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MACROECONOMICS
Week 8: The Aggregate Demand
& Supply Model

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THEORETICAL REVIEW

WHERE DOES THE AGGREGATE DEMAND COME FROM?

- The IS Curve:

$$Y = m\,\overline{A} - m\,\phi\,r, \quad m \equiv \frac{1}{1-c}, \quad \phi \equiv b + d + x,$$

$$\overline{A} = \overline{C} + \overline{I} - d\,\overline{f} + \overline{G} + \overline{NX} - c\,\overline{T}$$

- The MP Curve:

$$r = \overline{r} + \lambda\,\pi, \quad \lambda > 0$$

- The Aggregate Demand (AD):

$$Y = m\,\overline{A} - m\,\phi\,(\overline{r} + \lambda\,\pi)$$

WHERE DOES THE AGGREGATE SUPPLY COME FROM?

- The Philips Curve with adaptive expectations for the inflation:

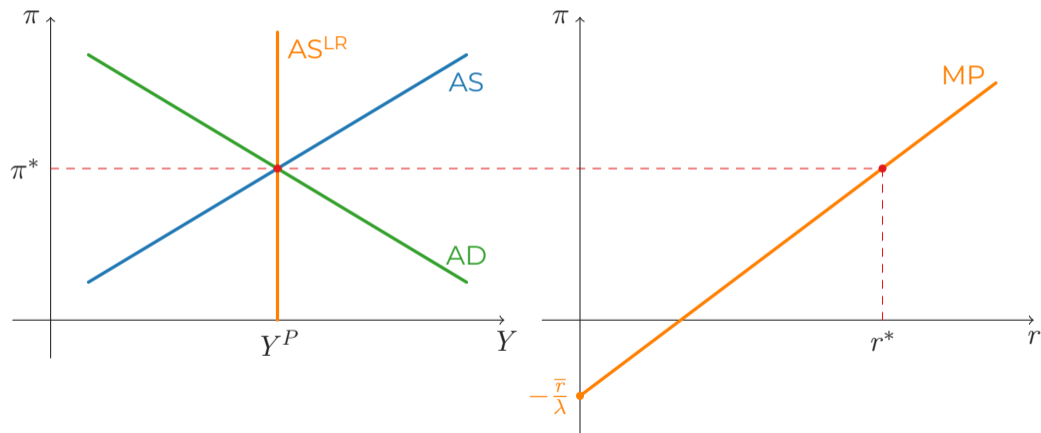$$\pi = \pi^e - \omega\left(U - U_n\right) + \rho, \quad \pi^e = \pi_{t-1}$$

- The Okun's Law:

$$U - U_n = -\theta\left(Y - Y^P\right)$$

- The Short-run Aggregate Supply (AS)

$$\pi = \pi^e + \gamma\left(Y - Y^P\right) + \rho, \quad \gamma \equiv \omega\theta, \quad \pi^e = \pi_{t-1}$$
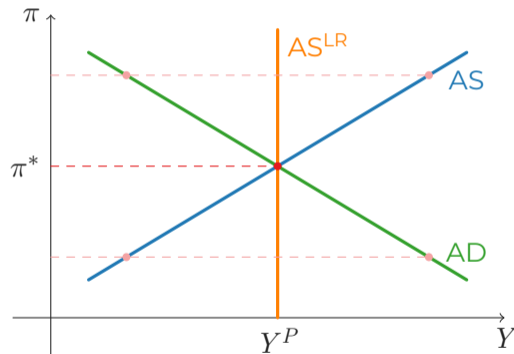
- The Long-run Aggregate Supply (AS$^{\text{LR}}$): $Y = Y^P$

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THE GRAPHICAL REPRESENTATION OF THE AD/AS MODEL

WHERE ARE WE RIGHT NOW?

- Our model predicts a *steady state* equilibrium
  - Excess supply if $\pi > \pi^*$
  - Excess demand if $\pi < \pi^*$
- This means that something must happen to the economy such that business cycles emerge
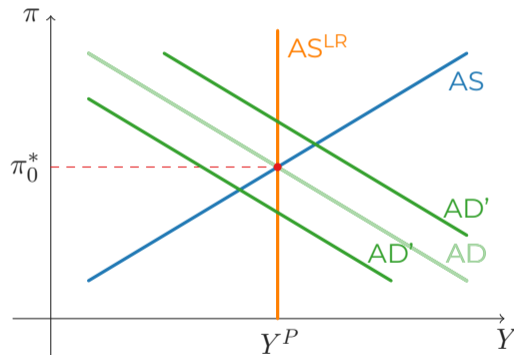
WHAT CAUSES BUSINESS CYCLES?

- *Shocks* are changes to the *fundamentals* of the model

$$Y = m\,\overline{A} - m\,\phi\,(\overline{r} + \lambda\,\pi) \Leftrightarrow$$

$$\pi = \frac{\overline{A}}{\phi\,\lambda} - \frac{\overline{r}}{\lambda} - \frac{1}{\phi\,m\,\lambda}\,Y$$
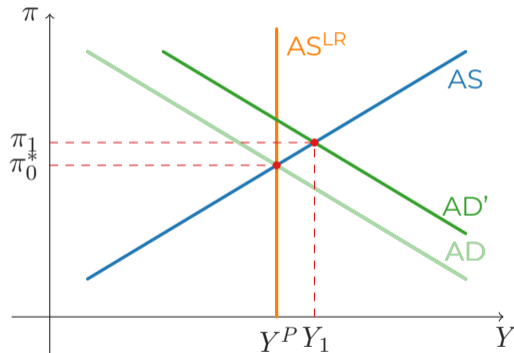
- ■ Some change the y-axis point
- ■ Some change the slope
- ■ Some change both

WHAT HAPPENS WHEN $\overline{A}$ INCREASES?

- Now we have a new short run equilibrium with: $Y_1 > Y^P$ (a boom)

- Is this situation stable?

- No, because of the *self-correcting mechanism of the supply*
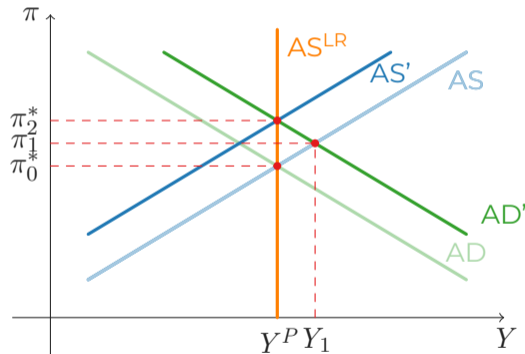
$$\pi = \pi_{t-1} + \gamma \left(Y - Y^P \right) + \rho$$

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# WHAT HAPPENS WHEN $\overline{A}$ INCREASES?

Economically:

- With higher prices and low unemployment, workers will demand higher wages

- Production costs rise, forcing firms to rise prices for all the levels of output

- The process lasts until there is no output gap triggering inflationary expectations

WHAT ABOUT A DECREASE IN $\overline{A}$?

- A recession steps in, with $Y_1 < Y^P$, pushing down inflation

- This makes the labor market loosen, triggering deflationary expectations on the supply side

- We end up with a long run equilibrium with less inflation

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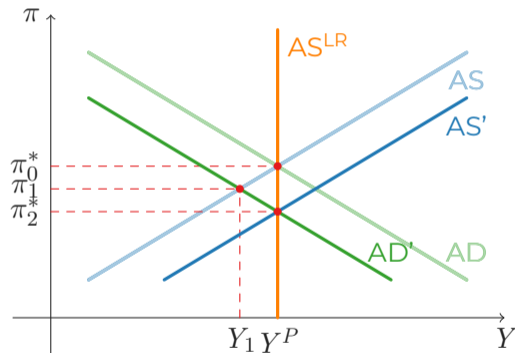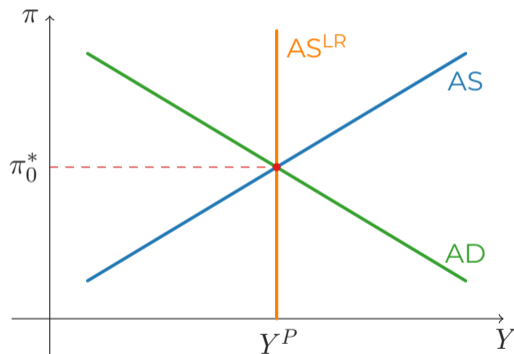
WHAT ABOUT SHOCKS ON THE SUPPLY?

- Again: shocks are changes on the *fundamentals* of the model

$$\pi = \pi^e + \gamma \left(Y - Y^P \right) + \rho \Leftrightarrow$$

$$\pi = \pi^e - \gamma\, Y^P + \rho + \gamma\, Y$$

- In the supply side of our model:
  - Some change the y-axis point
  - Some change both the y-axis point and the slope

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WHAT IF THERE IS A SPIKE IN OIL PRICES?

- We analyze this case through a temporary $\rho \uparrow$

- This sets in a recession where $Y_1 < Y^P$ and inflation increases $\pi_1 > \pi_0^*$

- But the negative output gap will loosen the labor market, pulling down the inflation and the supply to the initial position
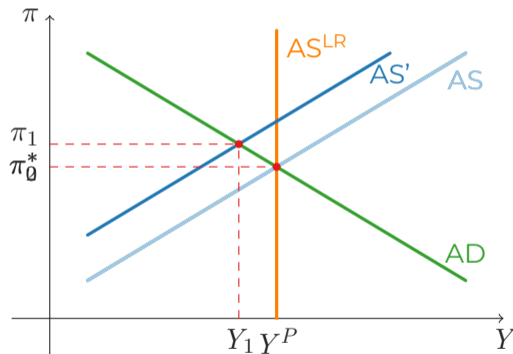
ARE THEY LONG RUN SUPPLY SHOCKS?

- Yes, e.g. an earth quake such that $Y^P \downarrow$

- This causes a boom in the short run, with $Y_1 = Y_0^P > Y_2^P$ that will trigger inflation

- We end up with a new long run equilibrium with higher inflation and lower output
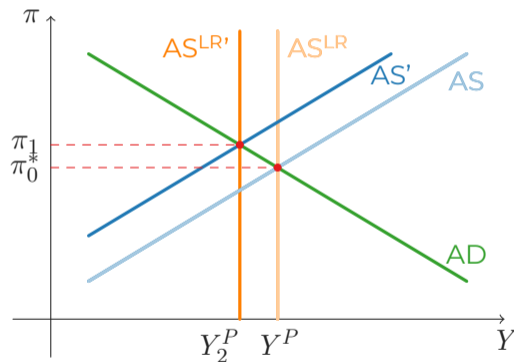
EXERCISES

EXERCISE 1. TAX INCENTIVES AND THE AD CURVE

a) $\overline{I} \uparrow \Rightarrow \overline{A} \uparrow$, AD shifts to the right (or upwards)
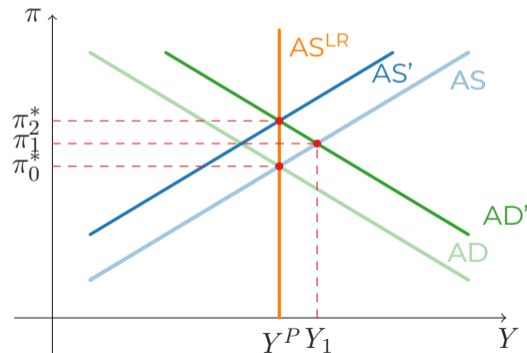
b)

From the textbook.
Suppose that Congress passes legislation that establishes a tax credit for small businesses and tax incentives for all businesses that invest in new plant and equipment.
a) What is the anticipated effect of these proposals on aggregate demand, if any?
b) Show your answer graphically.

EXERCISE 2. DOLLAR APPRECIATION AND THE AD CURVE

From the textbook.

Evaluate the accuracy of the following statement:

"The recent appreciation of the U.S. dollar has had a negative effect on the U.S. aggregate demand curve."

- An appreciation of the dollar will reduce net exports: $NX \downarrow$
- The AD curve will shift to the left (or downwards)
- The statement is correct

EXERCISE 3. PUBLIC SPENDING AND THE AD CURVE

a) $\overline{G} \downarrow \Rightarrow \overline{A} \downarrow$, AD shifts to the left (or downwards)
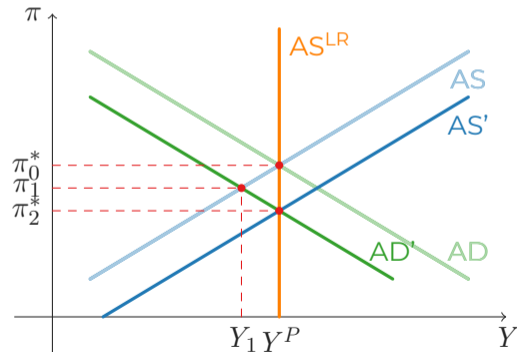
b)

From the textbook.
Suppose that the White House decides to sharply reduce military spending without increasing government spending in other areas.
a) Comment on the effect of this measure on aggregate demand.
b) Show your answer graphically.

EXERCISE 4. OIL PRICES AND THE AS CURVE

From the textbook.

Oil prices declined in the summer of 2008, following months of increases since the winter of 2007. Considering only this fall in oil prices, explain the effect on short-run aggregate supply and long-run aggregate supply, if any.

- This decline in the summer of 2008 was a temporary positive shock on the supply.

EXERCISE 5. A DEMAND SHOCK

Consider two fundamental curves of our macroeconomic model: the AD and AS curves. The MP curve and the Fisher equation will be re-introduced in the entire picture next week.

$$\text{AD:} \quad Y = m \cdot \overline{A} - m \cdot \phi \cdot (\overline{r} + \lambda \pi)$$

$$\text{AS:} \quad \pi = \pi^e + \gamma \left(Y - Y^P \right) + \rho$$

and the following information concerning exogenous variables and parameters:

$$\overline{A} = 7.6 \ , \ m = 2.0 \ , \ \phi = 0.2 \ , \ \overline{r} = 2.0 \ , \ \lambda = 0.5 \ , \ \pi^e = 2.0 \ , \ \gamma = 4.5 \ , \ Y^P = 14.0 \ , \ \rho = 0.$$

EXERCISE 5. A DEMAND SHOCK

Note that the rates $(\pi^e, \overline{r}, r, i)$ are measured in percentage points (e.g., 2.0 means 2.0%), while $\{Y, Y^P, \overline{A}\}$ are measured in trillion dollars. In the solutions below, to avoid doubt, we put the symbol % only at the final step of the solutions.

a) Calculate the short-run equilibrium values of GDP and the inflation rate. Represent graphically, involving the AD and AS curves.

- First, we pass the values to the Notebook
- Remember also that

$$\text{D } y\text{-axis point:} \quad \frac{\overline{A}}{\phi\,\lambda} - \frac{\overline{r}}{\lambda}$$

$$\text{S } y\text{-axis point:} \quad \pi^e - \gamma\,Y^P + \rho$$

EXERCISE 5. A DEMAND SHOCK

- As usually we can solve the system using the package `NLSolve`
- Or, if you prefer, using standard linear algebra, defining the following matrices

$$\boldsymbol{A} \equiv \begin{bmatrix} 1 & m\,\phi\,\lambda \\ -\gamma & 1 \end{bmatrix} \qquad \boldsymbol{Y} \equiv \begin{bmatrix} Y \\ \pi \end{bmatrix} \qquad \boldsymbol{B} \equiv \begin{bmatrix} m\,\overline{A} - m\,\phi\,\overline{r} \\ \pi^e - \gamma\,Y^P + \rho \end{bmatrix}$$

- The solution will be $\boldsymbol{Y} = \boldsymbol{A}^{-1}\boldsymbol{B}$ or in Julia: `Y = inv(A) * B`
- The solution is $Y = Y^P = 14$ and $\pi = 2\%$

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EXERCISE 5. A DEMAND SHOCK

b) Is the economy in a recession or an economic boom? Justify.

- The previous result implies that $Y = Y^P = 14$

- So, the Economy is in equilibrium: neither a boom, nor a recession

EXERCISE 5. A DEMAND SHOCK

c) If there is no demand or supply shock, what will happen to the economy over time?

- The current level of inflation and of output is a short run equilibrium and a long run equilibrium
- Then, if no shocks occur, the economy will stay at these levels forever

EXERCISE 5. A DEMAND SHOCK

d) Suppose the government, to stimulate economic activity, increases its spending on goods and services (G & S) by 0.2 trillion dollars. Describe what will happen to the economy over time. What will be the new value of the long-run equilibrium inflation rate? Use the sliders below to graphically represent this policy measure's impact.

EXERCISE 5. A DEMAND SHOCK

- $\Delta \overline{G} = 0.2$ will shift the AD curve to the right (or upwards)

- A new short run equilibrium arises where the economy is in a boom ($Y_1 > Y^P$ and $\pi_1 > \pi_0^*$)

- This triggers inflation and shifts the AS curve to the left (or upwards)

- New long-run equilibrium: $Y_2 = Y^P = 14$, though $\pi_2^* = 4\%$
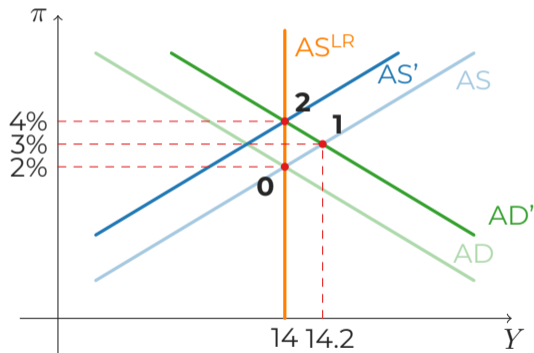
EXERCISE 6. A SUPPLY SHOCK

Consider the same values for the parameters and the exogenous variables of Exercise 5. However, due to a sharp decline in oil prices, there is a positive supply shock of $\rho = -1.9$.

a) Calculate the short-run equilibrium values for the inflation rate and the level of GDP that result from such a shock. Using the slider below, represent graphically this shock, involving the AD and AS curves.

b) Is the economy in a recession or an economic boom? Justify.

c) If there is no further supply or demand shocks, what will happen to the economy over time?
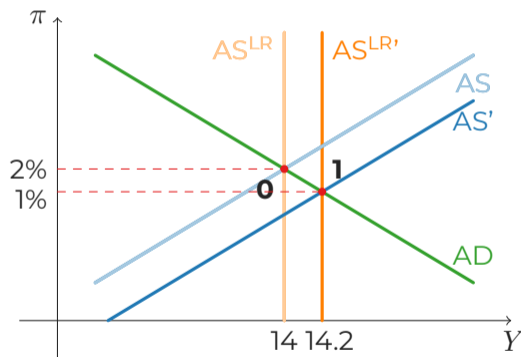
EXERCISE 6. A SUPPLY SHOCK
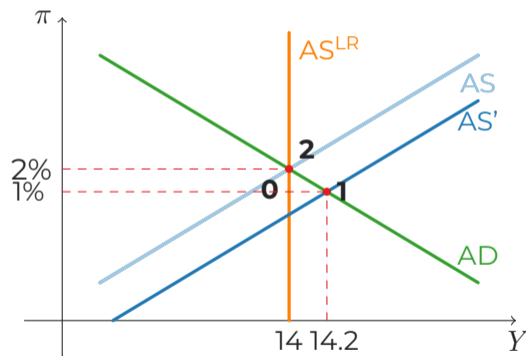
EXERCISE 7. A PERMANENT SUPPLY SHOCK

Consider Exercise 6 with one single change: suppose the supply shock is **permanent** instead of temporary; that is, oil prices go down, and then they will stay there for a long period of time. This positive shock will cause Potential GDP to increase by 0.2 trillion dollars.

a) How would we change our answers to the raised three questions?

b) Calculate the short-run and long-run equilibrium values for the inflation rate and the GDP level resulting from such a shock. Using the slider `self7`, represent the new equilibrium graphically.

c) Is the economy in a recession or an economic boom? Justify.

d) If there is no further supply or demand shocks, what will happen to the economy over time?

EXERCISE 7. A PERMANENT SUPPLY SHOCK

EXERCISE 8. NEGATIVE SUPPLY SHOCKS IN THE 1970'S

On page 310 in the textbook:

"In 1973, the U.S. economy was hit by a series of negative supply shocks:

1. As a result of the oil embargo stemming from the Arab-Israeli war of 1973, the Organization of Petroleum Exporting Countries (OPEC) engineered a quadrupling of oil prices by restricting oil production.

2. A series of crop failures throughout the world led to a sharp increase in food prices.

3. The termination of U.S. wage and price controls in 1973 and 1974 led to a push by workers to obtain wage increases that had been prevented by the controls.

The triple thrust of these events shifted the short-run aggregate supply curve sharply upward."

EXERCISE 8. NEGATIVE SUPPLY SHOCKS IN THE 1970'S

a) What would we expect about the behavior of inflation in the 1970s?

- Inflation will have to increase as a result of the three shocks
- The rise of oil prices pushes production costs up
- Harvest failures push food costs up
- Higher wages also pushed production costs up

EXERCISE 8. NEGATIVE SUPPLY SHOCKS IN THE 1970'S

b) Can we explain what happened to the US economy in the 1970s with the AD/AS model?

- In our model these shocks can be represented as: $\rho \uparrow$ and $\pi^e \uparrow$
- If these variables increase, the AS curve shifts upwards
- This causes higher inflation
- Our model will also predict stagnation or even a recession, which actually happened in the 70's