Econ 702

Macroeconomics I

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Lecture 9: The Neoclassical Model

The neoclassical model may be appropriate for the “medium run”

- Shorter than the long run. In the long run, capital accumulation is significant. In the medium run, investment occurs, but additions to the capital stock are small. Treat the capital stock as given
- Longer than the short run. In the short run, nominal prices and wages do not fully adjust to shocks.
- “Classical dichotomy” holds in the neoclassical model.
- The neoclassical model is special also because there are no other distortions to markets that matter for macroeconomic outcomes

We will review the building blocks of the neoclassical model, then examine the model graphically.

Households

Consumption
Labor supply
Money demand

Firms

Investment
Labor demand

Government

Government spending and taxation
Money supply

Consumption

$$C_t = C^d(Y_t - T_t, Y_{t+1} - T_{t+1}, r_t)$$

Consumption depends positively on current after-tax income.
It also depends on future after tax income.

The marginal propensity to consume, MPC, is less than one.
MPC is , $\frac{\partial C^d(\cdot)}{\partial Y_t}$ which is less than one and which we will treat as constant.

Also, consumption falls when the interest rate rises. We assume the substitution effect dominates the income effect.

$r_t = i_t - \pi^e_{t+1}$: The real interest rate

Labor supply

$$N_t = N^s(w_t, \theta_t)$$

- Labor supply depends positively on the real wage.
- The real wage can be defined as $w_t = \frac{W_t}{P_t}$, where W_t is the nominal wage and P_t is the nominal price level.
- There is an income and substitution effect of the real wage on labor supply. We assume the substitution effect dominates.
- In the real world data, labor supply is not very sensitive to the real wage.

Money demand

$$M_t = P_t M^d(i_t, Y_t)$$

What is money?

- It is a particular type of asset
- The asset that can be used in transactions

We want money only to make transactions

- If the interest rate, i_t, is higher, we hold less money
  - Why is in the nominal interest rate that matters?
- We want more money if we make more transactions, and we make more transactions as Y_t rises.
- The nominal amount of money we need for transactions rises proportionately to an increase in the nominal price level, P_t

Firms

$$Y_t = A_t F(K_t, N_t)$$

$$K_{t+1} = I_t + (1 - \delta)K_t$$

$$N_t = N^d(w_t, A_t, K_t)$$

$$I_t = I^d(r_t, A_{t+1}, K_t)$$

Expected future productivity matters for investment decision.

Government

Government spending and taxes are exogenous.

Note that Ricardian Equivalence holds. That is, because taxes are lump sum, household behavior is not affected by whether they are collected in period t or $t+1$.

Household budget constraint: $$C_t + \frac{C_{t+1}}{1+r_t} = Y_t - T_t + \frac{Y_{t+1} - T_{t+1}}{1+r_t}$$

Government budget constraint: $$G_t + \frac{G_{t+1}}{1+r_t} = T_t + \frac{T_{t+1}}{1+r_t}$$

Substituting in: $$C_t + \frac{C_{t+1}}{1+r_t} = Y_t - G_t + \frac{Y_{t+1} - G_{t+1}}{1+r_t}$$

Taxes don't even show up in the aggregate budget constraint!

Intuitively, if government reduces T_t by \$Z, it must increase T_{t+1} by $(1+r_t)Z$.

The present value of revenue for the government is not affected:

$$G_t + \frac{G_{t+1}}{1+r_t} = T_t - Z + \frac{T_{t+1} + (1+r_t)Z}{1+r_t} = T_t + \frac{T_{t+1}}{1+r_t}$$

If taxes are lowered today, households know future taxes will increase by an amount of equal value. Hence all that matters is the amount of spending by government, not the timing of taxes. We can write:

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

Government also chooses the money supply, M_t. How?

Full Model

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

$$N_t = N^s(w_t, \theta_t)$$

$$N_t = N^d(w_t, A_t, K_t)$$

$$I_t = I^d(r_t, A_{t+1}, K_t)$$

$$Y_t = A_t F(K_t, N_t)$$

$$Y_t = C_t + I_t + G_t$$

$$M_t = P_t M^d(r_t + \pi^e_{t+1}, Y_t)$$

$$r_t = i_t - \pi^e_{t+1}$$

Endogenous: $C_t, I_t, Y_t, N_t, r_t, w_t, P_t, i_t$

Exogenous: $A_t, A_{t+1}, G_t, G_{t+1}, \theta_t, M_t, \pi^e_{t+1}$

Classical Dichotomy

Notice that the first six equations determine the real variables, $C_t, I_t, Y_t, N_t, r_t, w_t$:

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t)$$

$$N_t = N^s(w_t, \theta_t)$$

$$N_t = N^d(w_t, A_t, K_t)$$

$$I_t = I^d(r_t, A_{t+1}, K_t)$$

$$Y_t = A_t F(K_t, N_t)$$

$$Y_t = C_t + I_t + G_t$$

We will put together a set of graphs that show how the last four of those real variables, Y_t, N_t, r_t, w_t, are determined and respond to exogenous changes. We can infer also how C_t, I_t respond once we know how Y_t, N_t, r_t, w_t respond.

The last two equations determine the nominal variables, P_t, i_t.

Once we have determined r_t, then i_t is determined by the relationship $i_t = r_t + \pi^e_{t+1}$.

We will then have a separate graph that shows how the money market equilibrium determines P_t.

Graphing Goods Market Equilibrium

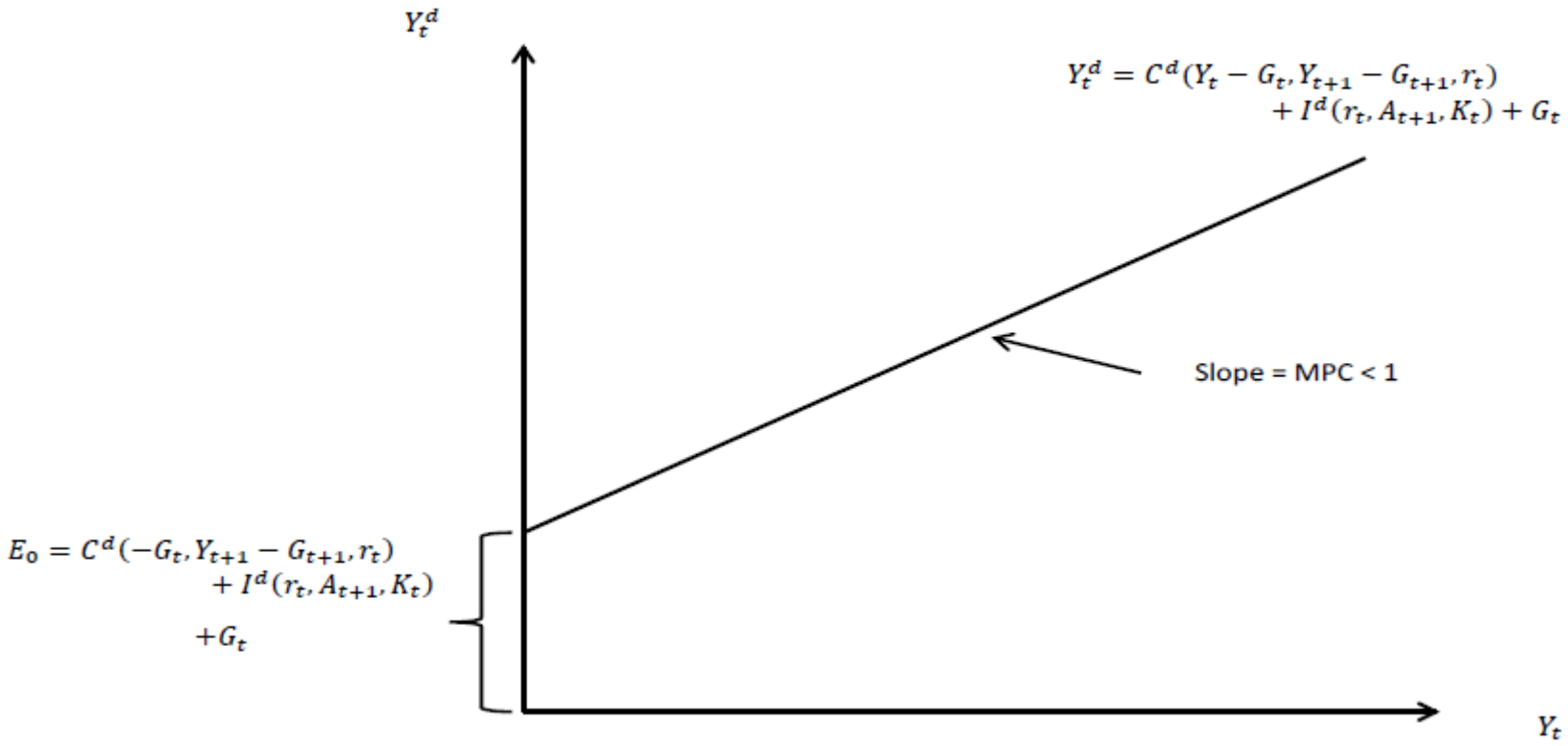
We have $Y_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t) + I^d(r_t, A_{t+1}, K_t) + G_t$

Define demand for final goods as:

$$Y_t^d = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t) + I^d(r_t, A_{t+1}, K_t) + G_t$$

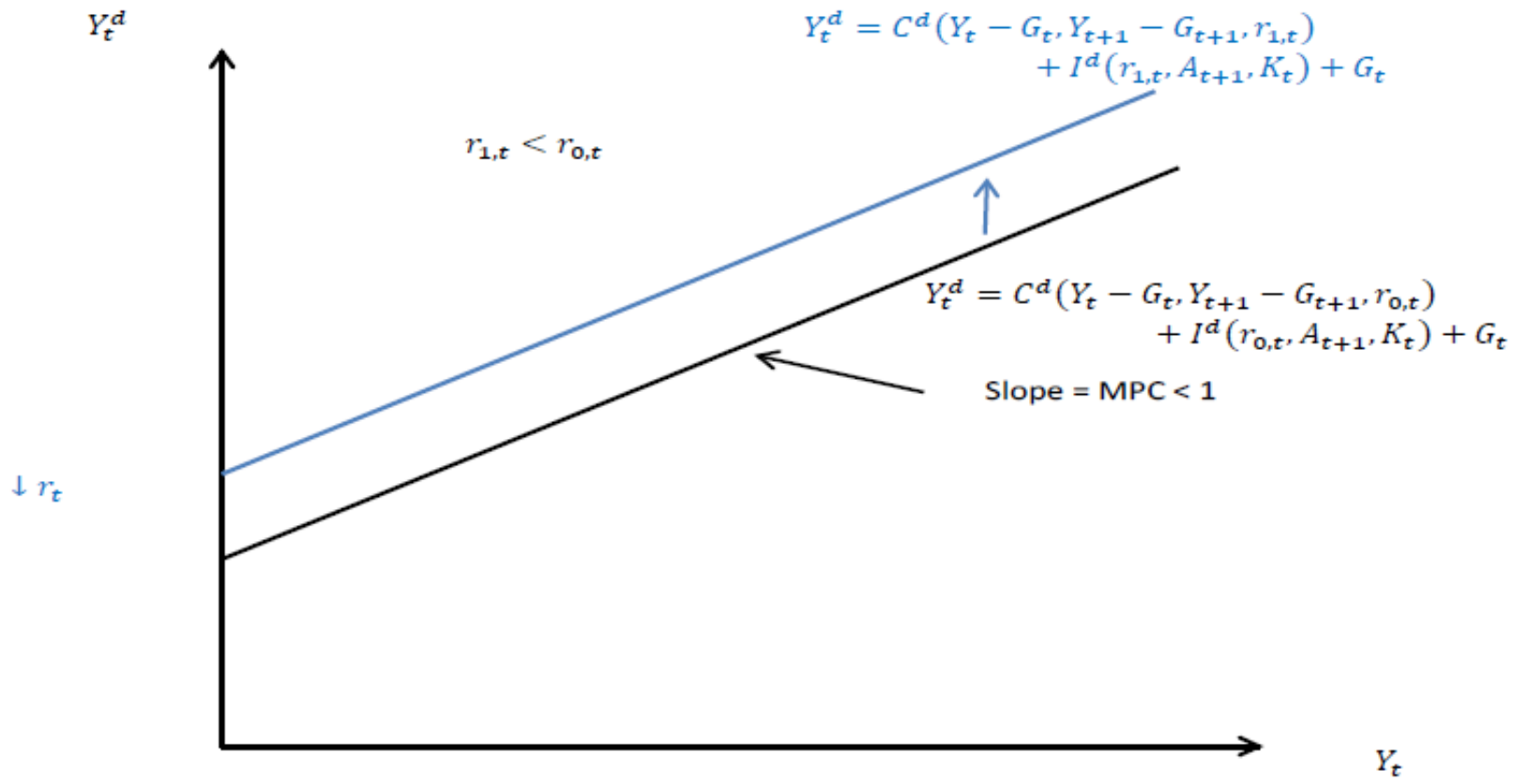
We can graph demand (or desired expenditure) against current income. The slope of the demand is positive but < 1 because MPC < 1.

Figure 17.1: Desired Expenditure and Income



We will derive the IS curve, that relates equilibrium r_t to Y_t.

Figure 17.2: Desired Expenditure and Income



Equilibrium is where demand for output equals output:

Figure 17.3: Desired Expenditure and Income: Expenditure Equals Income

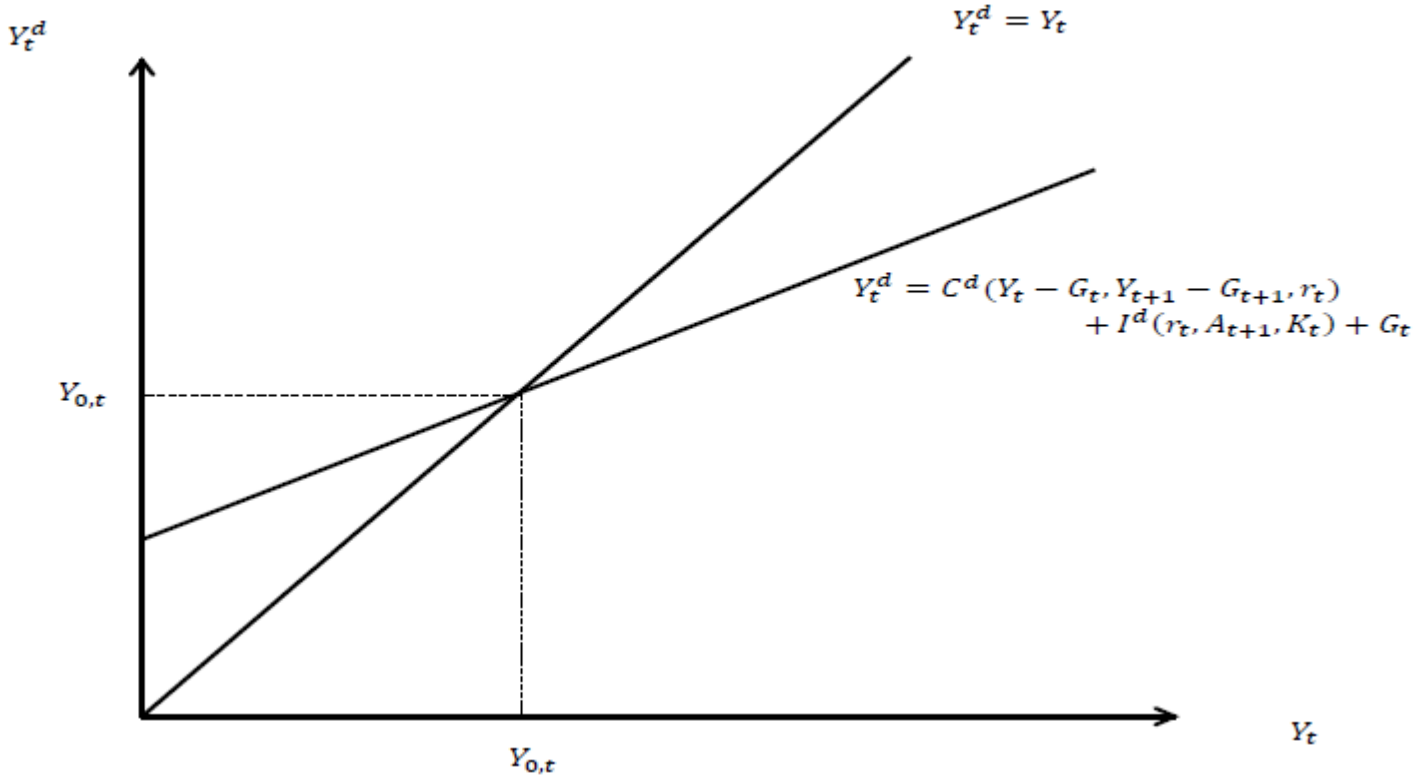


Figure 17.4: The IS Curve: Derivation

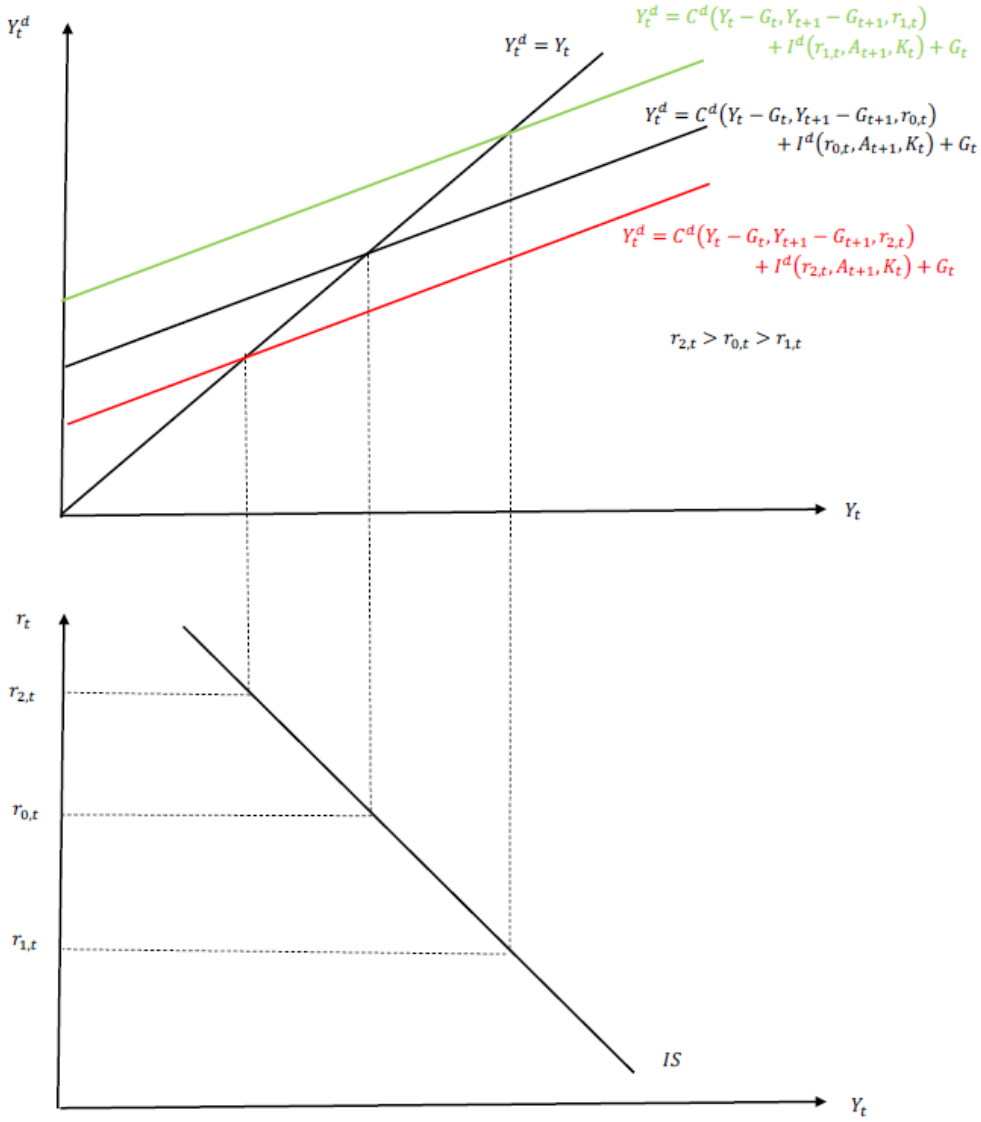


Figure 17.5: The Y^s Curve: Derivation

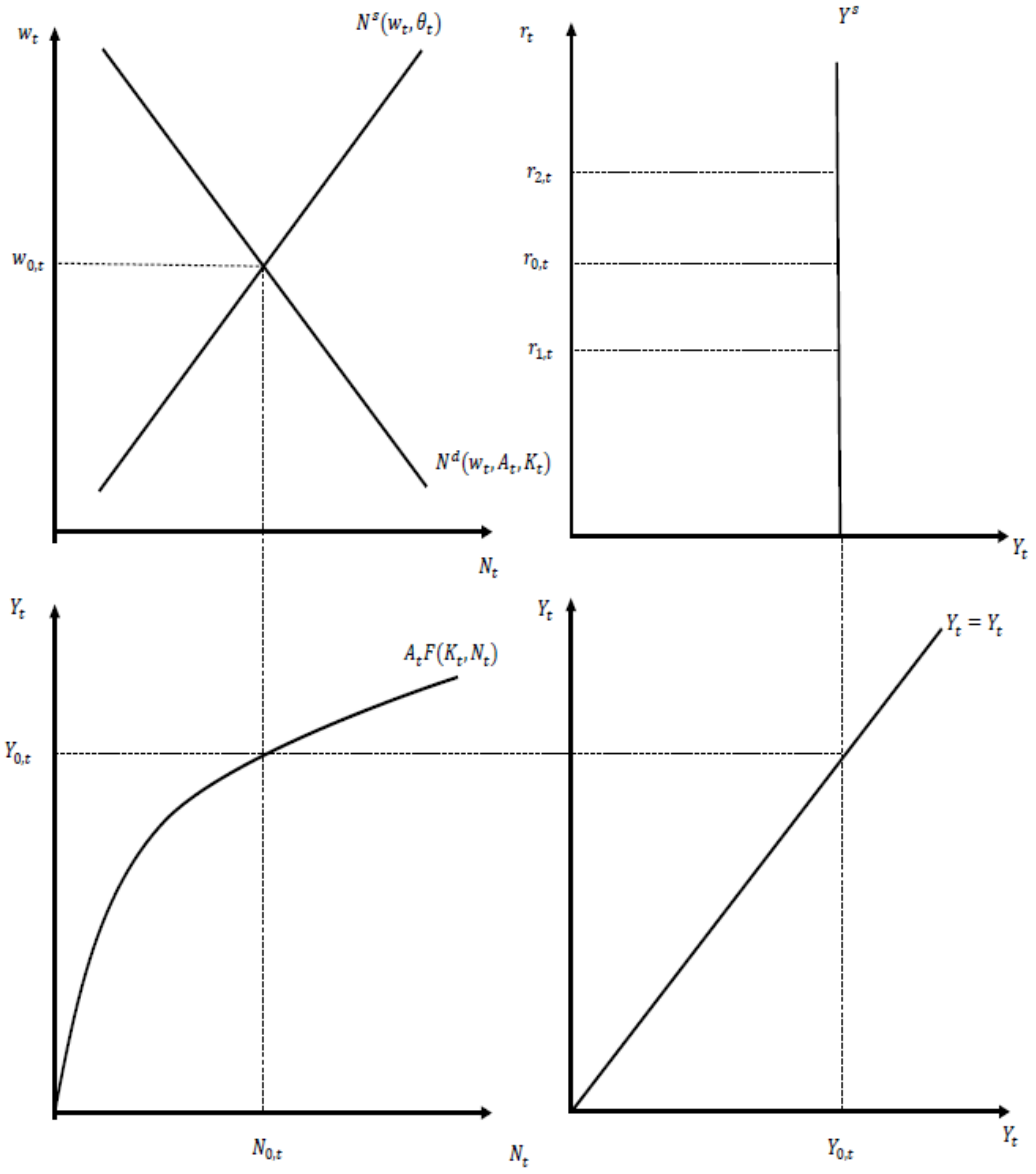


Figure 17.6: $IS - Y^s$ Equilibrium

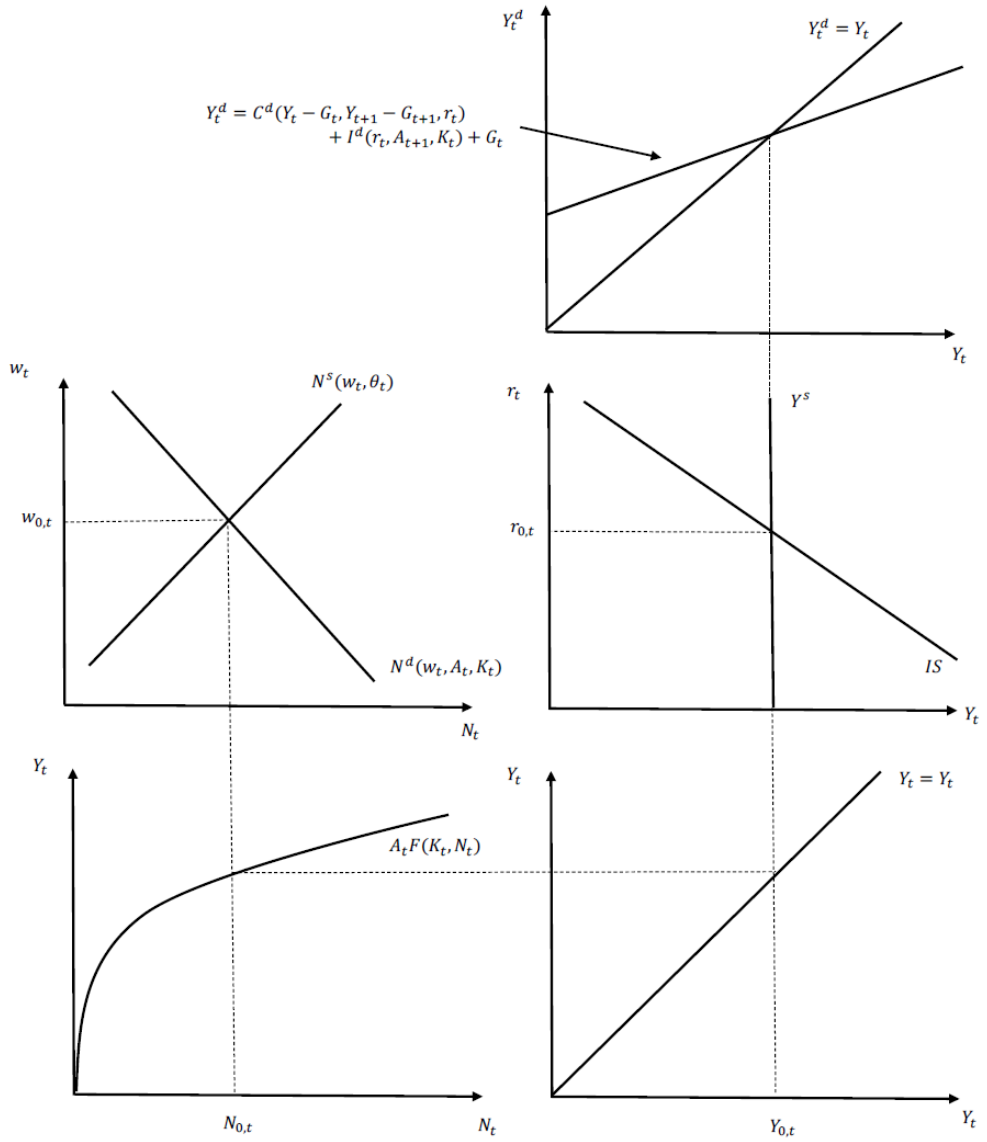
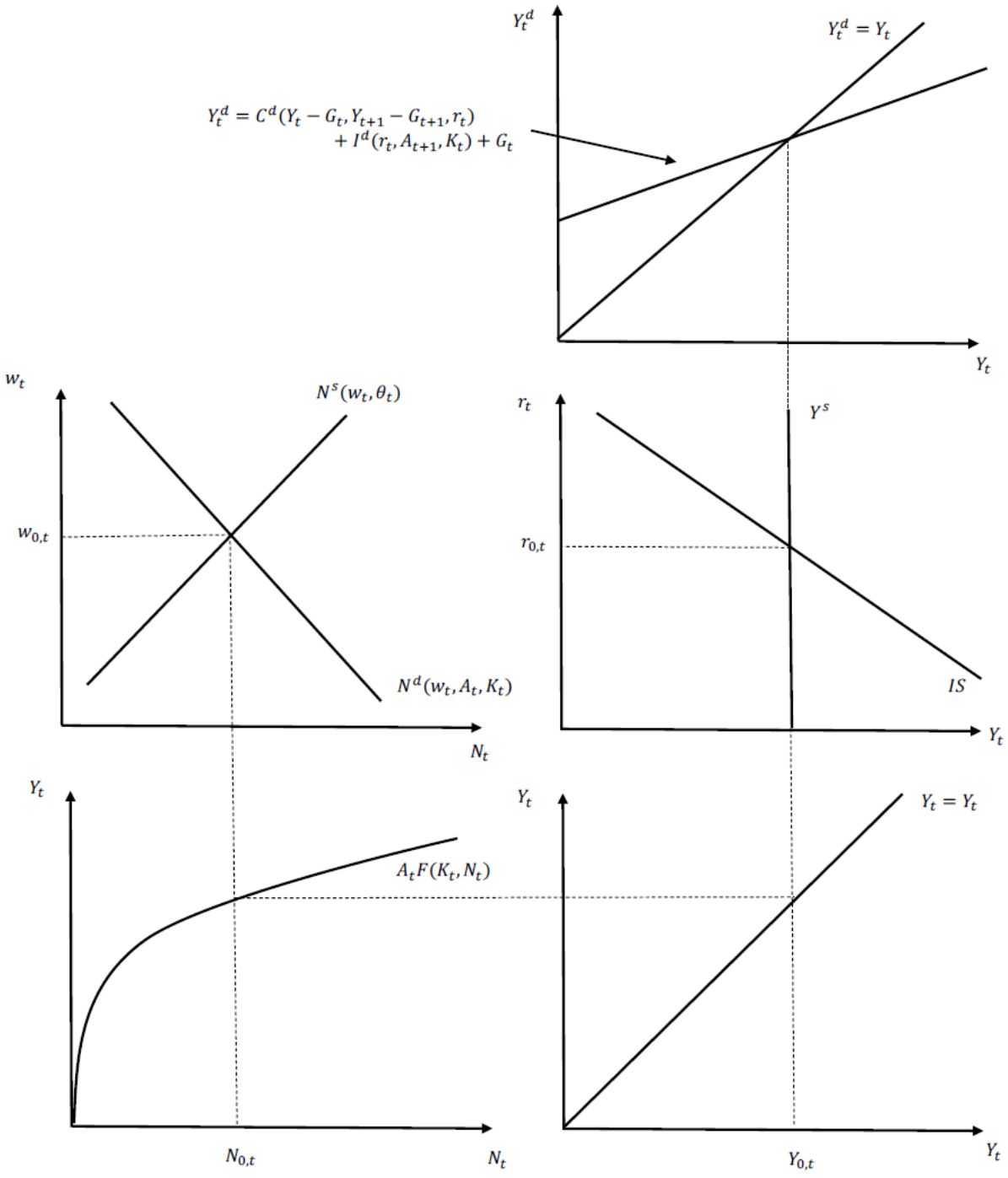


Figure 17.6: $IS - Y^s$ Equilibrium



The Nominal Side

As we said earlier, i_t is determined by the relationship $i_t = r_t + \pi^e_{t+1}$.

In the neoclassical model, changing the money supply does not affect the nominal interest rate (unless it affects expectations about future inflation.)

Instead, changes in the money supply influence P_t.

In the short-run model in the second half of the semester, nominal prices don't adjust. That is, P_t is given. Then changes in the money supply affect i_t.

Figure 17.7: Money Demand

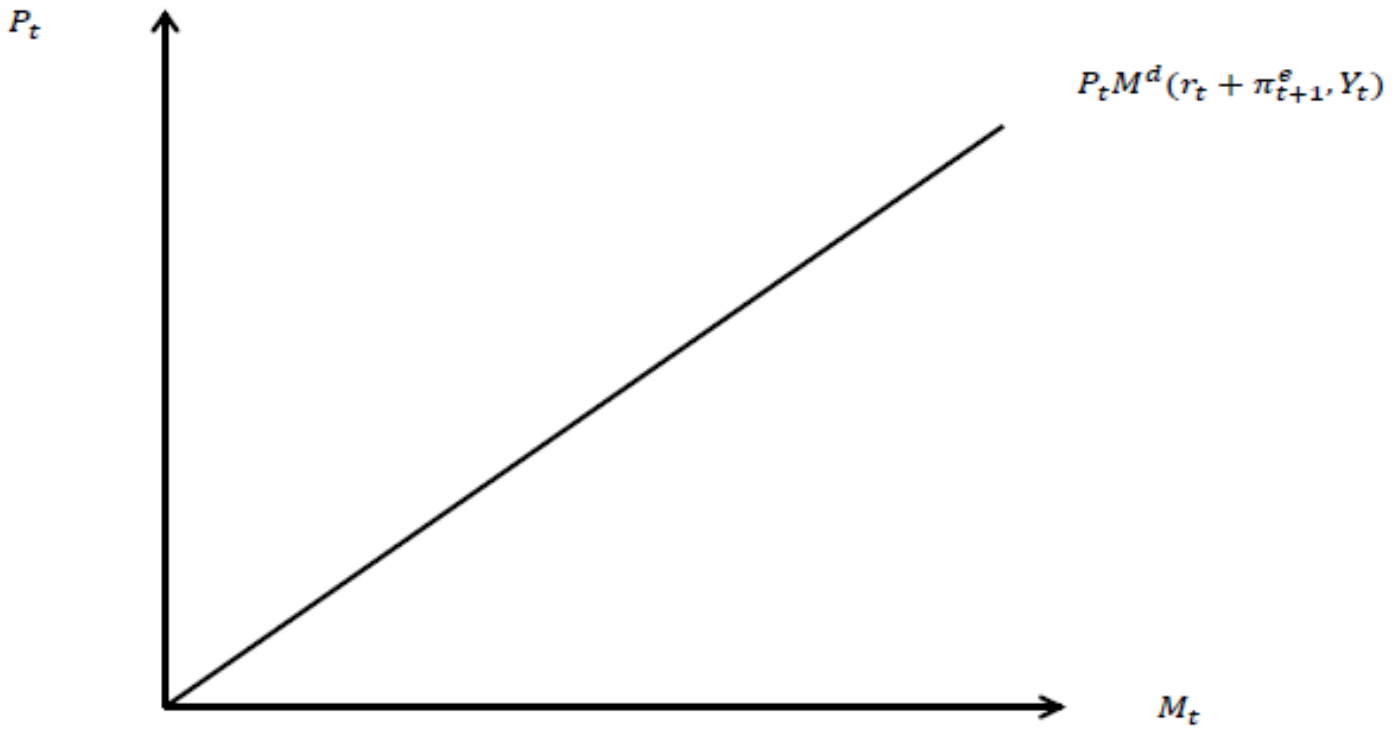


Figure 17.9: Money Supply

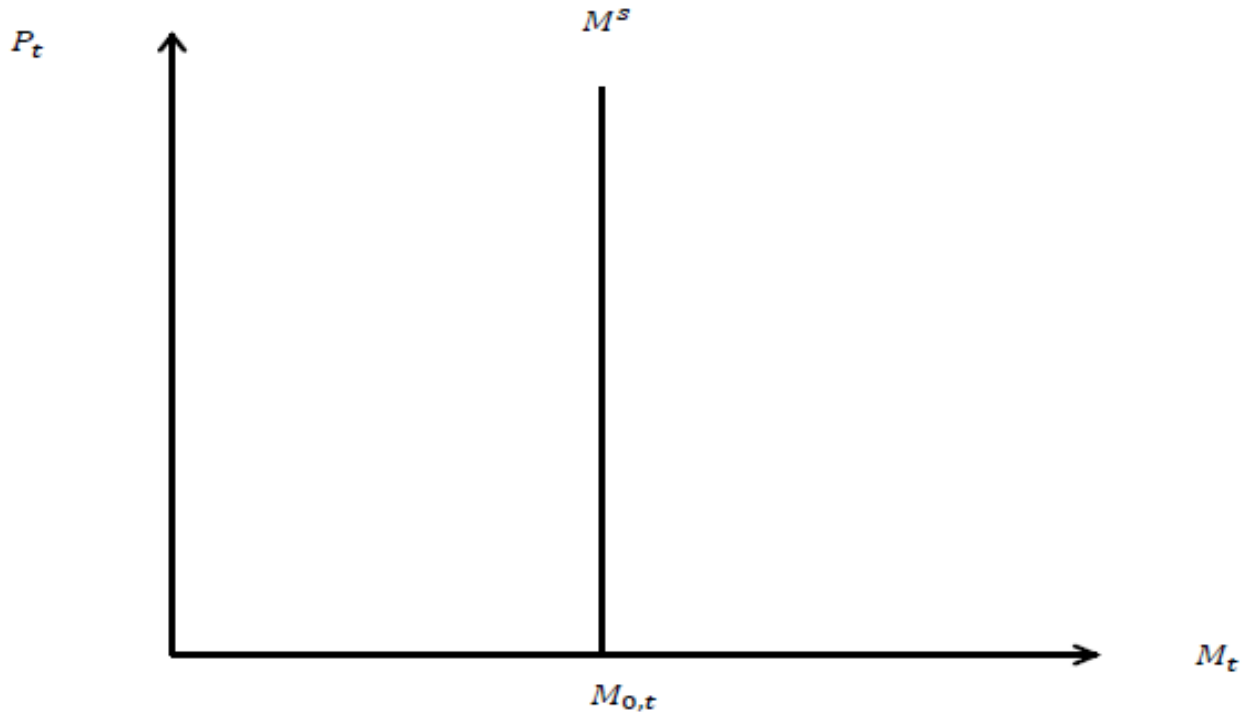


Figure 17.10: Equilibrium in the Money Market