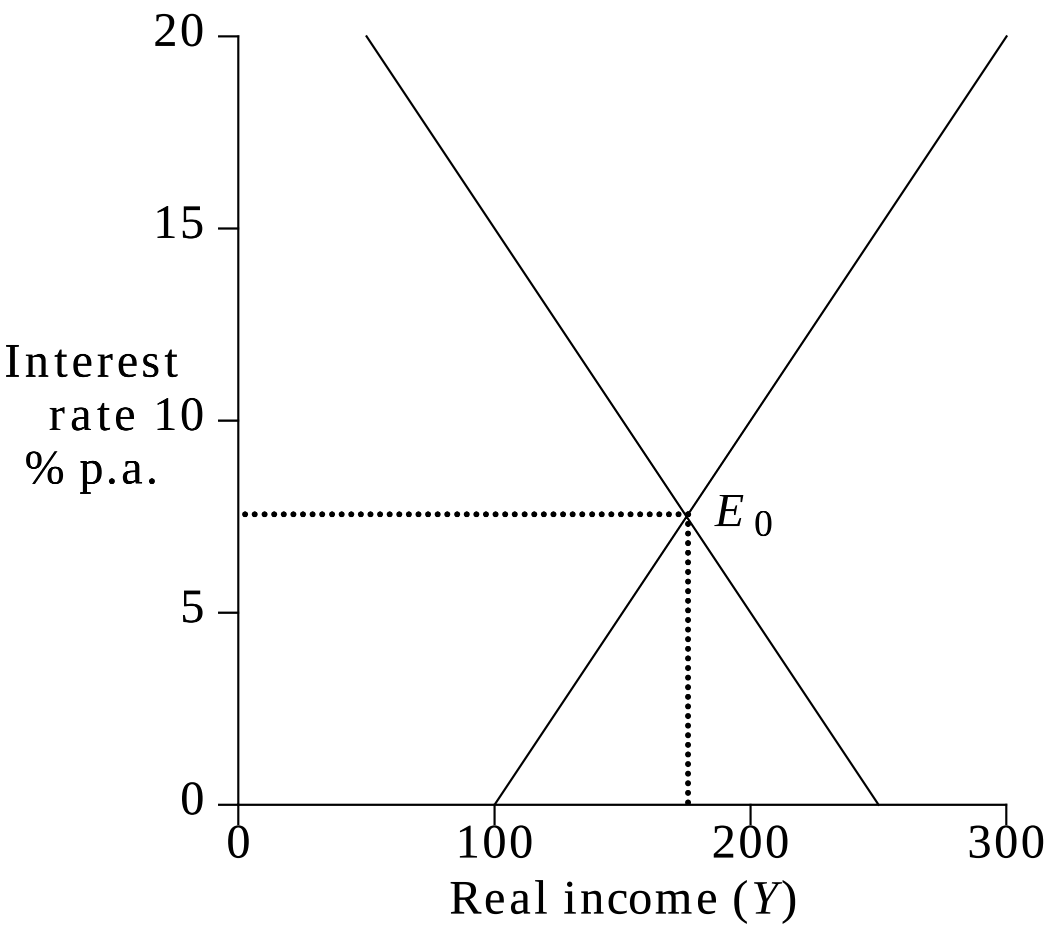
8. Simultaneous Equilibrium in the Commodity and Money Markets

We now combine the IS (commodity-market equilibrium) and LM (money-market equilibrium) schedules to establish a general equilibrium income (Y) and interest rate (r) for this economy. Neither IS nor LM alone can determine the two quantities Y and r. Obviously, equilibrium can only occur at the intersection of the IS and LM curves.



The *general equilibrium* point E_0 corresponds to equilibrium in both sectors — commodities and money. Equilibrium values are: Y = \$175 billion p.a., and r = 7.5% p.a.

8.1 Algebraically

Algebraically,[1] we can write the relationship between autonomous planned expenditure (A_p) and the interest rate (r):

$$A_p = A_0 - br,$$

where b is the interest responsiveness of A_p, in our example \$2.5 billion per percentage point increase in the interest rate. Substituting this into the equation for real income (the solution to the Keynesian cross) we get the equation for the IS schedule:

$$Y = k(A_0 - br), \tag{1}$$

or

$$r = \frac{A_0}{b} - \frac{1}{kb} Y,$$

where k is the multiplier, or the inverse of the marginal leakage rate (MLR).

If $k = 4$ (from $s = 0.25$), $A_0 = 62.5$, and $r = 0$, the intercept of the IS curve is 250, as above.

From above the LM curve shows all combinations of income (Y) and interest rate (r) where supply equals demand in the money market:

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1. From Gordon, Appendix to Chapter 4, pp. 104–107.

$$\left(\frac{M^s}{P}\right) = \left(\frac{M}{P}\right)^d = hY - fr$$

where h is the responsiveness of real money demand to higher income, and f is the interest responsiveness of real money demand ($5 billion per percentage point increase in the interest rate).

Rewriting this equation, we get

$$Y = \frac{\frac{M^s}{P} + fr}{h} \qquad (2)$$

or

$$r = \frac{h}{f} Y - \frac{1}{f} \left(\frac{M^s}{P}\right).$$

The two equations (1) and (2) constitute an *economic model*. With values for the six parameters k, A_0, b, M^s, P, f, and h, we can solve the model for the two unknown variables, Y and r.

For the following parameters:

k	4.0
A_0	$62.5 billion p.a.
b	$2.5 billion per percentage point of r
M^s	$50 billion
P	1.0
f	$5 billion per percentage point of r
h	0.5

we find equilibrium income (Y) of $175 billion p.a. and equilibrium interest rate (r) of 7.5% p.a.

It is possible to eliminate the interest rate r from the model, to get

$$Y = \frac{A_0 + \frac{b}{f}\left(\frac{M^s}{P}\right)}{\frac{1}{k} + \frac{bh}{f}} \tag{3}$$

Equation (3) combines all the information in the IS and LM curves: when (3) is satisfied, both the commodity and money markets are in equilibrium, and it can be used to calculate the unknown, income (Y), as determined by the six parameters.

Because we are interested primarily in the effect on income of a change in A_0 or M^s/P, we can simplify (3):

$$Y = k_1 A_0 + k_2\left(\frac{M^s}{P}\right) \tag{4}$$

where

$$k_1 = \frac{1}{\frac{1}{k} + \frac{bh}{f}} = \frac{1}{\frac{1}{4} + \frac{2.5 \times 0.5}{5}} = 2$$

and

$$k_2 = \left(\frac{b}{f}\right) k_1 = \frac{2.5}{5} \times 2 = 1$$

Equation (4) makes it easy to calculate the new value of Y when there is a change in A_0 caused by fiscal policy, or by a change in business or consumer confidence, and when there is a change in the real money supply (M^s/P) caused by a change in the nominal money supply.

For the values of the four parameters given above, equation (4) becomes:

$$Y = 2A_0 + \left(\frac{M^s}{P}\right) = \$175 \text{ billion}$$

and from equation (1) for the IS curve:

$$r = \frac{A_0}{b} - \frac{1}{kb}Y = 25 - \frac{Y}{10} = 7.5\% \text{ p.a.}$$

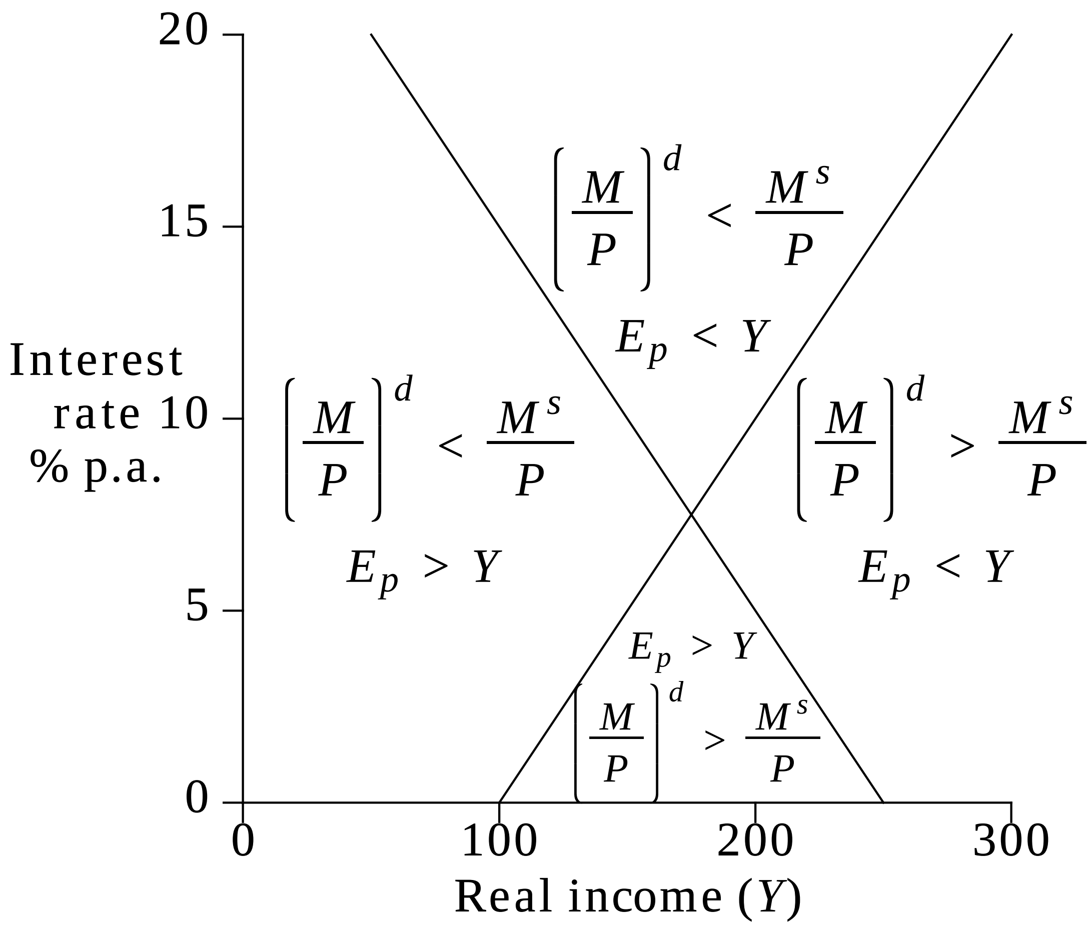
8.2 Disequilibrium adjustment

If the commodity market is out of equilibrium with positive or negative involuntary inventory accumulation, then firms will step up or cut back production, pushing the economy in the direction necessary to reach E_0. If the money market is out of equilibrium, there will be pressure to adjust interest rates, since people will have to sell shares and bonds if they cannot otherwise satisfy their demand for money. Either way E_0 is reached.

We can show this in a figure.

So far the model explains how equilibrium real income (or GDP) and the interest rate are determined, given the following exogenous variables:

- the level of business and consumer confidence
- the single instrument of monetary policy (the money supply M^s)
- the two instruments of fiscal policy (government spending G and tax rates T_0 and



t_0)

- price level P fixed
- net exports NX

9. Strong and Weak Effects of Monetary Policy

Assume that the desired level of income, "natural real GDP", is \$200 billion, and the equilibrium level of real income is only \$175 billion, so there is a \$25 billion gap between actual and desired Y.

By how much must the RBA increase the money supply? It depends on the slopes of the IS and LM curves.

9.1 Strong effects of an increase in the real money supply

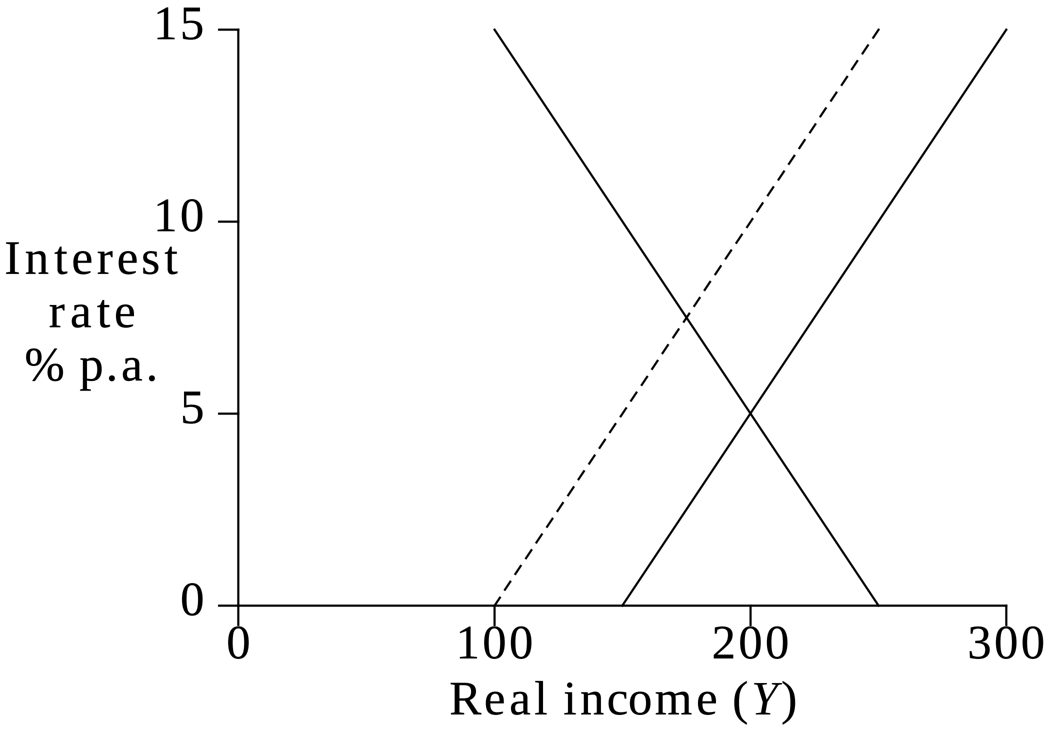
The LM curve has been derived with M^s = \$50 billion, A_0 = \$62.5 billion and $k = 4$. What if the RBA raises M^s to \$75 billion? If P remains at 1, then the real money supply increases similarly, generating an excess supply of money of \$25 billion, cet. par. How can the economy generate a sufficient increase in the real demand for money $(M/P)^d$ to balance the money market?

There are two effects:

- the *liquidity* effect: with more money than they need (for its convenience), individuals shift money into term deposits, shares, bonds, and other assets (commodities), raising the prices of bonds and shares and so reducing the interest rate;
- the lower interest rate raises the desired level of $a + I_p$, requiring an increase in production Y, the *income* effect.

The two effects can be seen on the figure: the increase in M^s/P results in a right-ward shift in the LM curve (at any level of Y the interest rate r drops). Intersection with the IS curve (which doesn't shift) must move down the IS curve. End result: increase in Y and fall in r.

From equation (4), the new Y is \$175 + \$25 = \$200 billion p.a., and from the IS schedule (equation 1),

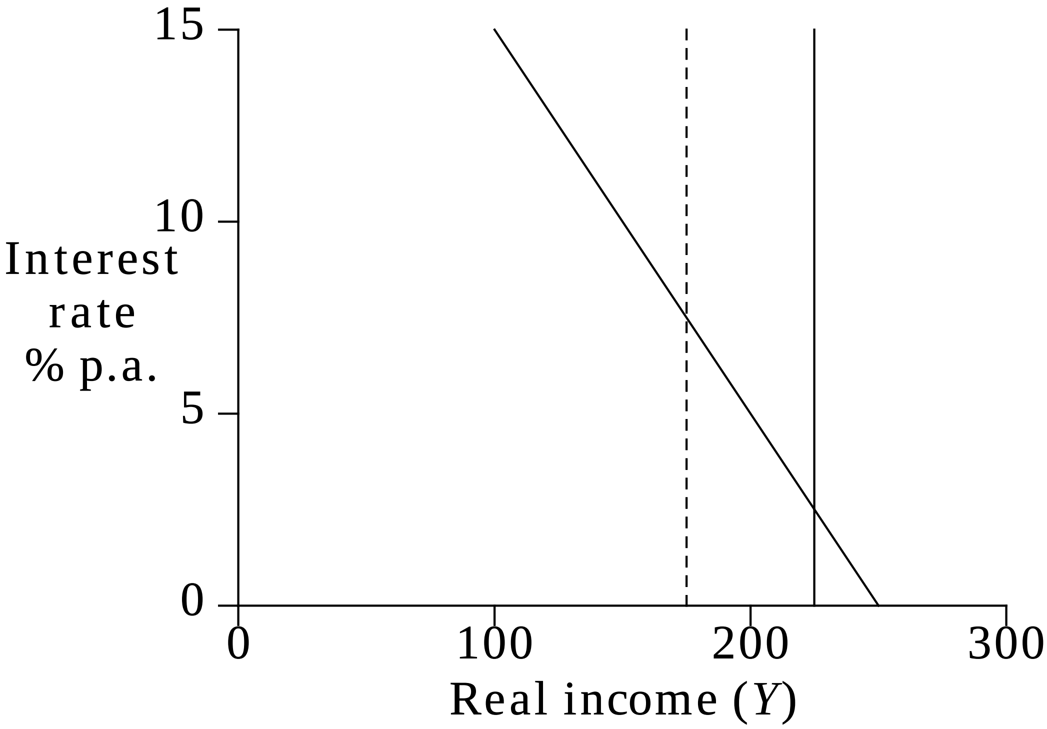


the new r is 7.5 – 2.5 = 5% p.a.

9.1.1 Interest response of money demand: The size of the drop in r depends on f, the interest responsiveness of the real money demand. If f is small, then it takes a very large drop in r to induce individuals voluntarily to hold the higher M^S; a lower f results in a steeper LM curve.

In the extreme case (f=0) the LM curve is vertical, when the demand for money depends only on Y and not at all on r, and there is zero liquidity effect: because the demand for money depends only on Y (f is zero), the injection of more money must stimulate output Y to rise by $50 billion, in order to balance the money market (recall that h is ½: the demand for money increases by half the increase in Y).

This is an example of *strong* monetary policy: some or all of the effect of increased supply of money is



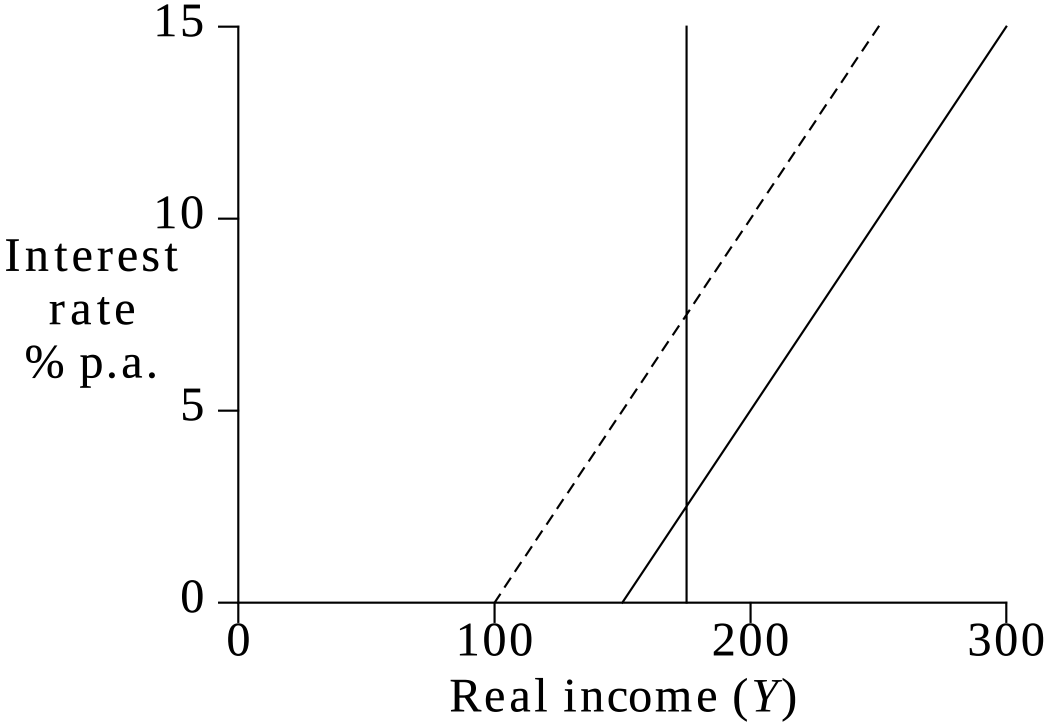
on income *Y*, rather than on interest rate *r*.

9.2 Weak effects of monetary policy

The other extreme is *impotent* monetary policy, which means that the RBA's control over money supply can have no effect on real GDP. Two possible reasons for this:

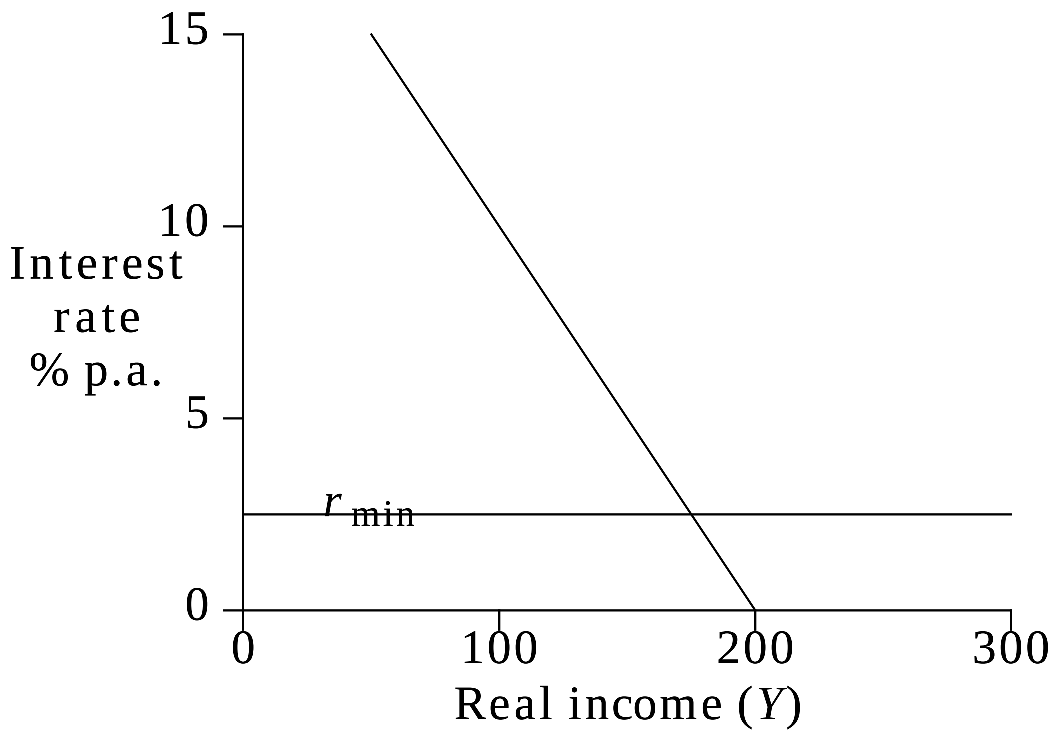
- because all of the effect goes in reducing *r*
- because the higher money supply has no effect on the interest rate (the *liquidity trap*).

9.2.1 Unresponsive expenditures: The first occurs with a vertical IS curve, which means that the interest responsiveness of autonomous planned spending (A_p) is zero (*b* is zero). This might occur in a severe depression as a result of extreme pessimism about the future of investments. In this case fiscal policy would be the only possibility for government stimulus.



9.2.2 Horizontal LM curve: The second occurs when there is floor on the interest rate *r*, as reflected in a horizontal LM curve. The RBA doesn't control *r* directly, only the M^S: an increase in M^S usually reduces *r* as people try to get rid of their excess money by purchasing shares and bonds (higher bond prices ⇔ lower interest rates). But if people, for instance, expect the prices of these assets to fall soon, they will not buy, and the increase in M^S is completely ineffective: the so-called "liquidity trap", with a horizontal LM curve, as shown.

Only if the IS curve was pushed to the right would the desired income level of $200 billion be attained. What if the money supply directly affected the IS curve, the "real balance effect"? Stay tuned.

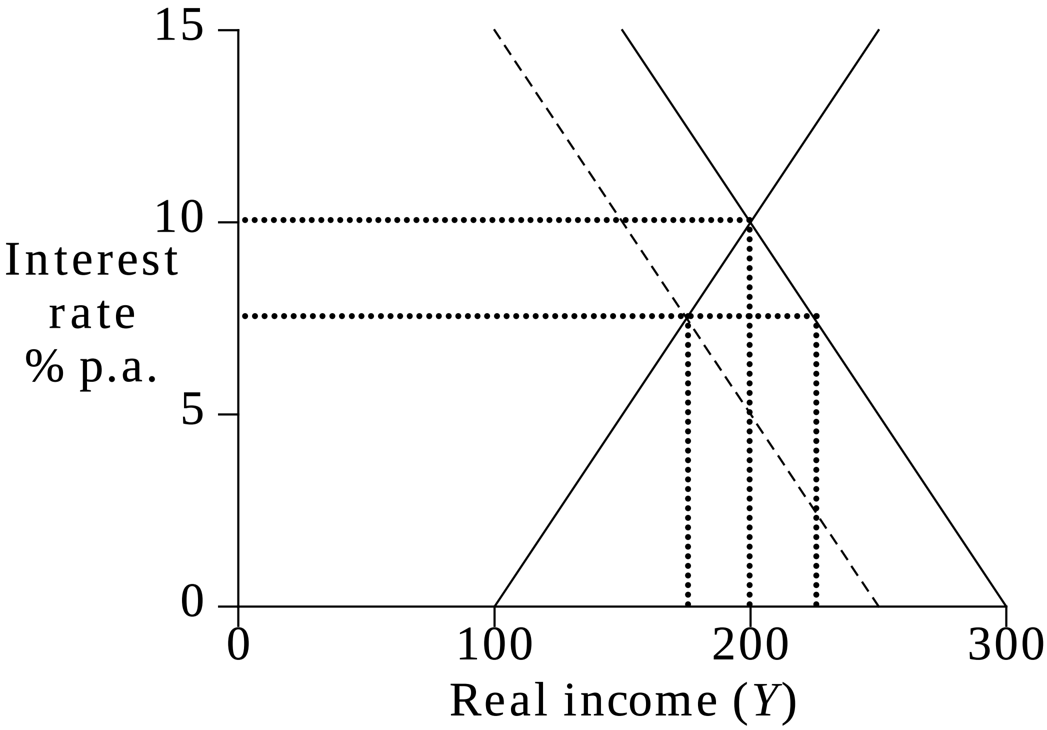


10. Crowding Out: the Normal Effect of Fiscal Expansion

As remarked above, when we considered fiscal stimulus holding interest rates constant in previous lectures, it was equivalent to a horizontal LM curve. Now that interest rates can change, the LM curve is no longer horizontal so that one effect of a fiscal stimulus can now be a rise in interest rates, instead of an increase in equilibrium income Y, as suggested by the Keynesian cross.

10.1 Expansionary fiscal policy shifts the IS curve

Since planned autonomous spending (A_p) includes government spending (G), an expansion in government spending by \$12.5 billion raises A_0 by the same amount and shifts the IS curve to the right by this amount. The figure is plotted with an A_0 of \$62.5 billion for the original IS curve, and an A_0 of \$75 billion for the new IS curve. Because of the multiplier (k = 4), the horizontal distance between the old and new IS curves is 4×12.5 = \$50 billion. How does inclusion of the money market affect such a stimulus?



The original equilibrium was at Y = \$175 billion and r = 7.5%. Were the LM curve horizontal, a ΔG of \$12.5 billion would result in an increase in Y of \$50 billion, the distance of the shift of the IS curve. At the point Y = \$225 billion, r = 7.5%, however, the economy is not in equilibrium: there is excess demand in the money market (in which the real supply of money is constant), although the commodity market clears (since this point falls on the IS curve).

This disequilibrium pushes up interest rates, which reduces the demand for money. The net result is a new equilibrium at Y = \$200 billion and r = 10%.

As r rises, however, private autonomous planned spending ($a + I_p$) falls, eventually by $6.25 billion, or fully half of the $12.5 billion increase in government spending. Half of the original multiplier of 4 is "crowded out".

10.2 The crowding-out effect

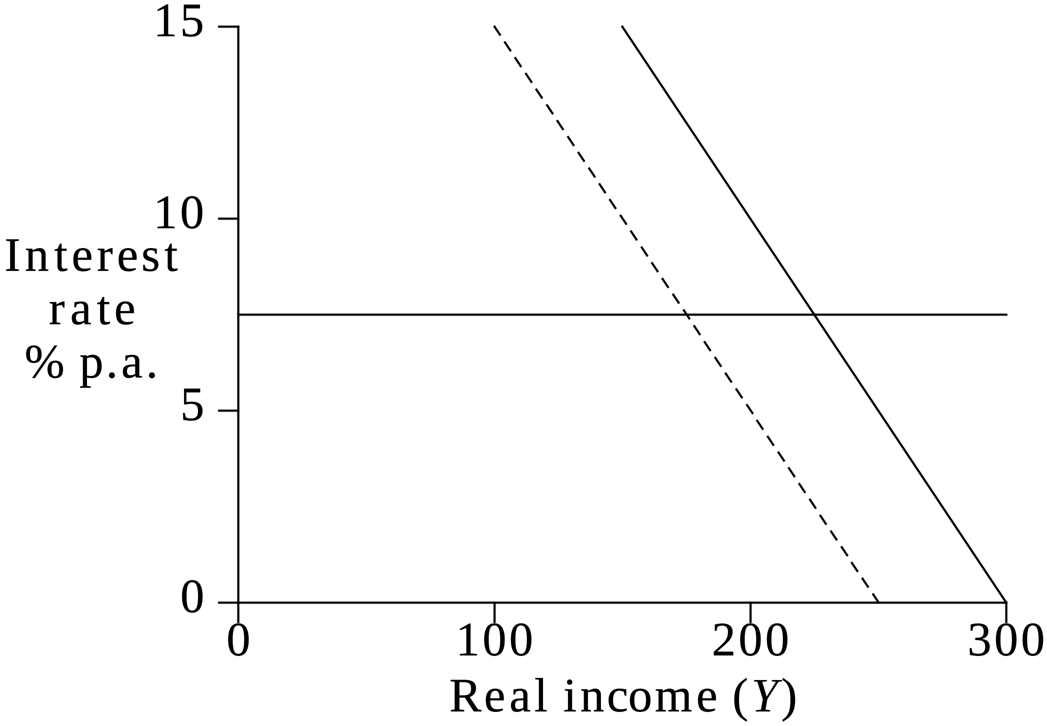
The *crowding-out* effect describes the effect of an increase in government spending or of a reduction in tax rates in reducing ("crowding out") the amount of one or more other components of private expenditures. But compare the two equilibria, old and new:

	Old	New
Government purchases G	0	12.5
Autonomous private spending ($I_p + a$)	43.75	37.5
Induced consumption (cY)	131.25	150
∴ Total real expenditures (Y)	175	200

Far from being crowded out, total private spending is higher after the stimulus than before: real income has increased by $25 billion, of which only $12.5 billion is higher government purchases, leaving $12.5 billion for extra private spending. Induced consumption is up, but autonomous private spending falls.

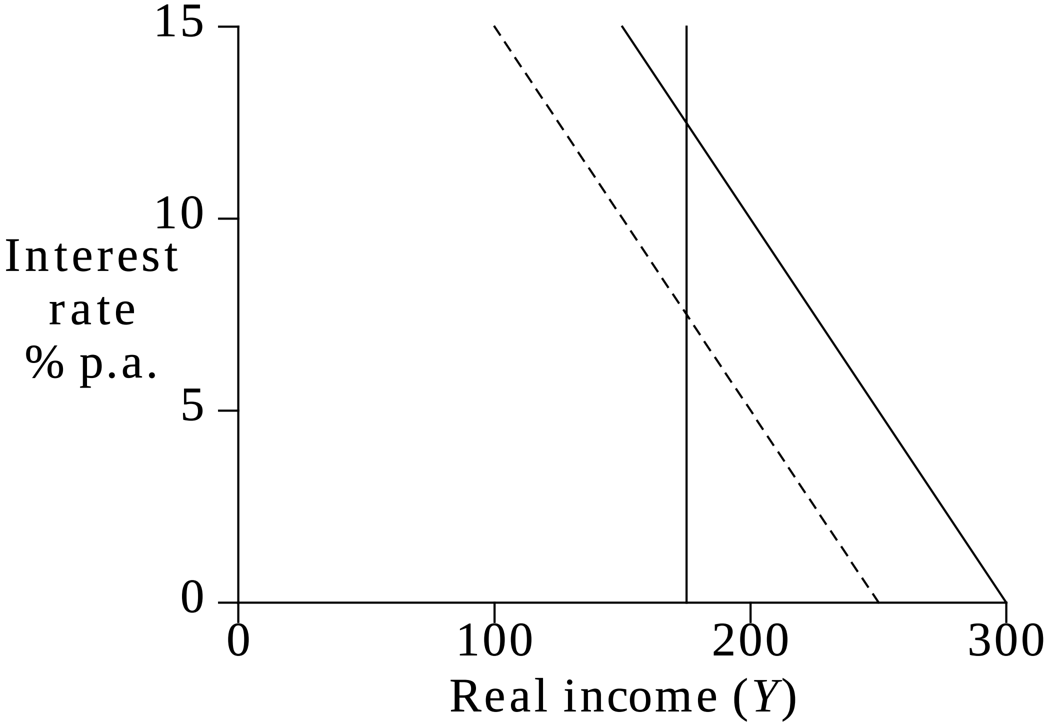
11. Strongand Weak Effects of Fiscal Policy

As we have argued above, the effect of a fiscal stimulus on real income depends on the slopes of the IS and LM curves. The effect is strong when the demand for money is highly interest-responsive, in the limit with a horizontal LM curve, as in the last chapter.



When the money demand's interest responsiveness is zero (the LM curve is vertical), the only effect of fiscal stimulus is to raise the interest rate. Crowding out is complete, with the higher interest rate cutting private autonomous spending by exactly the amount by which government spending increases.

Statistical evidence indicates that the LM curve is neither vertical (with complete crowding out) nor horizontal (with no crowding out).


15
10
Interest
rate
% p.a.
5
0
0
100
200
300
Real income (Y)