5. Recessions and Fiscal Policy

A change in planned autonomous spending (A_p) will cause a change in equilibrium income. Is such a "multiplier expansion" or "contraction" desirable or not? Yes, if it moves the economy (the real income Y) closer to its natural real GDP.

With A_p equal to $37.5 billion, we saw above that the equilibrium level of real income equalled $150 billion. If the level of natural real GDP is $200 billion, then a level of A_p of $50 billion would be desirable, since it would result in an equilibrium level of actual real GDP of $200 billion, as desired. A fall in A_p by $12.5 billion, however, would result in an actual real GDP of $150 billion, with a gap of $50 billion between actual and natural GDP.

What might cause a fall in planned autonomous spending (A_p) and hence in actual real income (Y)? Remember, planned autonomous spending is the sum of autonomous consumption (a) and planned autonomous investment (I_p). A fall in either of these will result in a fall in actual real income.

In the Great Depression, fixed investment in the USA fell by 74%, which contributed to the 29% fall in actual real GNP between 1929 and 1933. Changes in household autonomous consumption (a) can also cause exactly the same kind of effect on income as changes in the level of planned investment.

5.1 Government Spending and Taxation

Let's introduce government spending and taxation into the simple model. These can alter the

economy in two ways:

- an increase in government spending (G) can raise total income through the multiplier effect, and

- an increase in net tax revenue (T) has the opposite effect.[1]

Thus the government can try to offset fluctuations in autonomous investment and consumption.

Government spending on goods and services is part of planned expenditures (E_p):

$$E_p = C + I_p + G$$

A positive level of tax revenues reduces disposable income (Y_D) below actual income (Y):

$$Y_D = Y - T$$

Replacing Y by Y_D in the consumption function makes the level of consumption spending dependent on tax revenues:

$$C = a + cY_D = a + c(Y - T)$$

Previously, we said that equilibrium income equals planned autonomous spending (A_p) divided by the marginal propensity to save (s). How do government actions to spend and tax affect

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1. Net tax revenue equals taxes R minus transfer payments F, so such an increase can be achieved either by an increase in taxes R or a fall in transfer payments F or both.

planned autonomous spending?

Substituting the revised consumption function into the revised definition of planned spending:

$$E_p = a + cY - cT + I_p + G$$

But planned autonomous spending (A_p) is simply planned spending (E_p) minus induced consumption (cY):

$$A_p = a - cT_0 + I_p + G$$

(The subscripted 0 after the T indicates that tax revenues are assumed to be *autonomous* and do not necessarily change with income Y. Later we look at the case of induced tax changes as income changes. The subscript p on I_p indicates that it is *p*lanned by firms.)

Assuming the marginal propensity to consume (c) remains fixed, we note that the other four variables can change, affecting A_p:

$$\Delta A_p = \Delta a - c\Delta T_0 + \Delta I_p + \Delta G$$

So planned autonomous spending (A_p) can be changed:

1. A $100 change in autonomous consumption (*a*) changes A_p by $100 in the same direction.

2. A $100 change in autonomous tax revenue (T_0) changes A_p by c times $100 in the opposite direction, so that a $5 billion increase in T_0 would reduce A_p by $3¾ billion for marginal propensity to consume c = ¾, and households would pay for the other $1¼ billion in higher taxes by reducing their

saving.

3. A $100 change in planned investment (I_p) changes A_p by $100 in the same direction.

4. A $100 change in government spending (G) changes A_p by $100 in the same direction.

With the change in A_p, the basic multiplier expression remains:

$$\Delta Y = \frac{\Delta A_p}{s}$$

5.2 Fiscal Expansions

So if the initial level of autonomous planned spending (A_p) is $37.5 billion, resulting in an equilibrium level of real income of $150 billion, from

$$Y = \frac{A_p}{s}$$

But if the natural real GDP is $200 billion, then there is a shortfall in actual real GDP and income of $50 billion, which will be accompanied by unemployment, as well as forgone output. How can government *fiscal policy* correct this through control over the level of government expenditures?

To increase equilibrium income by $50 billion requires an increase of autonomous spending by $s \times$ $50 billion or $12.5 billion, which can occur from two possibilities:

*   a $12.5 billion increase in government spending (G), or

- a \$16⅔ billion reduction[2] in autonomous tax revenue (or, equivalently, a \$16⅔ increase in transfer payments, since transfer payments are equivalent to negative taxes).

5.3 Financing the Government Budget Deficit

The government budget surplus has been defined as tax revenues (T) minus government expenditures (G). Any change in government expenditures or tax revenues has consequences for the government's budget.

Assume that our example began with a balanced budget, with expenditures equal to tax revenues:

$$B = G - T = \$0$$

Then the government spends \$12.5 billion, moving the economy from an equilibrium income of \$150 billion to one of \$200 billion. Since its tax revenues remain unchanged, the government budget deficit B becomes \$12.5 billion.

How is this deficit financed? From above, the government surplus equals the difference between private investment and saving plus exports:

$$S - I - NX \equiv G - T$$

Changes on the LHS must equal changes on the RHS:

_____

2. 16⅔ = 12.5/0.75: a reduction in taxes raises A_p by c (= 0.75) times the reduction.

$$\Delta S - \Delta I - \Delta NX \equiv \Delta G - \Delta T$$

The changes in autonomous expenditure have assumed unchanged investment and net exports and tax revenues ($\Delta I = \Delta NX = \Delta T = 0$), so only savings and government spending can change:

$$\Delta S = s\Delta Y \equiv \Delta G$$

$$0.25(50) \equiv 12.5$$

The $50 billion of extra income induces $12.5 billion of extra saving, but without extra private investment or net exports to finance, which leaves the households able to purchase the $12.5 billion of government bonds (IOUs) to finance the $12.5 billion government budget deficit.

6. Tax Changes and the Multiplier

6.1 The Effect of Autonomous Taxes

In the previous section the government chose to increase its spending (G) by $12.5 billion with no increase in net taxes (T), which led to an increase in its deficit equal to ΔG. To keep the fiscal expansion *revenue neutral*, the government could also increase net taxes by an amount equal to its increase in spending, so that

$$\Delta G = \Delta T$$

What effect would this have on the equilibrium income?

From the equation in section 5.1:

$$\Delta A_p = \Delta a - c\Delta T_0 + \Delta I_p + \Delta G$$

If the only change is that net taxes are raised from

zero to $12.5 billion, then:

$$\Delta A_p = 0 - c\Delta T_0 + 0 + 0 = -0.75 \times 12.5 = -9\,3/8$$

A $12.5 billion increase in autonomous tax revenues ($\Delta T_0 = 12.5$) reduces autonomous planned spending by only $9\,3/8 billion because households "pay" the remaining $3\,1/8 billion of higher taxation by saving less than they otherwise would.

If autonomous planned spending drops by $9\,3/8 billion because of the tax increase, then equilibrium income drops by $9.375/0.25 = $37.5 billion, with the marginal propensity to save (s) of 0.25. This follows from:

$$\Delta Y = \frac{\Delta A_p}{s} = \frac{-c\Delta T_0}{s} = \frac{-(0.75)12.5}{0.25} = -37.5$$

The multiplier for an increase in taxes (cet. par.) is the ratio of the change in income to the change in autonomous tax:

$$\frac{\Delta Y}{\Delta T_0} = \frac{\Delta A_p}{s\Delta T_0} = \frac{-c\Delta T_0}{s\Delta T_0} = \frac{-c}{s} = \frac{-0.75}{0.25} = -3.0$$

Question: What is the effect of an increase in government spending (G) of $12.5 billion and an increase in autonomous taxes (T_0):

- on equilibrium income?

- on the government budget deficit?

- What is the multiplier in this case?

6.2 Effect of Income Taxes

By definition, an autonomous tax is one that is completely inelastic to income changes. But if the government raises some of its revenues with *income taxes*, then its total tax revenue is the sum of the autonomous tax (T_0) and the income tax ($t_0 Y$):

$$T = T_0 + t_0 Y$$

Income tax revenue is the tax rate (t_0) times income (Y). Disposable income (Y_D) is total income minus tax revenue:

$$Y_D = Y - T = Y - T_0 - t_0 Y = (1 - t_0) Y - T_0$$

6.2.1 Leakages from the spending stream:

Following any change in total income (Y), disposable income changes by a fraction ($1 - t_0$) as much only. Any change in total income (ΔY) is now divided into:

- induced consumption: $c(1 - t_0)\Delta Y$,

- induced saving: $s(1 - t_0)\Delta Y$, and

- induced tax revenue: $t_0 \Delta Y$.

If $c = 0.75$, $s = 0.25$, and $t_0 = 0.3$, then the three components are 0.525, 0.175, and 0.3, respectively, of the change in income.

As before, the economy is in equilibrium when income equals planned expenditure:[3]

$$Y = E_p$$

As before, subtract induced consumption from both sides of the equilibrium condition. LHS: from the analysis in the previous paragraph, income less induced consumption is just induced saving plus induced tax revenue. RHS: planned expenditure less induced consumption is just planned autonomous spending.[4] Thus the equilibrium condition can be written algebraically:

$$[s(1 - t_0) + t_0]\,Y = A_p$$

The term in square brackets is the fraction of a change in income that doesn't go into induced consumption because it goes into induced saving and into income tax revenue. This rate is the *marginal leakage rate*, the fraction of income that is taxed or saved rather than being spent on consumption.

The equilibrium income can be determined by dividing both sides by the term in brackets:

$$Y = \frac{A_p}{s(1 - t_0) + t_0}$$

If planned autonomous spending (A_p) is $50

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3. Remember, only then will unintended inventory investment (I_u) be zero.
4. From above, section 5.1, planned spending:
$$E_p = a + cY - cT + I_p + G$$
    and
$$A_p = a - cT_0 + I_p + G$$

billion, then equilibrium income will be only $\dfrac{50}{0.25(1-0.3)+0.3}$ = \$105.26 billion, instead of \$200 billion without income taxes. Why?

Because a greater fraction of each dollar of income now leaks out of the spending stream — 0.475 in this numerical example — than occurred due to the saving rate of 0.25 alone. This allows the injection of planned autonomous spending (A_p = 50) to be balanced by leakages out of the spending stream at a lower level of income.

6.3 Income Taxes and the Multiplier

The multiplier is simply the ratio of the change in income (ΔY) to the change in autonomous spending (ΔA_p). A more general form of the multiplier is simply the inverse of the marginal leakage rate.

When the only leakage was to savings, the multiplier (k) was given by:

$$k = \frac{1}{s} = \frac{1}{0.25} = 4.0$$

Now that we have introduced a new form of leakage — the induced tax revenues of the income tax — the multiplier has become:

$$k = \frac{1}{s(1 - t_0) + t_0} = \frac{1}{0.475} = 2.105$$

Thus raising the income tax rate (t_0) reduces the multiplier and vice versa. This gives the government an additional tool for stabilising income:[5]

- when the government wants to stimulate the economy and raise income (using fiscal instruments), it can do so by cutting income tax rates (t_0), which raises the multiplier (k) and the income (Y).

- when the government wants to restrain the economy (using fiscal instruments), it can raise income tax rates (t_0).

6.4 The Government Budget Deficit

Automatic stabilisation is the effect of income taxes in lowering the multiplier effect of changes in autonomous spending. To see this, write the government deficit as:

government budget deficit $= G - T = G - T_0 - t_0 Y$

As the level of income (Y) rises, this falls, and vice versa: when income rises, so do income tax revenues which syphon off some of the income before households can spend it, and vice versa.

7. Foreign Trade, Net Exports, and the Multiplier

What happens to the marginal leakage rate when we introduce the possibility of foreign trade in general, and household purchases of imports in

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5. But remember the assumptions of exogenous and constant interest rate and price level. Later we shall endogenise these, which may radically change the government's options.

particular? (Induced purchases of imports are a third leakage from income before domestic consumption.) The answer to this question will enable us to derive a new multiplier associated with foreign trade.

Let us write the relationship between net exports (NX) and income (Y) as:

$$NX = NX_0 - n_0 Y$$

The first term is autonomous (NX_0), reflecting the observation that the level of gross exports depends mainly on the level of incomes in foreign countries (which is exogenous here). The second term is induced ($-n_0 Y$), reflecting the observation that imports rise as domestic income (Y) rises,[6] thus reducing net imports (NX). We can call n_0 the *marginal propensity to import*, although Gordon resists the temptation.

With a new component of autonomous expenditure — the autonomous component (NX_0) of net exports — we can rewrite our definition of planned autonomous expenditure (A_p) as:

$$A_p = a - cT_0 + I_p + G + NX_0$$

To summarise in a table:

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6. Gordon might have made imports an induced function of disposable income (Y_D), since tax payments come first, but didn't. We follow Gordon here.
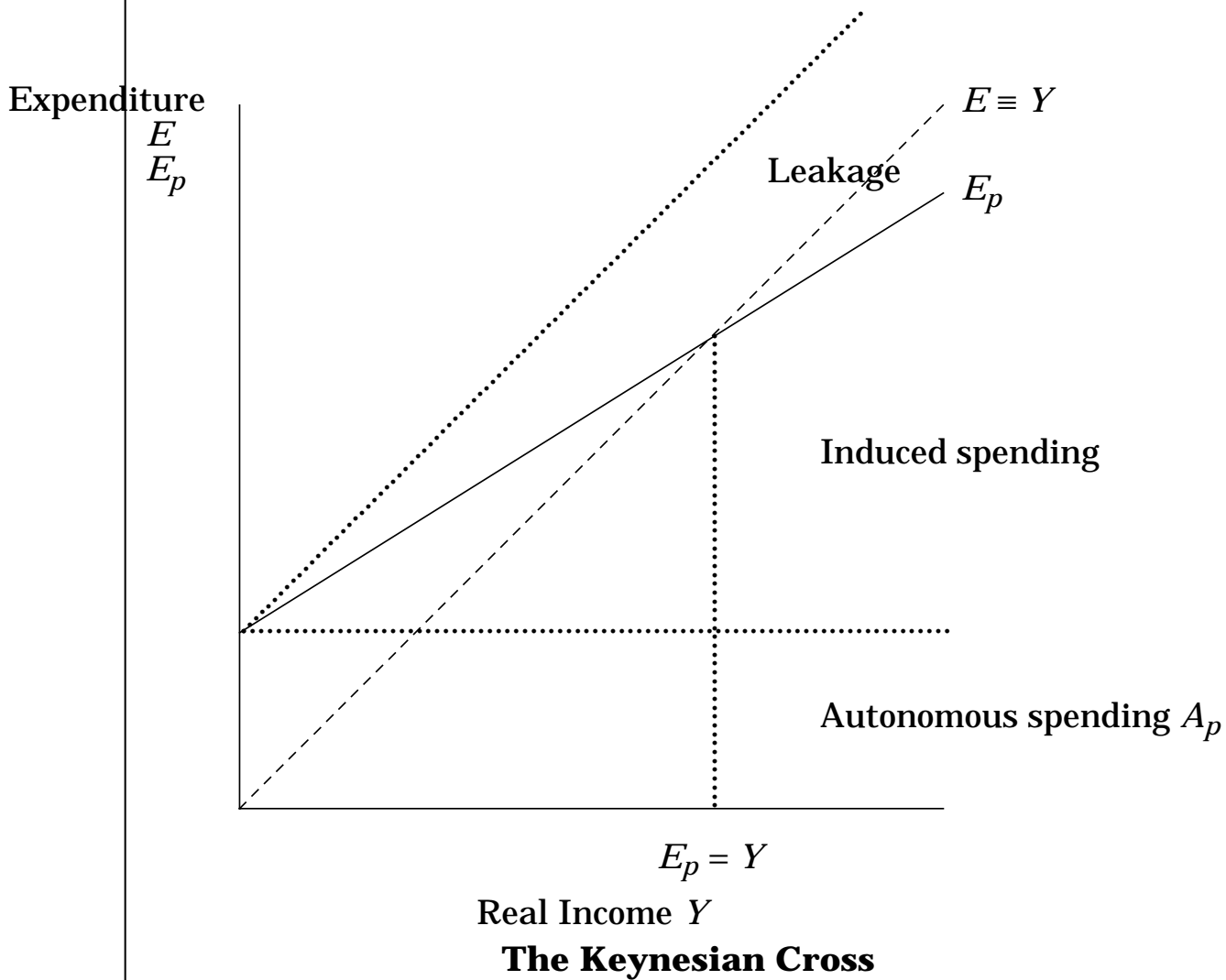
Types of leakages	*Marginal leakage rate*
Saving only	s
Saving and income tax	$s(1 - t_0) + t_0$
Saving, income tax, and imports	$s(1 - t_0) + t_0 + n_0$

Finally, equilibrium income becomes:

$$Y = \frac{A_p}{\text{marginal leakage rate}} = \frac{a - cT_0 + I_p + G + NX_0}{s(1 - t_0) + t_0 + n_0}$$

Remember, this simple Keynesian model of income determination has been built keeping both the interest rate and the price level fixed.

To summarise graphically:

Expenditure
E
E_p

$E \equiv Y$

Leakage

E_p

Induced spending

Autonomous spending A_p

$E_p = Y$

Real Income Y

The Keynesian Cross

Where:

- Autonomous spending A_p equals $a - cT_0 + I_p + G + NX_0$
- Leakage equals $[s(1 - t_0) + t_0 + n_0] \times$ income Y
- Induced spending equals $(c(1 - t_0) - n_0) \times$ income Y
- Planned spending E_p equals $A_p + c(1 - t_0)Y - n_0 Y$