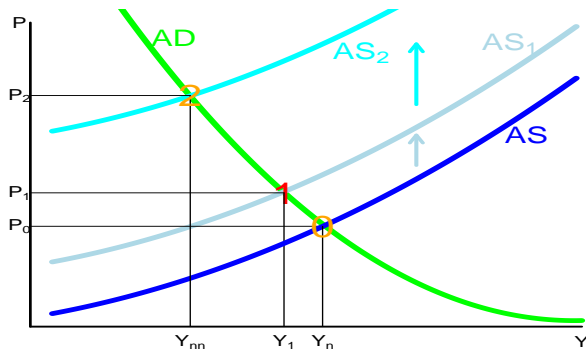
## The mark-up shifts the AS curve

The AS curve is given by the relation

$$P = (1 + \mu)P^e \cdot F\left(1 - \frac{Y}{AL}, z\right)$$

for fixed  $P^e, z, \mu$  in an  $(Y, P)$  diagram. A higher  $\mu$  shifts the AS curve up (inward): higher prices for any given output or unemployment rate.

## Experiment 3: AS-AD graph



The increase in mark-up shifts the AS curve up (inward) and reduces natural output from  $Y_n$  to  $Y_{nn}$ . The AS curve will shift up (inward), until  $Y = Y_{nn}$ .

## Experiment 3: Summary

- ▶ Unlike in the policy experiments #1 and #2, there is no shift in the AD curve, whereas natural output is affected. Prices increase and output falls for some time;
- ▶ In the IS-LM world, the episode works like a monetary contraction: rising  $P$  causes falling  $Y$  and rising  $i$ , as the LM curve shifts up an immobile IS curve;
- ▶ The new medium-term equilibrium is worse in all respects:  $Y$  is lower,  $I$  has decreased strongly because of  $i$ ,  $u_n$  has increased.  $G/Y$  is also higher.