

The Demand-Determined Model of National Income Lecture Notes

Lanny Zrill

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The AD-AS Model

We would like to develop a theoretical model of National Income (Y) and the Price Level (P). We proceed as follows:

- ▶ Describe the demand side of the economy by constructing a model of aggregate expenditure
- ▶ Describe the supply side of the economy by hypothesizing the typical behaviour of firms
- ▶ Bring the two sides together in a (aggregate) supply and demand framework in order to analyze economic shocks and policy

Desired Aggregate Expenditure

Consider the theoretical counterpart to our measure of Real GDP from Ch. 20, called the Desired Aggregate Expenditure (AE) function:

$$AE = C + I + G + NX$$

This is the total amount that all parties (households, firms, and the gov't) *want* to spend - like quantity demanded but for *all* goods

Types of Expenditure

Two types of expenditures:

- ▶ Induced Expenditure: purchases of goods and services that depend on the level of national income
- ▶ Autonomous Expenditure: purchases of goods and services that do not depend on the level of national income

* The distinction is important for evaluating quantitative effects of gov't policy (i.e. the Multiplier - later)

Desired Consumption

Consumption function: relates the level of desired consumption to disposable income

*Assume: all disposable income not used for consumption is saved

Level of desired consumption also depends on:

- ▶ Wealth
- ▶ Interest Rates
- ▶ Expectations about the future

Why?

Consider a generic consumption function:

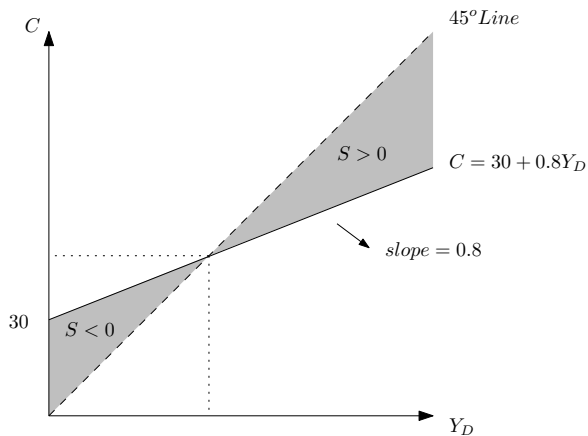
$$C = a + bY_D$$

- ▶ Consumption is a linear function of disposable income
- ▶ Autonomous consumption is represented by a
- ▶ The slope of the consumption function is represented by b , it is called the Marginal Propensity to Consume (MPC)
- ▶ The MPC tells you what fraction of each additional dollar of disposable income consumers wish to spend.

$$MPC = \frac{\Delta C}{\Delta Y_D}$$

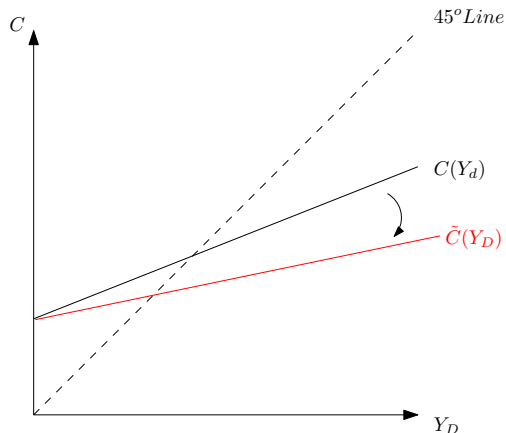
Numerical Example

$$C = 30 + 0.8Y_D$$



Shifts in the Consumption function

Example: what is the effect of a stock-market crash?



At all levels of disposable income, desired consumption expenditure is lower

Desired Investment

Recall: Investment *only* includes:

- ▶ Changes in Inventory
- ▶ Plant and Equipment
- ▶ New Residential Housing

Depends on:

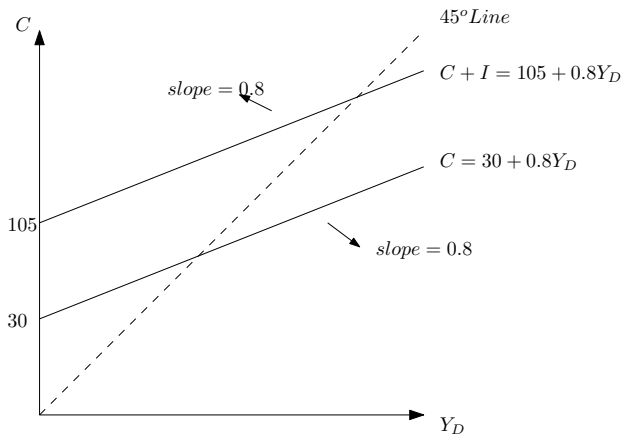
- ▶ Real Interest Rate
- ▶ Business Confidence

Assume: Desired Investment is *Autonomous*, e.g. $I=75$

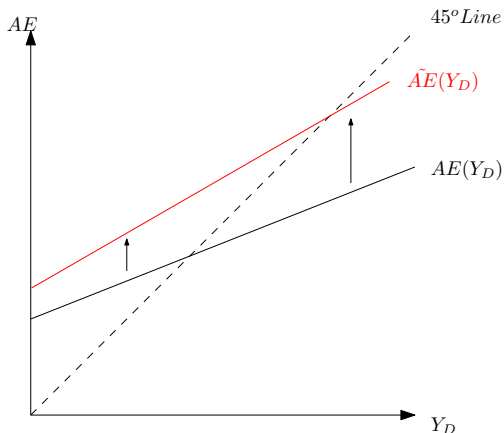
A (Very) Simple Economy

*Assume there is no gov't and or international trade

$$AE = C + I = 30 + 0.8Y_D + 75 = 105 + 0.8Y_D$$



Example: what is the effect of a fall in interest rates?



At all levels of disposable income, desired aggregate expenditure is higher. Why?

Government Purchases

Recall: Government Purchases (G) *does not* include transfer payments

Transfer payments enter the equation through Net Taxes (T)

$$T = tY$$

where t is the net tax rate, and Y is national income.

- ▶ Net Taxes includes taxes collected minus transfer payments
- ▶ Net Taxes includes all types of taxes (income, sales, etc.) from all levels of gov't (Federal, Provincial, and Municipal)

Budget Balance

The Gov't budget balance is given by Revenues (T) minus Government Purchases (G), thus

- ▶ Surplus: $T - G > 0$

- ▶ Deficit: $T - G < 0$

* More on the consequences of budget deficits/surpluses later in the course

International Trade

Assume: Exports (X) are autonomous and Imports (IM) are induced

$$IM = mY$$

where m is the *marginal propensity to import*

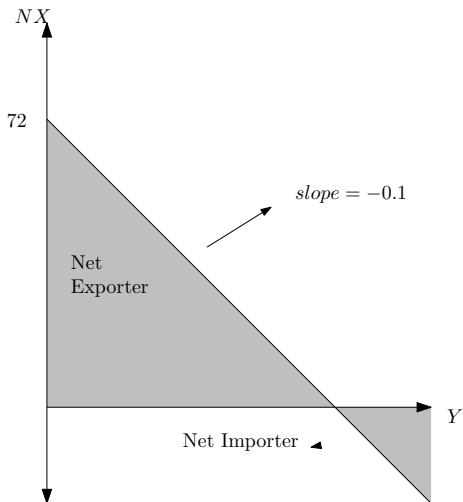
Thus, Net Exports (NX) is given by

$$NX = X - mY$$

Net Exports depends on:

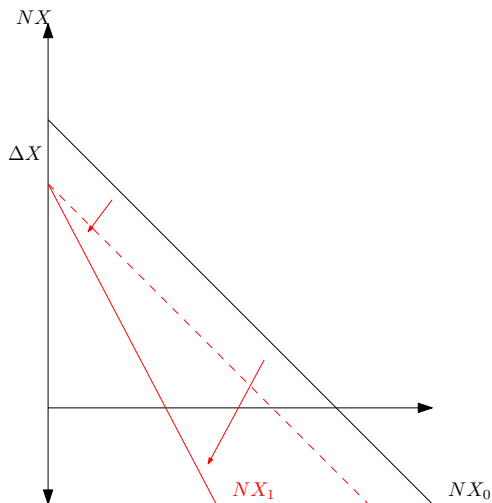
- ▶ Changes in Foreign Income
- ▶ Changes in Price Level
- ▶ Changes in Exchange Rate

$$X = 72, m = 0.1 \Rightarrow NX = 72 - 0.1Y$$



Shifts in Net Exports

What is the effect on Net Exports of an relative decrease in the US Price Level?



*Notice that *both* Exports and Imports are affected

Aggregate Expenditure Function

Now we combine all 4 elements in order to construct the Desire Aggregate Expenditure (AE) Function

$$AE = C + I + G + NX$$

We would like to express it solely as a function of National Income (Y), so we plug in our formulas

$$AE = a + bY_D + I + G + (X - mY)$$

Problem: How can we express Disposable Income (Y_D) in terms of National Income (Y)?

We can write the Consumption Function in terms of National Income in 4 steps:

1. Write out Net Taxes (T) in terms of National Income

$$T = tY$$

2. Write out Disposable Income (Y_D) in terms of National Income

$$Y_D = Y - T = Y - tY = (1 - t)Y$$

3. Recall the Consumption Function

$$C = a + bY_D$$

4. Substitute for Disposable Income

$$C = a + b(1 - t)Y$$

AE Function

Having converted the Consumption Function we now have:

$$AE = a + b(1 - t)Y + I + G + (X - mY)$$

Rearranging, we have

$$AE = \underbrace{a + I + G + X}_{\text{Autonomous Expenditure}} + \underbrace{[b(1 - t) - m]Y}_{\text{Induced Expenditure}}$$

Furthermore, define

$$z \equiv b(1 - t) - m$$

as the Marginal Propensity to Spend (z). Tells us what fraction of National Income gets spent on domestic goods and services.

Numerical Example

Recall:

- ▶ $C = 30 + 0.8Y_D$
- ▶ $I = 75$
- ▶ $G = 51$
- ▶ $t = 0.1$
- ▶ $X = 72$
- ▶ $m = 0.1$

Numerical Example

Recall:

▶ $C = 30 + 0.8Y_D$

▶ $I = 75$

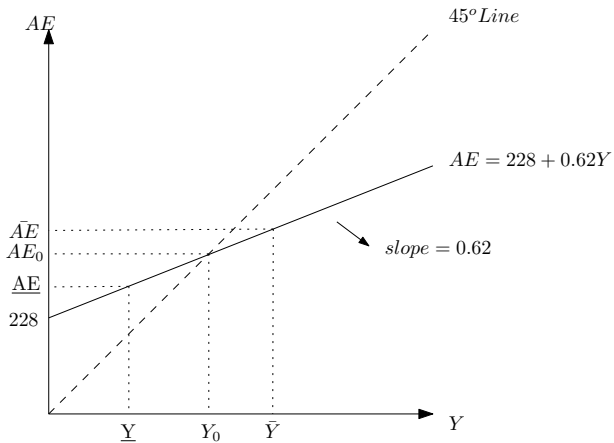
▶ $G = 51$

▶ $t = 0.1$

▶ $X = 72$

▶ $m = 0.1$

$$\Rightarrow AE = 30 + 75 + 51 + 72 + [0.8(1 - 0.1) - 0.1]Y = 228 + 0.62Y$$



Equilibrium

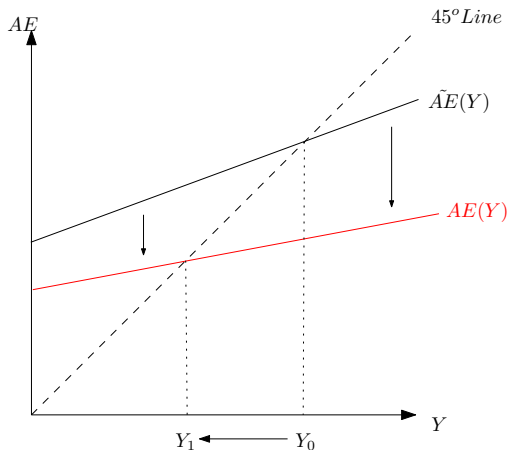
- ▶ When $Y > AE$, then national income exceeds desired expenditure
- ▶ When $Y < AE$, then national income is less than desired expenditure
- ▶ We define Aggregate Demand as the level of National Income, Y , such that $AE(Y^{AD}) = Y^{AD}$
- ▶ Numerically,

$$Y^{AD} = AE \Rightarrow Y^{AD} = 228 + 0.62Y^{AD} \Rightarrow Y^{AD} = 600$$

- ▶ Thus, *aggregate demand* Y^{AD} is the level of national income that is equal to aggregate expenditure

Changes in Aggregate Expenditure

Canada just announced that Real GDP growth over the next few quarters will be lower than expected. What effect might this have on business confidence and consumer expectations?



* Decrease in C and I causes a decrease in AE

Quantitative Changes in AE

What effect would an increase in Gov't Purchases (ΔG) have on AE?

Will it increase AE by exactly ΔG ? More? Less?

Think about this in terms of the circular flow diagram ...

- ▶ Round 1: Gov't increases purchases by ΔG . This creates new income equal to ΔY_1^{AD} . What happens to this new income?
- ▶ Round 2: A fraction, z , of the new income is spent on domestic goods and services. Thus, more new income is created, $\Delta Y_2^{AD} = z\Delta Y_1^{AD}$
- ▶ Round 3: $\Delta Y_3^{AD} = z\Delta Y_2^{AD} = z^2\Delta Y_1^{AD}$
- ▶ And so on

Adding this all up we get

$$\Delta Y^{AD} = \Delta Y_1^{AD} + \Delta Y_2^{AD} + \Delta Y_3^{AD} + \dots$$

Substituting, we get

$$\Delta Y^{AD} = \Delta Y_1^{AD} + z\Delta Y_1^{AD} + z^2\Delta Y_1^{AD} + \dots$$

Using the fact $\Delta Y_1^{AD} = \Delta G$ we have

$$\Delta Y^{AD} = \Delta G + z\Delta G + z^2\Delta G + \dots$$

Using the formula for an infinite series we get

$$\Delta Y^{AD} = \frac{1}{1-z}\Delta G$$

The Simple Multiplier

Using the formula above, we can find the change in Aggregate Demand Y^{AD} given any change in Autonomous Expenditure, i.e. a , I , G , or X . Thus we define the following

$$\frac{\Delta Y^{AD}}{\Delta A} = \frac{1}{1 - z}$$

where $A = a + I + G + X$.

Note: You *cannot* use the Simple Multiplier for economic shocks that effect the Marginal Propensity to Spend

The Simple Multiplier - An Example

- ▶ Given the AE-function from above, i.e.
 $AE = 228 + 0.62Y$, by how much would Aggregate Demand increase if there was an exogenous increase in Government Purchases (G) by 50?
- ▶ We can use the Simple Multiplier formula to find the answer ...

$$\Delta Y_D = \frac{1}{1 - z} \Delta G = \frac{1}{1 - 0.62} 50 \approx 132$$

- ▶ Hence, an increase in G of 50 results in an increase in National Income of 132 through the multiplier process

Changes in the Price Level

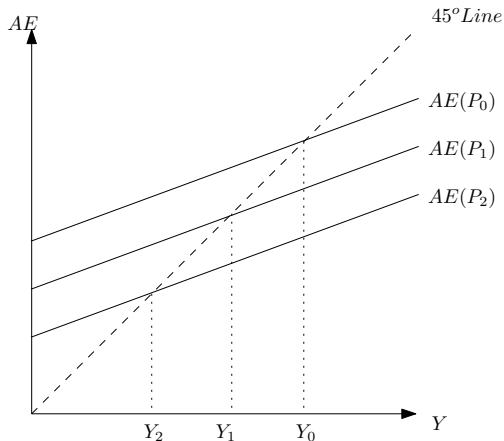
So far we have acted as if the Price Level was constant. How do changes in the price level affect aggregate demand?

- ▶ When the price level changes, so do the relative prices of goods and services? How can we think of substitution in the aggregate?
- ▶ What if we consider the future? How does a change in the price level affect wealth? What effect will this have on aggregate expenditure?

Suppose the Price Level increases from P_0 to P_1 . What happens to the AE-function? What happens to the value of wealth?

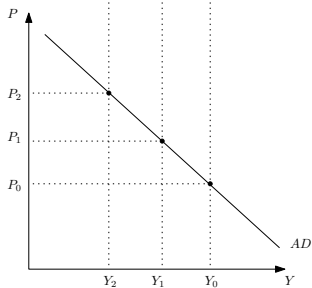
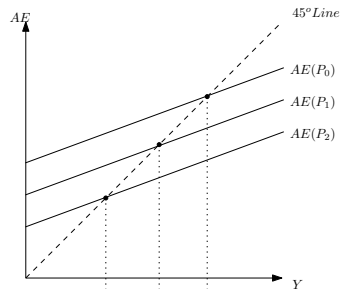
- ▶ Generally, a rising price level makes future purchases more expensive
- ▶ Thus, a person's savings, i.e. wealth, decreases in purchasing power as the price level increases
- ▶ People may respond to this by saving more at the expense of current consumption
- ▶ This results in a decrease in current Aggregate Expenditure

Changes in the Price Level



Is there a way to represent aggregate demand and the price level in a simpler way?

Aggregate Demand



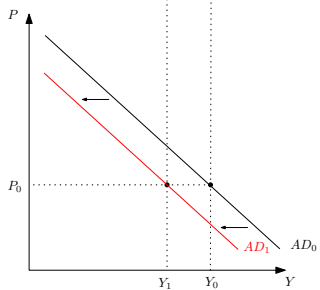
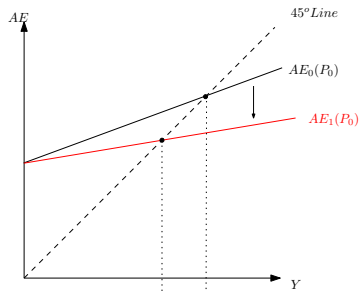
Changes in Aggregate Demand

Suppose there was an exogenous increase in the net tax rate (t), what effect would this have on aggregate demand?

Things to consider:

- ▶ Which component of aggregate expenditure is affected? Slope or intercept? Or both?
- ▶ How does aggregate expenditure change? Up or down?
- ▶ How is the change in aggregate expenditure reflected in a change in aggregate demand?

We can use the “two diagram” approach to answer these questions ...



Changes in Aggregate Demand

- ▶ Generally speaking, a change in aggregate expenditure induced by an exogenous shock, excluding changes in the price level, will result in a *shift* of the aggregate demand curve.
- ▶ Changes in the price level will cause a *movement* along the existing aggregate demand curve

The Simple Multiplier and Aggregate Demand

Consider an exogenous decrease in autonomous expenditure, i.e. $\Delta A < 0$. What effect will this have on the aggregate demand curve?

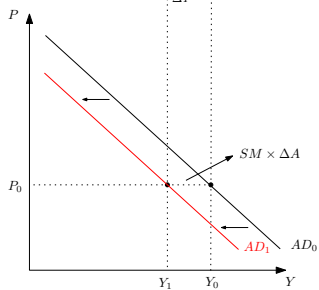
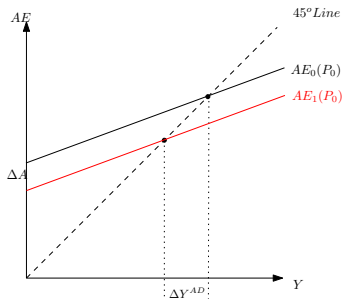
- ▶ The change in aggregate demand is given by:

$$\Delta Y^{AD} = SM \times \Delta A$$

- ▶ This induces a shift in the AD-curve equal to exactly ΔY^{AD}

Thus, the simple multiplier tells us *how far* the AD-curve shifts when there is a change in autonomous expenditure.

*Recall: The simple multiplier says nothing about changes in z



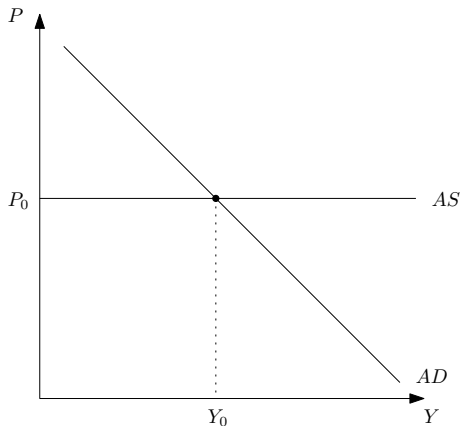
Aggregate Supply

The Aggregate Supply (AS) curve tells us for any price level what quantity of *all* goods and service firms *would like* to produce.

- ▶ For now we assume:
 - ▶ The price level is fixed
 - ▶ Firms are willing to produce any amount of goods and services that are demanded at this price level

What does the AS-curve look like given these assumptions?

Aggregate Supply



Equilibrium

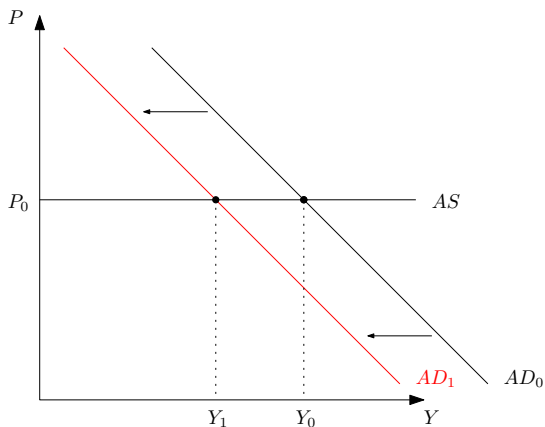
Equilibrium requires two types of consistency:

1. Desired Aggregate Expenditure must be equal to National Income, i.e. the amount of goods and services people want to buy is equal to the amount of income available.
2. Aggregate Demand must equal Aggregate Supply, i.e. the amount of goods and services that people want to buy is equal to the amount of goods and services that firms want to produce

Together, we combine the behaviour of producers and consumers in order to predict the level of National Income, i.e. Real GDP

Comparative Statics

Consider an appreciation of the Canadian dollar, i.e. decrease in the exchange rate, what effect will this have on National Income?



Fiscal Policy

- ▶ **Fiscal Policy** refers to the government's use of expenditures and taxation in order to influence economic variables, i.e. National Income.
- ▶ What is the government's goal?
 - ▶ Potential Output (Y^*): the level of national income/output where resources are utilized at their *normal* level of intensity

$$\text{Output Gap} = Y - Y^*$$

Output Gaps

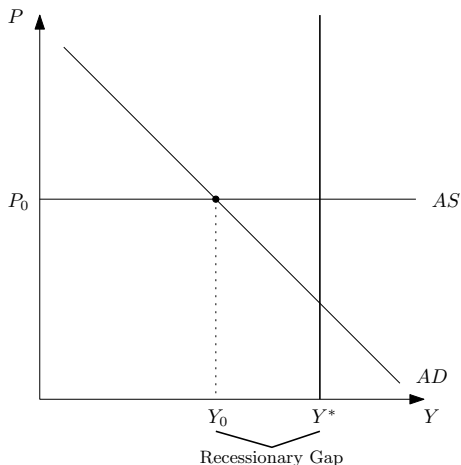
Two types of output gaps:

- ▶ Recessionary Gap: some resources are idle, i.e. $Y < Y^*$
- ▶ Inflationary Gap: resources are over-utilized, i.e. $Y > Y^*$

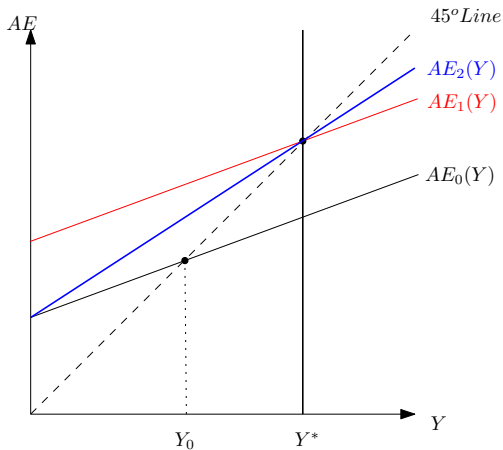
Fiscal policy can be used to minimize fluctuations around potential output, i.e. business cycles

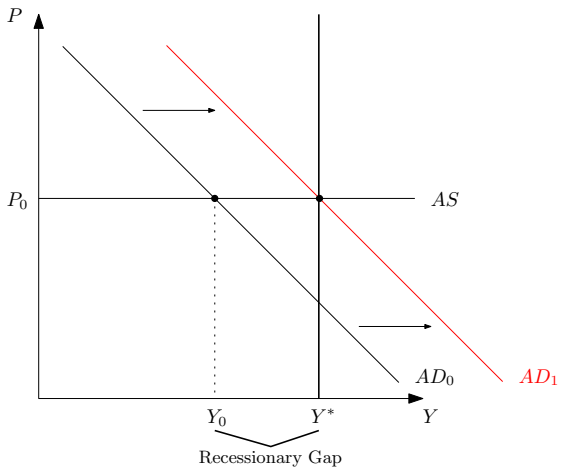
Fiscal Policy

Consider a recessionary gap, i.e. $Y < Y^*$. What can the government do correct this?



Two Options: Increase government purchases (G) or decrease the tax rate (t)





Consider our quantitative example from above. Recall:

▶ $C = 30 + 0.8Y_D$

▶ $I = 75$

▶ $G = 51$

▶ $t = 0.1$

▶ $X = 72$

▶ $m = 0.1$

⇒ $AE = 228 + 0.62Y$

- ▶ Recall: Equilibrium National Income = 600
- ▶ Suppose Potential National Income = 700
- ▶ How much would the government have to change G or t in order to restore National Income to its Potential?
- ▶ Two ways

Government Purchases

- ▶ Consider changing G ... we can use the Simple Multiplier!
- ▶ $\Delta Y = \Delta Y^{AD} = SM \times \Delta G$
- ▶ $SM = \frac{1}{1-z} = \frac{1}{1-0.62} \approx 2.63$
- ▶ $\Delta Y = Y^* - Y = 700 - 600 = 100$
- ▶ $100 = 2.63 \times \Delta G \Rightarrow \Delta G = 38$
- ▶ The government would have to increase their purchases by 38 in order to get rid of the Recessionary Gap

Tax Rate

- ▶ Now suppose the government wants to change t ? Can't use the Simple Multiplier so now what?
- ▶ In the Demand Determined Model, National Income is given by $Y = AE$
- ▶ Thus, we have: $Y = 228 + [0.8(1 - t) - 0.1]Y$
- ▶ The Equilibrium we want is $Y = Y^* = 700$, thus $700 = 228 + [0.8(1 - t) - 0.1]700$
- ▶ Solving for t we get: $t \approx 0.032$
- ▶ The government would have to decrease the tax rate from 10% to 3.2% in order to get rid of the Recessionary Gap

The Demand Determined Model

Is the Demand-Determined Model a good model of National Income?

- ▶ Are the assumptions regarding firm behaviour reasonable?
- ▶ Are the predictions of the model likely to match reality?

The answer to both of these questions is likely no ... so what now?