1. The expenditure multiplier effect

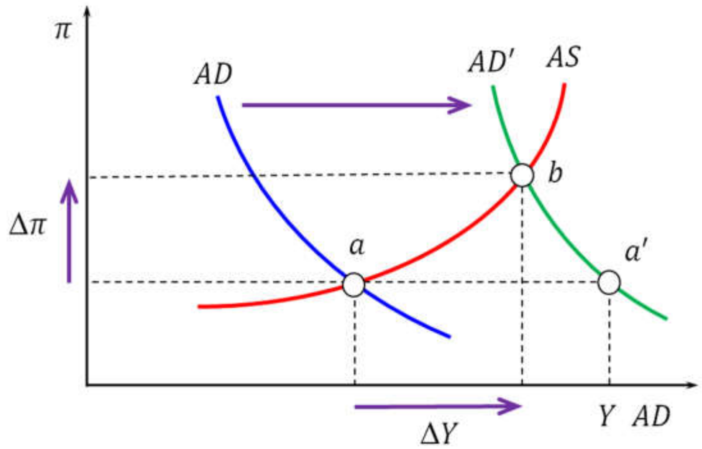


Fig. 1. Effect of a demand expansion

Fig. 1 on the right shows the outcome of a demand expansion: as the macroeconomic equilibrium moves from point a to point b, both GDP and the inflation rate rise. The transition from a to b can be viewed as the result of a multiplier effect involving expenditure. The numerical example presented next illustrates how the expenditure multiplier effect operates.

2. Numerical example of the expenditure multiplier effect

Let the AD function only depend on consumption C and investment 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 the expectations of producers 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; thus, a change in AD multiplies itself.

3. Case 1: temporary demand boost with constant inflation rate

Suppose investment jumps from 10 to 17 but only temporarily, just for one period (for example, the optimism of producers 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 1 below shows the dynamics of all the variables involved when it is presumed that today's GDP 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 1. 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 as follows:

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

$$\Uparrow$$

$$\downarrow I_2 \ \ (\text{with } \downarrow I_2 > \uparrow C_2)$$

The economy eventually converges to a state described by equations $Y = AD$, where $AD = 4 + 0.8 \cdot Y \quad \pi + 10$, and $\pi = 2$. Hence, $Y = 4 + 0.8 \cdot Y \quad 2 + 10 = 12 + 0.8 \cdot Y$. 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.

4. Case 2: permanent demand boost with constant inflation rate

Suppose now that investment jumps permanently from 10 to 17. Assume again that the inflation rate does not change and remains at 2%. Table 2 next 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 2. 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 $AD = 4 + 0.8 \cdot Y \quad \pi + 17$, and $\pi = 2$. Thus, $Y = 4 + 0.8 \cdot Y \quad \pi + 17 = 19 + 0.8 \cdot Y$. 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. The formula of the multiplier in the model on which the example is based is $1/(1 \quad c) = 5$: one aditional unit of expenditure eventually generates 5 units of income.

Case 2 could be captured by the transition from a to a' in Fig. 1. In this transition the inflation rate is supposed to be unaffected by additional expenditure and, as consequence, the multiplier effect operates with full force and produces the maximum impact on GDP. As in case 1, it could be interpreted in case 2 that the AS function is flat: a horizontal line going through point a (that assumption would mean that GDP growth is completely non-inflationary).

5. Case 3: permanent demand boost with variable inflation rate

Suppose finally that investment jumps permanently from 10 to 17, but that the inflation rate changes according to the AS function. Assuming that current consumption depends on past inflation, Table 3 below 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 3. The multiplier effect generated by a permanent AD shock with variable inflation rate

When the AS function is included in the analysis, part of the expenditure is transformed into inflation. With $Y = 30 \cdot \pi$ and $AD = 4 + 0.8 \cdot Y \quad \pi + 17$, 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:

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

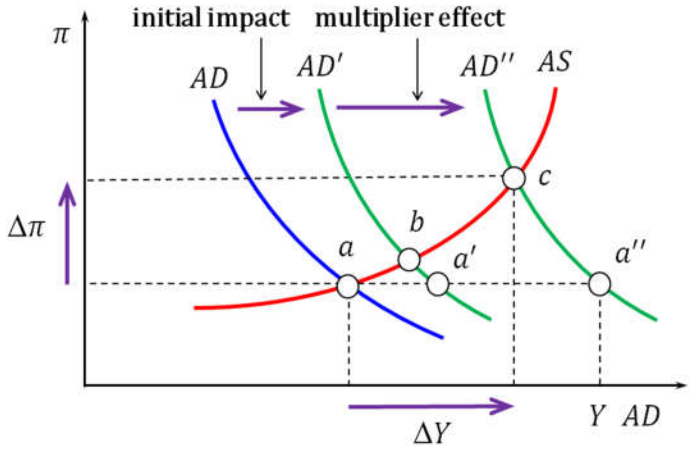
$$\Downarrow \qquad \Downarrow \qquad \Downarrow$$

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

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.

6. The AS-AD model as a summary of the expenditure multiplier process

The interpretation of the AS-AD model presumes that the transition from one equilibrium (period 1 in Tables 1-3) to the next one (period ∞) occurs swiftly (according to the orthodox view, almost instantaneously). The graphical representation of the AS-AD hides the underlying multiplier process and gives the false impression that the initial change in expenditure shifts the AD function directly to its final position. The figure on the right separates the initial impact from the multiplier effect. For instance, an increase in investment would shift the AD function from AD to AD′. Without the inflation impact, the immediate transition would be from point *a* to *a*′. When the effects on both economic activity and inflation are taken into account, the immediate passage would be from point *a* to *b*. Finally, when the effects of the multiplier process are included, the final outcome would be represented by *a*′′ (if the inflation rate is presumed unaltered) or *c* (if the impact of the multiplier process on the inflation rate is also considered).



7. The expenditure multiplier process also works in the reverse

As Table 1 illustrates, the expenditure multiplier process also magnifies the effect of a contraction in expenditure or in economic activity. The left-hand figure below shows that the expenditure multiplier process makes the AS and AD functions interdependent. A contraction in the AS function from AS to AS′ causes the equilibrium to move from *a* to *b*. Since this transition lowers income, aggregate demand is negatively affected and the AD function shifts to the left, from AD to AD′. The intensity of this shift is uncertain. The left-hand figure corresponds to the case in which the fall in the inflation rate caused by the demand contraction dominates the inflation rise associated with the supply contraction, whereas the right-hand figure displays the opposite case in which the supply contraction is dominant.