1. The aggregate supply, aggregate demand (AS-AD) model

The AS-AD model is an orthodox model built to analyze the fluctuations of real GDP Y and the inflation rate π. The model can be used to provide explanations of the business cycle (changes in the level of economic activity and the dynamics of the general price level) and, more specifically, to determine the impact on Y and π of exogenous shocks. The model is like a macroeconomic version of the competitive market model in which the whole economy is taken to be the market. The model is used to ascertain the impact on Y and π of economic shocks.

2. Aggregate supply (AS) function

The AS function establishes, for every amount Y of aggregate production (real GDP), the inflation rate π that results in the economy during the period of time in which Y is produced. The interpretation of the AS function represented below in Fig. 1 is that, when Y_0 is produced, the economy generates inflation rate π_0. The function is assumed to be upward-sloping up to a certain inflation rate π'. It is for that section that the function is read in the direction from Y to π, that is, production determines inflation. The upward-sloping section has two regions: the inflationary and the non-inflationary regions.

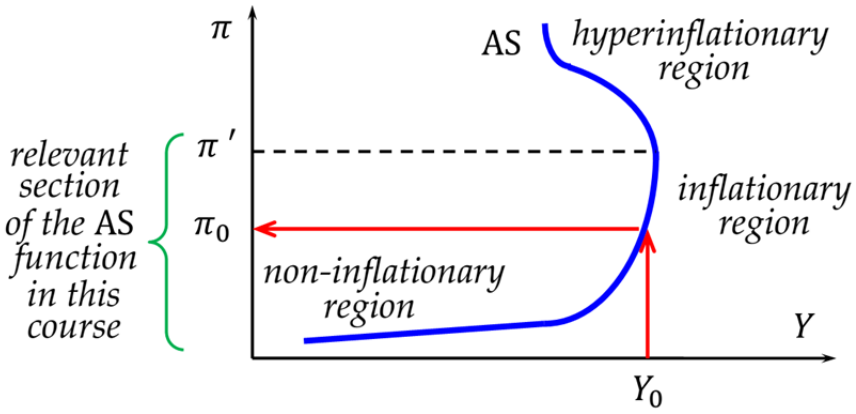


Fig. 1. The AS function

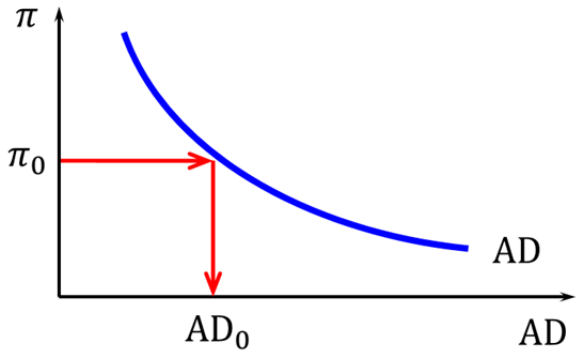


Fig. 2. The AD function

3. Non-inflationary region of an AS function

The non-inflationary region (that may start for negative inflation rates) of an AS function represents the states of the economy in which Y can grow without rising π significantly: there are idle resources usable to increase production without creating a pressure on costs and prices.

4. Inflationary region of an AS function

The inflationary region of an AS function represents the states of the economy where producing more requires accepting more inflation (inflation in this region is cost-push inflation). Some reasons for the speed-up of inflation in the inflationary region are listed next.

- Competition for resources. The amount of resources is finite. Hence, as the economy approaches potential GDP, firms encounter resource bottlenecks. Eventually, firms can only obtain more inputs by detracting them from other firms. This requires paying more for those inputs to attract them.
- Training costs. More production eventually demands hiring more workers, who in general should be trained to be able to operate efficiently.

- Reorganization costs. Changing the scale of production may require a redesign of the production process, which is costly.
- Diminishing marginal productivity. Apparently, production processes eventually face the principle of diminishing marginal productivity: each additional unit of input will add less to total production. This means that, to produce the same again, more inputs are needed and costs therefore increase.

5. Hyperinflationary region of an AS function

The hyperinflationary region of an AS function represents the states of the economy where the production activities no longer run smoothly, because prices are changing so fast (there is hyperinflation) that agents in the economy are more concerned with the preserving purchasing power of the money they earn or have than with carrying the usual economic activities. As the normal operation of the productive system is disturbed under an excessive inflation, AS functions on the hyperinflationary region are assumed downward-sloping: above a certain inflation rate (π' in Fig. 1), the higher the inflation rate, the smaller aggregate production. Since advanced economies do not experience hyperinflations, from now on the hyperinflationary region will be disregarded from the analysis.

6. Aggregate demand (AD) function

Aggregate demand AD is the sum of four components: C (aggregate planned consumption), I (aggregate planned investment), G (planned government purchases), and NX (aggregate planned net exports). The AD function establishes, for each inflation rate π, the total amount AD of planned aggregate expenditure. The interpretation of the AD function represented above in Fig. 2 is that, when the inflation rate is π_0, the economy generates the amount AD_0 of total expenditure. AD functions are assumed to be downward-sloping: the higher the inflation rate, the smaller total expenditure.

7. Why AD functions are supposed decreasing

The following are basic reason that could justify that AD decreases as π increases.

- **Reason 1**: as the inflation rate grows, purchasing power diminishes and, as a result, consumption tends to diminish.
- **Reason 2**: as the inflation rate grows, the central bank raises the nominal interest rate i, which leads to a fall in consumption and investment. The rise in the interest rate causes an appreciation of the nominal exchange rate e, which erodes competitiveness and makes net exports decline.
- **Reason 3**: a rise in the inflation rate erodes competitiveness, which tends to reduce net exports.

8. Other effects captured by AD functions: the Keynes effect

The Keynes effect or interest rate effect is summarized by the following sequences:

$$\downarrow \mathrm{P} \Rightarrow \uparrow \frac{\mathbf{M1}}{\mathrm{P}} \Rightarrow \text{excess of money holdings} \Rightarrow \uparrow\text{purchases of financial assets} \Rightarrow \ \ldots$$
$$\ldots \Rightarrow \uparrow\text{price of financial assets} \Rightarrow \downarrow i \Rightarrow \uparrow\text{borrowing} \Rightarrow \uparrow \mathrm{C}\ \uparrow \mathrm{I} \Rightarrow \uparrow \mathrm{AD}$$

$$\downarrow \mathrm{P} \Rightarrow \downarrow\text{demand for liquidity} \Rightarrow \downarrow i \Rightarrow \uparrow\text{borrowing} \Rightarrow \uparrow \mathrm{C}\ \uparrow \mathrm{I} \Rightarrow \uparrow \mathrm{AD}\,.$$

9. Other effects captured by AD functions: the Pigou effect

The Pigou effect, Pigou wealth effect, or real balance effect is summarized by the following sequence:

$$\downarrow P \Rightarrow \uparrow \text{wealth in realm terms} \Rightarrow \uparrow C \uparrow I \Rightarrow \uparrow AD\,.$$

The Polish economist Michał Kalecki put forward some objections to the Pigou effect:

$$\downarrow P \Rightarrow \uparrow \text{debt in realm terms} \Rightarrow \uparrow \text{bankruptcies} \Rightarrow \downarrow \text{loans} \Rightarrow \downarrow C \downarrow I \Rightarrow \downarrow AD$$

$$\downarrow P \Rightarrow \text{consumption delayed if further price falls are expected} \Rightarrow \downarrow C \Rightarrow \downarrow AD\,.$$

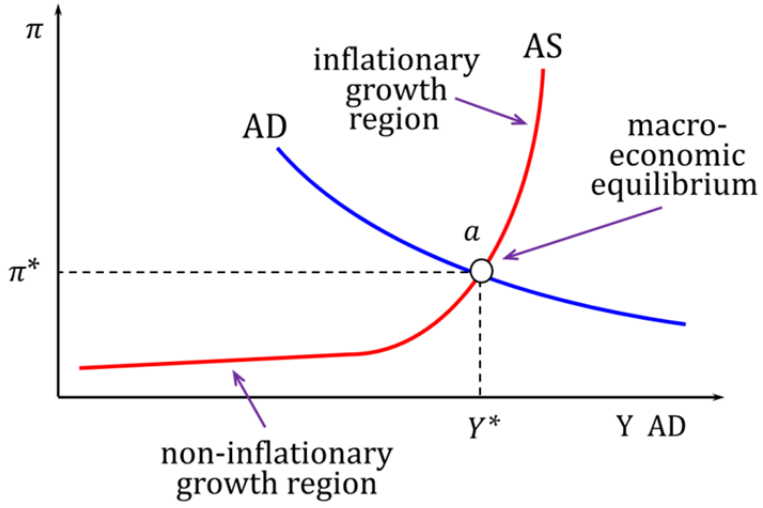
10. Other effects captured by AD functions: the net exports effect

The net export effect or open economy effect is summarized by the following sequence:

$$\downarrow P \Rightarrow \text{consumers switch from foreign to domestic goods} \Rightarrow \downarrow \text{imports} \Rightarrow \uparrow NX \Rightarrow \uparrow AD\,.$$

11. Macroeconomic equilibrium

The macroeconomic equilibrium condition states that $Y = AD$: aggregate production equals planned aggregate expenditure. Any pair (Y^*, π^*) satisfying the macroeconomic equilibrium condition is a macroeconomic equilibrium, where Y^* is the equilibrium production (equilibrium GDP, equilibrium income) and π^* is the equilibrium inflation rate. Geometrically, a macroeconomic equilibrium is represented by the intersection of the AS function and the AD function; see Fig. 3 on the left.



Not everything is constant along an AS function: wages, for instance, may change. That change is endogenous in the sense that it is generated by the production sector itself.

Not everything is constant along an AD function: i and e, for instance, may change (the change in i is the result of a built-in feature of the model: the automatic response of the central bank to rising inflation).

Fig. 3. Equilibrium in the AS-AD model

12. Aggregate supply and aggregate demand are interdependent

An AS function captures the production capacities of an economy. These capacities depend on the means of production, or capital goods, available. Capital goods are the accumulation of the flow of investment. And investment is a component of AD functions. It then follows that an increase in investment affects the aggregate demand (initially) and the aggregate supply (later). On the other hand, consumption depends on income, which is turn is generated by production activities. In view of this, whether the change in a variable modifies the AS or the AD function will depend on which variables are allowed to change when each function is defined. That makes the AS-AD model a tool of doubtful usefulness.

13. Shifts in an AS function

• Negative shocks to an AS function. An AS function is expected to shift to the left when:
– production costs rise exogenously (for instance, an oil shock for an oil importing economy or the government declares a wage increase);
– the amount of resources (factors of production) falls;
– less credit is available;
– the number of firms is reduced;
– the government rises taxes;
– the inflation rate is expected to rise in the next period (likely effect);
– more pessimistic expectations of businessmen on the evolution of the economy (for example because AD has been falling for a certain number of periods);
– investment falls.

• Positive shocks to an AS function. An AS function is expected to shift to the right when:
– production costs fall exogenously;
– the amount of resources increases;
– more credit is available;
– the number of firms rises;
– the government lowers taxes;
– previous investments become operative;
– technological progress applied to production;
– improvements in the organization of production;
– productivity increases;
– businessmen adopt optimistic (profit) expectations;
– supply-side reforms are applied (these are policy measures whose goal is to expand the economy's ability to supply goods).

14. Shifts in an AD function

• Positive shocks to consumption. Consumption (and therefore AD) is positively affected by:
– increases in income and wealth (for instance, a rise in the price of financial assets);
– an increase in the number of consumers (more population);
– the expectation that income, wealth, the inflation rate, or the interest rate will grow in the future (better to consume now than later);
– a reduction in taxes or a rise in transfers;
– the reduction in the (real) interest rate;
– credit made more easily available.

• Positive shocks to investment. Investment (and therefore AD) is positively affected by:
– favourable expectations by businessmen on profits or on the evolution of the economy;
– an increase in the number of firms;
– subsidies stimulating investment;
– a reduction in taxes on profits;
– the reduction in the (real) interest rate;
– credit made more easily available;
– technological progress and, in general, the diffusion of innovations.

• Positive shocks to net exports. Net exports (and therefore AD) are positively affected by:
– a reduction in domestic income (less imports);
– an increase in foreign income (more exports);
– a depreciation of the nominal exchange rate (domestic goods become cheaper);
– a reduction in domestic inflation in comparison to the rest of the world (competiteveness is gained);
– an increase in foreign inflation in comparison to domestic inflation;
– government subsidies to exports;
– a rise in tariffs.

15. Changes in the macroeconomic equilibrium due to shifts in the AD function

Fig. 4 shows the primary (most immediate) effect on the macroeconomic equilibrium of an expansion (shift to the right) of the AD function: the equilibrium inflation rate and production both rise. An contraction (shift to the left) of the AD function causes the opposite result. This general conclusion should be qualified: if the economy lies in the non-inflationary region, the increase in the inflation rate may be negligible (and the expansion only creates growth). In contrast, if the economy lies ahead in the inflationary region (and near the potential GDP), it is the increase in production that may be negligible (so the expansion mostly creates inflation).

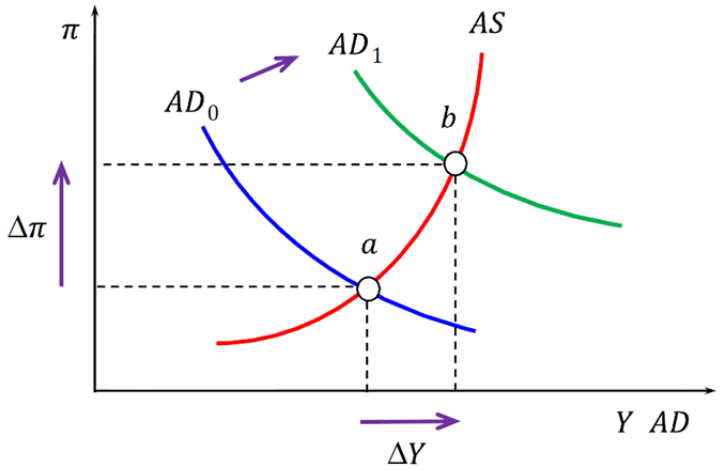


Fig. 4. Effects of an AD expansion

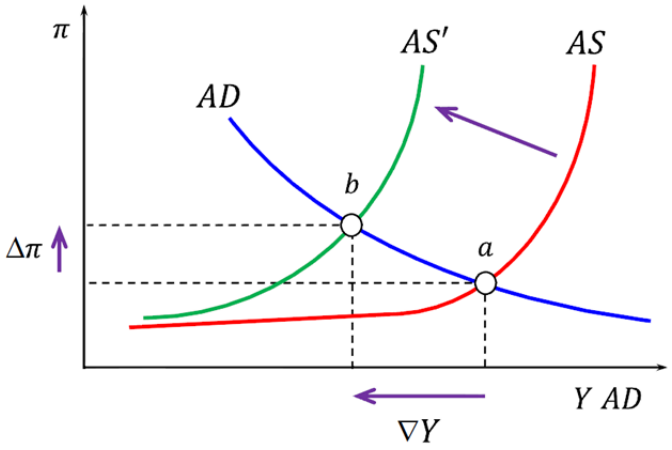


Fig. 5. Effects of an AS contraction

16. Changes in the macroeconomic equilibrium due to shifts in the AS function

Fig. 5 shows the primary (most immediate) effect on the macroeconomic equilibrium of a contraction (shift to the left) of the AS function: the equilibrium inflation rate rises but production declines. Stagflation is a short-hand for 'stagnant economy with rising inflation' and corresponds to the simultaneous occurrence of a increase of the inflation rate and a decrease of GDP (Western economies all experienced staglation in the 1970s). An expansion (shift to the right) of the AS function causes the opposite result: non-inflationary growth. The US economy experienced non-inflationary growth in the 1990s and it was at the time speculated that a *New Economy* was born capable of sustaining non-inflationary growth thanks to continuous productivity gains created by the digital revolution.

17. Changes in the macroeconomic equilibrium are in general self-replicating

The effects of either an AD or an AS shock need not be limited to the primary effects, because the new macroeconomic equilibrium need not be stable. Consequently, the initial shock may induce more shocks. For instance, subsequent changes in the macroeconomic equilibrium may be easily caused by the revision of expectations that the initial shock, in altering the state of the economy, proved to be wrong. In particular, when representing the AD and AS functions, the expected inflation rate (π^e) caused by the initial shock is supposed given. Hence, after a shock leads the inflation rate to an unexpected level, the update of expectations may cause further changes in the AD and/or the AS function. To illustrate the role of inflationary expectations, suppose the economy is at point a in Fig. 6. The initial shock is an increase in foreign income (foreign GDP). This represents a positive shock to the AD function, because the higher foreign income leads a higher value of net exports. As the AD function shifts to the right, the macroeconomic equilibrium moves from a to b. Suppose the initial AD function is drawn assuming a

correct expected inflation rate: $\pi^e = \pi_a$. After the shock, the inflation rate raises to π_b, so people realize that their former expectation was incorrect: inflation is higher than expected. People will probaly revise π^e upwards. As the inflation rate is expected to increase, consumers anticipate purchases. This shifts the AD function from AD′ to AD″, which stimulates the economy further. If the revised expectation on the inflation rate is smaller than the new equilibrium inflation rate π_c, inflationary expectations will continue to grow. The expectation of a higher inflation generates a higher inflation: the Tinkerbell effect.

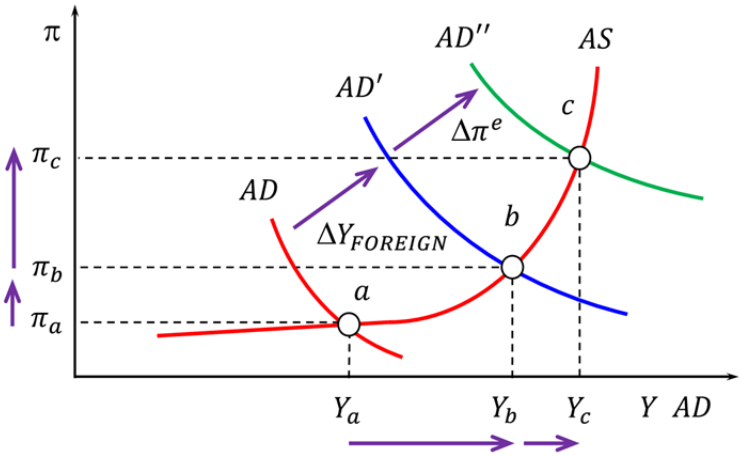


Fig. 6. Secondary effects of an AD expansion

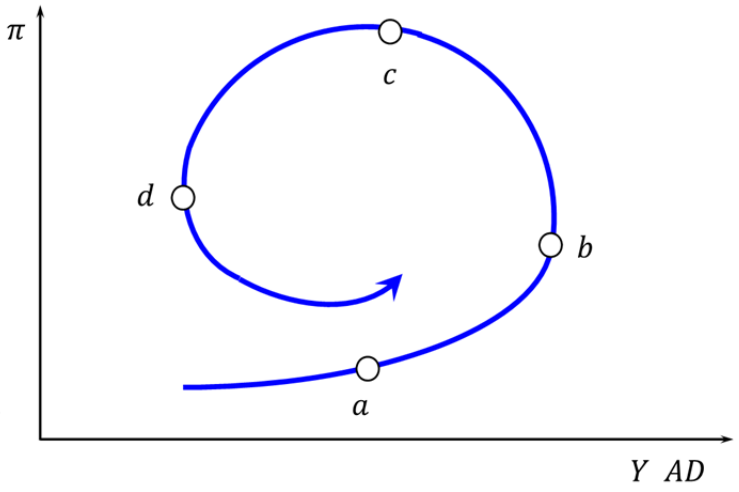


Fig. 7. A business cycle loop in the AS-AD model

18. The business cycle in the AS-AD model

The self-replicating nature of shocks explains the sustainability of the expansionary phase of the business cycle (and also the sustainability of the contractionary one). Fig. 7 represents the dynamic pattern that is reasonable to expect during the business cycle.

- From a to b the economy lies in the expansionary phase of the business cycle: GDP and π both grow.
- From b to c the economy enters the contractionary phase: GDP falls while some inflation inertia still pushes π up.
- From c to d the economy deepens into the contractionary phase: GDP and π both fall.
- From d onwards the economy enters again an expansionary phase, now enjoying GDP growth with declining π.

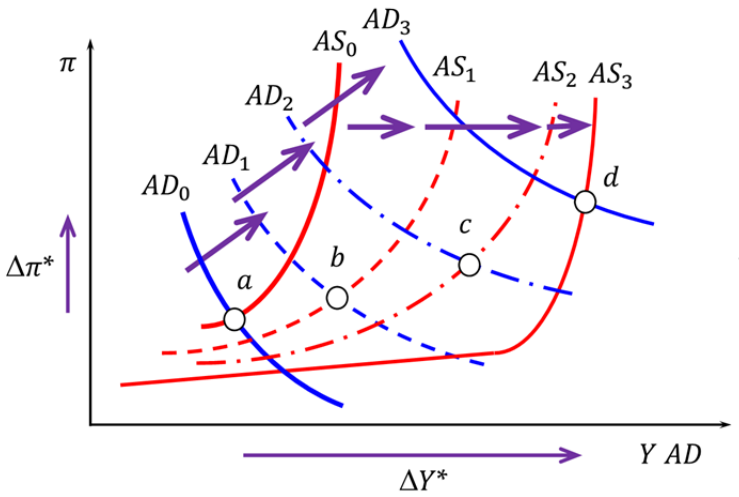


Fig. 8. A booming economy

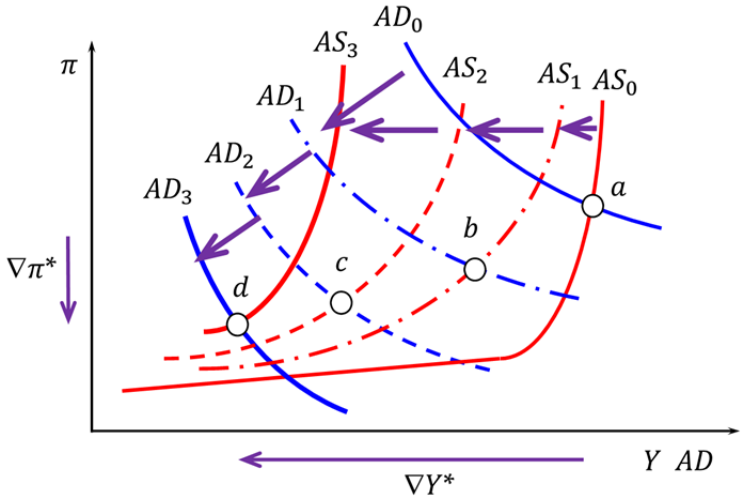
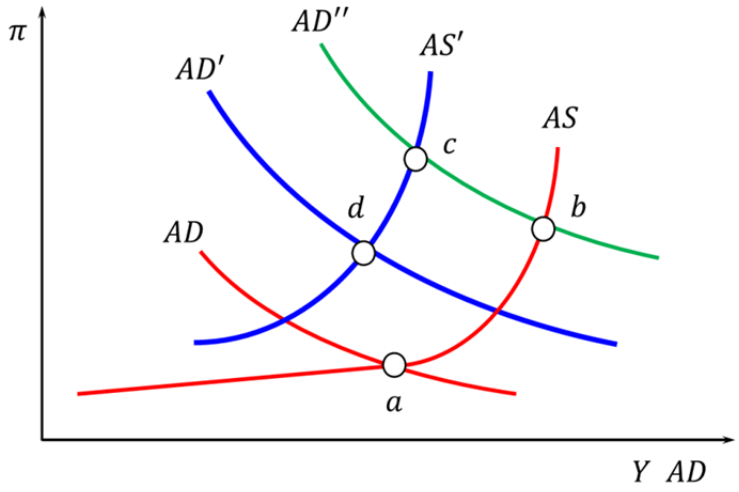


Fig. 9. A slumping economy

Figs. 8 and 9 illustrate how the expansion and recession periods of the business cycle arise: a continuous shift in, typically, both functions. Fig. 8 indicates the typical changes in the AS and AD functions that characterize the expansionary phase of the business cycle, whereas Fig. 9 displays the typical changes in the AS and AD functions that characterize the contractionary phase.

19. An example that generates a business cycle in the AS-AD model



The following example provides an illustration of how the path of production and inflation rate in Fig. 7 can arise. Let *a* in Fig. 10 represent the initial state of the economy. Wages are being negotiated and workers expect a certain increase in wages. At the expense of the future wage increase, workers rise consumption now. AD shifts to AD'' and *b* is reached. By then the result of the negotiations are known: wages rise but less than expected.

Fig. 10. Generating a business cycle

Being wages a production cost, the wage increase shifts the AS function to the left, from AS to AS'. The equilibrium goes from *b* to *c*. But since the wage surge was smaller than expected, workers cut consumption (AD'' moves to AD') and *d* is reached. An interesting lesson of this example is that the cause of the business cycle is the incorrect perception of reality; specifically, mistakes in anticipating the future. If ignorance causes business cycles, there is little hope in eliminating GDP fluctuations completely.

20. The textbook view: short run vs long run

Orthodox textbooks make production converge to a long run fixed production level representing potential GDP, which is (unrealistically) presumed to be given and unaffected by short run decisions. This assumption is debatable, as one may contend that there is no long run but a sequence of short runs. The orthodox textbook view seems to miss at least two relevant considerations.

- AD and AS are interdependent: investment is an AD component that contributes to the productive capacity of the economy; and the installed capacity depends on expected sales (and thus on AD).
- The phenomenon of hysteresis: short run decisions may have long run permanent and different consequences (the butterfly effect), so the state eventually reaches an economy depends on history: the sequence of decisions that made each short run. [The butterfly effect states that chaotic and/or complex systems are sensitively dependent on initial conditions: a trivially small change in the characteristics of an economy can lead to large qualitative changes in economic outcomes (a butterfly flapping its wings could in theory cause a large-scale change in the weather on the other side of the planet). For economic modeling and analysis, the butterfly effect means that small errors in data, or criteria to aggregate or round off data, could drastically alter the predicted results.]

"The long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is past the ocean is flat again." John Maynard Keynes, *A Tract on Monetary Reform*, 1923, chapter 3.

21. The expenditure multiplier effect

The expenditure multiplier effect explains how the transition from a to b in Fig. 4 unfolds. The following example illustrates the concept and the mechanism generating the multiplier effect.

Example. Let the AD function only depend on C and I, so $AD = C + I$. Let I be constant. Specifically, $C = 4 + 0.8Y - \pi$ and $I = 10$ (where π is a percentage and the value 0.8 is the marginal propensity c to consume: which fraction of an additional unit of income is consumed). The AS function is $Y = 30 \cdot \pi$. The macroeconomic equilibrium (Y^*, π^*) is obtained from the equilibrium condition $Y = AD$. That is, $Y = 4 + 0.8 \cdot Y - \pi + 10$. Therefore, $0.2 \cdot Y = 14 - \pi$. As $Y = 30 \cdot \pi$, $\pi^* = 2$ is the equilibrium inflation rate. Given $\pi^* = 2$, the AS function yields the equilibrium production level $Y^* = 30 \cdot 2 = 60$.

Suppose that investment I increases. This may be due to the fact that businessmen's expectations suddenly become more optimistic about the level of economic activity or the expected level of profits. The impact on Y^* of a change in the AD function is the result of an expenditure multiplier effect. Given that expenditure AD depends on income Y and, in equilibrium $Y = AD$, the sequence $\uparrow AD \rightarrow \uparrow Y \rightarrow \uparrow AD \rightarrow \uparrow Y \rightarrow \ldots$ is generated, so a change in AD multiplies itself.

• **Case 1. Temporary demand boost with constant inflation rate**. Imagine that investment jumps from 10 to 17 but only temporarily, just for one period (for example, businessmen's optimism vanishes quickly). To make the multiplier effect easier to grasp, assume that the inflation rate does not change and remains at 2%. This means that it is as if the AS function were horizontal at $\pi = 2$: the economy absorbs any increase in planned expenditure without fuelling inflation. Table 11 shows the dynamics of all the variables involved when it is presumed that GDP today is yesterday's aggregate demand AD.

temporary shock on I with constant inflation

time	$Y_t = AD_{t-1}$	ΔY	$C_t = 4 + 0.8 \cdot Y_t - \pi$	I	$AD = C + I$	$\pi = 2$
0	60	–	$4 + 0.8 \cdot 60 - 2 = 50$	10	60	2
1	60	0	$4 + 0.8 \cdot 60 - 2 = 50$	17	$50 + 17 = 67$	2
2	67	7	$4 + 0.8 \cdot 67 - 2 = 55.6$	10	$55.6 + 10 = 65.6$	2
3	65.6	–1.4	$4 + 0.8 \cdot 65.6 - 2 = 54.48$	10	$54.48 + 10 = 64.48$	2
4	64.48	–1.12	$4 + 0.8 \cdot 64.48 - 2 = 53.58$	10	$53.584 + 10 = 63.584$	2
5	63.58	–0.896	$4 + 0.8 \cdot 63.58 - 2 = 52.86$	10	$52.86 + 10 = 62.86$	2
...	...	...	...	10	...	...
∞	60	–	$4 + 0.8 \cdot 60 - 2 = 50$	10	$50 + 10 = 60$	2

equilibrium

Table 11. The multiplier effect generated by a temporary AD shock with constant inflation rate

The increase in investment takes place in period 1. Seven additional investment (AD) units become seven additional aggregate production units in period 1. In period 2, production adjusts to the demand boost, so aggregate income in period 2 is 67. AD in period 2 is subject to two changes: first, investment returns to its previous level (from 17 to 10); and second, as income has grown (from 60 to 67), consumption also grows. Unfortunately, the fall in investiment (7 units) is larger than the rise in consumption (5.6 units). For this reason, AD diminishes 1.4 units: from 67 to 65.6.

For period 3, then, aggregate production (and, hence, income) declines, from 67 to 65.6. Investment remains constant but the fall in income causes a fall in consumption, which goes from 55.6 to 54.48. As a result, AD goes down as well in period 3. Consequently, production and income fall in period 4: from 65.6 to 64.48. And what occurred in period 3 repeats itself in period 4: the income reduction contracts consumption, which decreases aggregate demand. The sequence of events is then as follows:

$$\uparrow I_1 \Rightarrow \uparrow AD_1 \Rightarrow \uparrow Y_2 \Rightarrow \uparrow C_2 \Rightarrow \downarrow AD_2 \Rightarrow \downarrow Y_3 \Rightarrow \downarrow C_3 \Rightarrow \downarrow AD_3 \Rightarrow \downarrow Y_4 \Rightarrow \downarrow C_4 \Rightarrow \downarrow AD_4 \Rightarrow \ldots$$
$$\Uparrow$$
$$\downarrow I_2$$

The state at which the economy eventually converges is described by equations $Y = AD$, where $AD = 4 + 0.8 \cdot Y - \pi + 10$, and $\pi = 2$. Hence, $Y = 4 + 0.8 \cdot Y - 2 + 10 = 12 + 0.8 \cdot Y$. That is, $0.2 \cdot Y = 12$, so $Y = 60$. The final conclusion is that the temporary increase in aggregate demand has no permanent effect on aggregate production and income: the impact of the initial spending stimulus eventually vanishes.

• **Case 2. Permanent demand boost with constant inflation rate**. Imagine now that investment jumps permanetly from 10 to 17. Assume again that the inflation rate does not change and remains at 2%. Table 12 provides the sequence of changes caused by the permanent demand boost. The sequence of events is

$$\uparrow I_1 \Rightarrow \uparrow AD_1 \Rightarrow \uparrow Y_2 \Rightarrow \uparrow C_2 \Rightarrow \uparrow AD_2 \Rightarrow \uparrow Y_3 \Rightarrow \uparrow C_3 \Rightarrow \uparrow AD_3 \Rightarrow \uparrow Y_4 \Rightarrow \uparrow C_4 \Rightarrow \uparrow AD_4 \Rightarrow \ldots$$

permanent shock on I with constant inflation

multiplier effect

time	$Y_t = AD_{t-1}$	ΔY	$C_t = 4 + 0.8 \cdot Y_t - \pi$	I	AD = C + I	$\pi = 2$
0	60	–	$4 + 0.8 \cdot 60 - 2 = 50$	10	60	2
1	60	0	$4 + 0.8 \cdot 60 - 2 = 50$	17	$50 + 17 = 67$	2
2	67	7	$4 + 0.8 \cdot 67 - 2 = 55.6$	17	$55.6 + 17 = 72.6$	2
3	72.6	5.6	$4 + 0.8 \cdot 72.6 - 2 = 60.08$	17	$60.08 + 17 = 77.08$	2
4	77.08	4.48	$4 + 0.8 \cdot 77.08 - 2 = 63.66$	17	$63.66 + 17 = 80.66$	2
5	80.66	3.58	$4 + 0.8 \cdot 80.66 - 2 = 66.53$	17	$66.53 + 17 = 83.53$	2
...	...	...	...	17	...	...
∞	95	–	$4 + 0.8 \cdot 95 - 2 = 78$	17	$78 + 17 = 95$	2

equilibrium

Table 12. The multiplier effect generated by a permanent AD shock with constant inflation rate

The difference with respect to Case 1 is the multiplier effect of the additional investment that takes place every period. Given that the investment boost of 7 units is permanent, there are 7 units more of expenditure each period, so aggregate income is at least 7 units higher each such period. But with higher income comes higher consumption, which represents more demand and, for the next period, more income: that is the multiplier effect. The initial increase in demand and income multiplies itself period after period due to the feedback between consumption and income: more consumption today is more income tomorrow and more income tomorrow is more consumption tomorrow.

The economy eventually converges to a state described by equations $Y = AD$, where $AD = 4 + 0.8 \cdot Y - \pi + 17$, and $\pi = 2$. Thus, $Y = 4 + 0.8 \cdot Y - \pi + 17 = 19 + 0.8 \cdot Y$. That is, $0.2 \cdot Y = 19$, so $Y = 95$. To sum

up, expenditure has only been increased 7 units (from $I = 10$ to $I = 17$), but production and income have risen 35 units (from $Y = 60$ to $Y = 95$). This is caused by the multiplier effect. In this case, the multiplier is 5, which equals $1/(1 - c)$: one aditional unit of expenditure eventually generates 5 units of income.

• **Case 3. Permanent demand boost with variable inflation rate**. Imagine finally that investment jumps permanently from 10 to 17, but that the inflation rate changes according to the AS function. It is assumed that current consumption depends on past inflation. Table 13 calculates the path followed by the variables in the model as a result of the permanent demand boost and the inflation adjustment.

permanent shock on I with inflation adjustment

multiplier effect

time	$Y_t = AD_{t-1}$	ΔY	$C_t = 4 + 0.8 \cdot Y_t - \pi_{t-1}$	I	$AD = C + I$	$\pi = Y/30$
0	60	–	$4 + 0.8 \cdot 60 - 2 = 50$	10	60	2
1	60	0	$4 + 0.8 \cdot 60 - 2 = 50$	17	$50 + 17 = 67$	2.23
2	67	7	$4 + 0.8 \cdot 67 - 2.23 = 55.37$	17	$55.37 + 17 = 72.37$	2.41
3	72.37	5.37	$4 + 0.8 \cdot 72.37 - 2.41 = 59.48$	17	$59.48 + 17 = 76.48$	2.54
4	76.48	4.11	$4 + 0.8 \cdot 76.48 - 2.54 = 62.64$	17	$62.64 + 17 = 79.64$	2.65
5	79.64	3.16	$4 + 0.8 \cdot 79.64 - 2.65 = 65.06$	17	$65.06 + 17 = 82.06$	2.73
...	...	...	…	17	...	...
∞	90	–	$4 + 0.8 \cdot 90 - 3 = 73$	17	$73 + 17 = 90$	3

equilibrium

Table 13. The multiplier effect generated by a permanent AD shock with variable inflation rate

When the AS function enters the picture, part of the expenditure is transformed into inflation. With $Y = 30 \cdot \pi$ and $AD = 4 + 0.8 \cdot Y - \pi + 17$, the new macroeconomic equilibrium is given by $\pi^* = 3$ and $Y^* = 90$. This means that inflation eats up 5 units of income, which is 90 instead of 95. In particular, the sequence of events is:

$$\uparrow I_1 \Rightarrow \uparrow AD_1 \Rightarrow \uparrow \pi_1 \Rightarrow \uparrow Y_2 \Rightarrow \uparrow C_2 \Rightarrow \uparrow AD_2 \Rightarrow \uparrow \pi_2 \Rightarrow \uparrow Y_3 \Rightarrow \uparrow C_3 \Rightarrow \uparrow AD_3 \Rightarrow \uparrow \pi_3 \Rightarrow \uparrow Y_4 \Rightarrow \uparrow C_4 \Rightarrow \uparrow AD_4 \Rightarrow \dots$$

$$\Downarrow \qquad \Downarrow \qquad \Downarrow$$

$$\downarrow C_2 \qquad \downarrow C_3 \qquad \downarrow C_4$$

In every period, a factor pushes consumption down (the increase in the inflation rate from the previous period) and another one pushes it up (the increase in aggregate demand from the previous period that generates an increase in aggregate income in the current period). In the above example, the positive effect compensates the negative effect, so consumption increases each period (the multiplier effect) but each time the increase is smaller.

The AS-AD model is interpreted in the sense that the transition from one equilibrium (period 1 in Tables 11-13) to another (period ∞) occurs swiftly (according to the orthodox view, almost instantaneously). The important lesson of Case 3 is that one should visualize Table 13 when, in Fig. 4, one shifts the AD function to the right and concludes that the economy moves from point a to b.