Foundations of Modern Macroeconomics Second Edition

Chapter 1: Who is who in macroeconomics?

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Outline

Aims of this lecture

- To study the effectiveness of fiscal and monetary policy.
- To introduce the most important past and current schools of thought.
- To refresh and extend first-year macro knowledge.

Some crucial building blocks

- First look at the labour market:
  - Demand for labour by firms.
  - Supply of labour by households.
- Demand for money.

Technology

- Production function:

$$Y = F(N, \bar{K}),$$

  - $\bar{K}$ is the aggregate capital stock (fixed in the short run).
  - Y is aggregate production.
  - N is aggregate employment.

- Properties:
  - $F_N > 0$, $F_K > 0$
  - $F_{NN} < 0$, $F_{KK} < 0$
  - Constant returns to scale.

Profit maximization

- Short-run profit:

$$\Pi \equiv PY - WN$$

  - Π is nominal profit (revenue minus variable cost).
  - P is "the" price level.
  - W is the nominal wage.

- Objective of the firm: choose N to maximize short-run profit:

$$\begin{aligned} \max_{\{N\}} \quad \Pi &\equiv PY - WN \\ &= PF(N, \bar{K}) - WN \end{aligned}$$

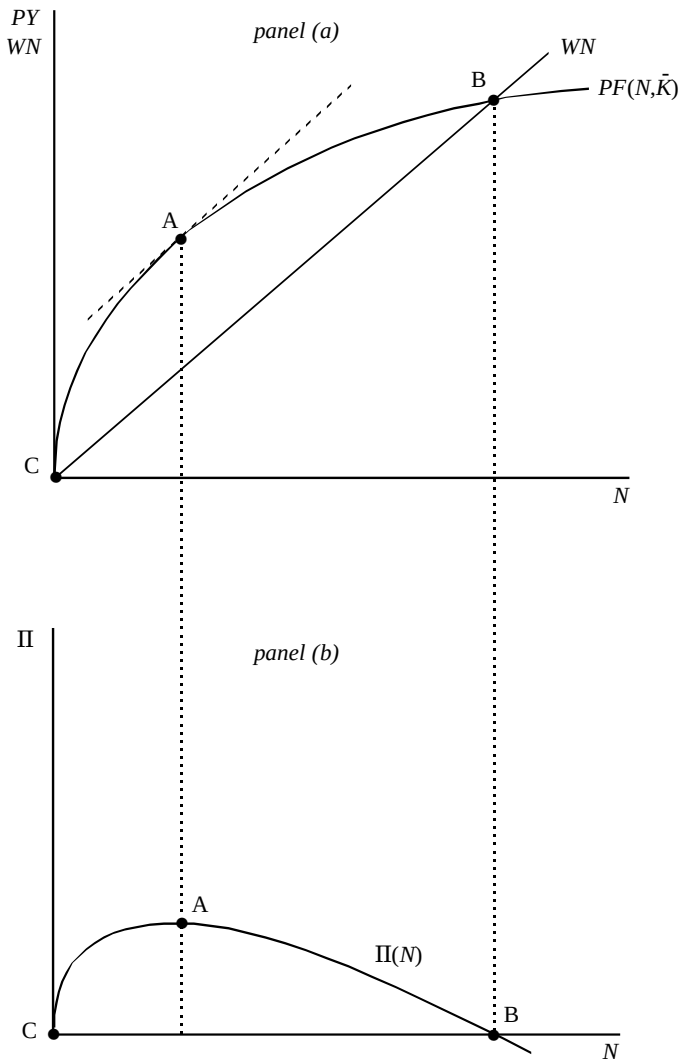
Profit maximization

- First-order condition (for an extremum):

$$\frac{d\Pi}{dN} = 0: \qquad PF_N(N, \bar{K}) - W = 0,$$

  where $F_N \equiv \frac{\partial F(N,\bar{K})}{\partial N}$ is the marginal product of labour, i.e. the partial derivative of $F(N, \bar{K})$ with respect to N.
- See **Figure 1.1** for the graphical derivation.

Figure 1.1: Short-run profit maximization



Property of the labour demand function

Using the Implicit Function Theorem

- First-order condition is really an "implicit function" relating labour demand (N^D) to the real wage (W/P) and the capital stock ($\bar{K}$):

$$PF_N(N^D, \bar{K}) = W \quad \Longleftrightarrow \quad F_N(N^D, \bar{K}) = \underbrace{W/P}_{\text{real wage}}$$

- First-year trick comes in handy: total differentiation of the expression to see how N^D, W/P, and $\bar{K}$ are related:

$$\begin{aligned} dF_N(N^D, \bar{K}) &= d(W/P) \quad \Rightarrow \\ F_{NN}dN^D + F_{NK}d\bar{K} &= d(W/P) \quad \Rightarrow \\ F_{NN}dN^D &= d(W/P) - F_{NK}d\bar{K} \quad \Rightarrow \\ dN^D &= -\left(F_{NK}/F_{NN}\right)d\bar{K} + \left(1/F_{NN}\right)d(W/P) \end{aligned}$$

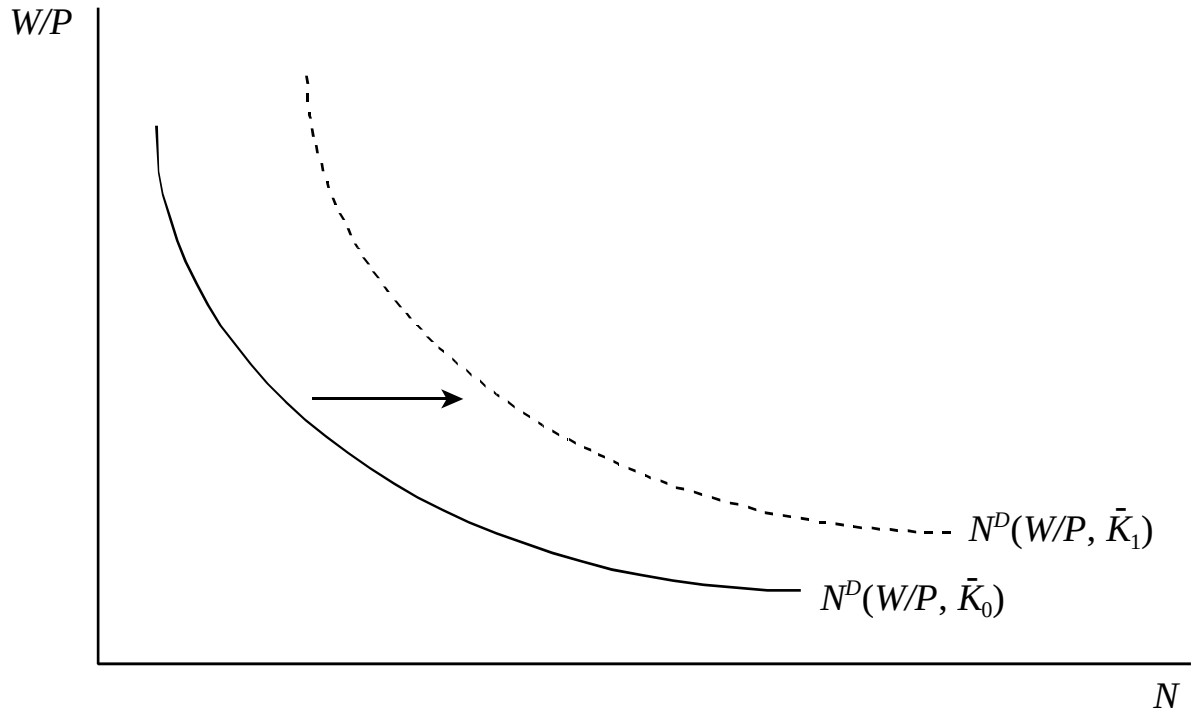
Property of the labour demand function

- In a general form we can thus write the implicit function:

$$N^D = N^D(\underset{-}{W/P}, \underset{+}{\bar{K}})$$

  with $N^D_{W/P} \equiv 1/F_{NN} < 0$ and $N^D_{\bar{K}} \equiv -F_{NK}/F_{NN} > 0$ ("cooperative factors").
- See **Figure 1.2** for the effect of an increase in $\bar{K}$.

Figure 1.2: The demand for labour



Preferences

- Utility function of the household:

$$U \equiv U(C, 1 - N^S)$$

  - C is household consumption.
  - N^S is household supply of labour (1 is the time endowment so $1 - N^S$ is leisure).
  - U is (an index of) household utility.

- Properties:
  - $U_C > 0$, $U_{1-N} > 0$
  - $U_{CC} < 0$, $U_{1-N,1-N} < 0$

Constrained utility maximization

- Budget constraint:

$$P^e C = W N^S$$

  - P^e is expected price level (point expectation).
  - Labour income only source of income.

- Objective of the household is to choose C and N^S to maximize utility:

$$\max_{\{C,N^S\}} U \equiv U(C, 1 - N^S) \quad \text{subject to} \quad P^e C = W N^S.$$

- Simplified treatment (substitute budget constraint into objective function):

$$\max_{\{N^S\}} U \equiv U\left[(W/P^e)N^S, 1 - N^S\right]$$

Constrained utility maximization

- First-order condition for an extremum:

$$\frac{dU}{dN^S} = 0: \quad \underbrace{(W/P^e)U_C}_{1} + \underbrace{[-1 \times U_{1-N}]}_{2} = 0.$$

  - Term 1 features U_C, the marginal utility of consumption, which measures the benefit of an extra unit of consumption.
  - Term 2: features U_{1-N}, the marginal utility of leisure, which measures the cost of "producing" an extra unit of labour supply.
- Private cost-benefit analysis determines optimal C and N^S.
- See **Figures 1.3 and 1.4** for a graphical illustration.

Figure 1.3: The consumption-leisure choice

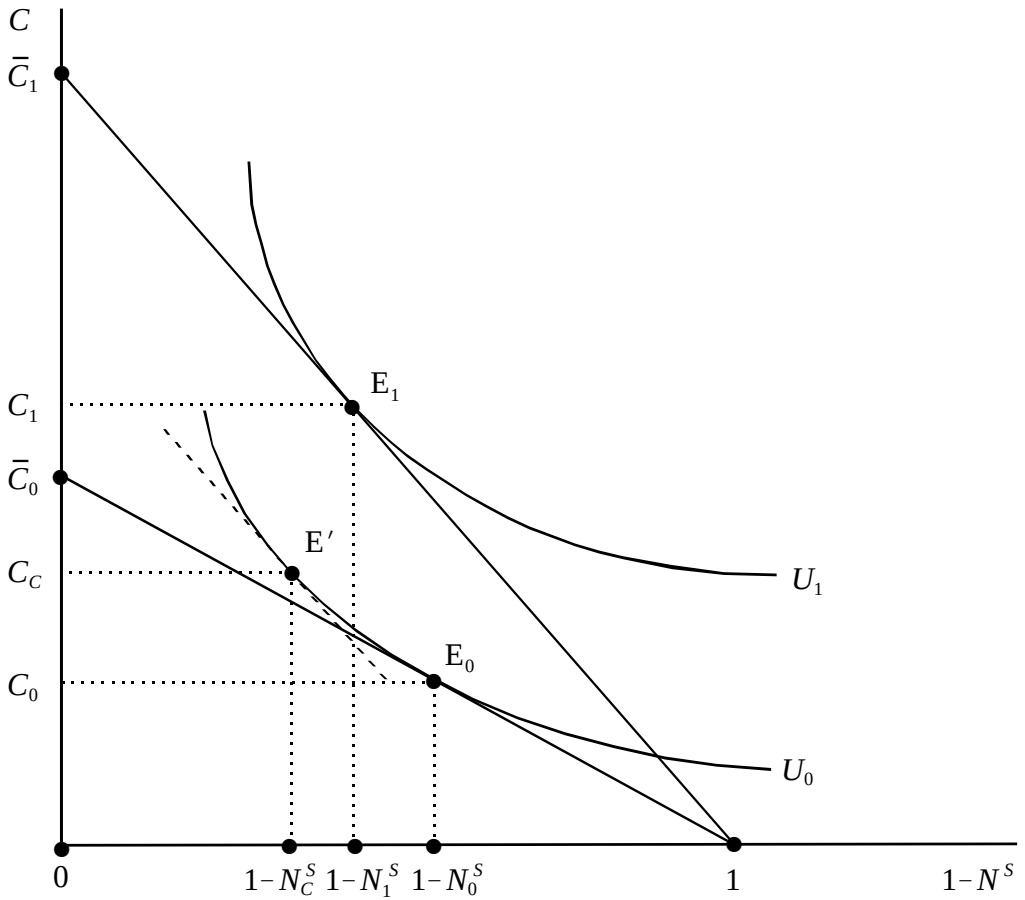
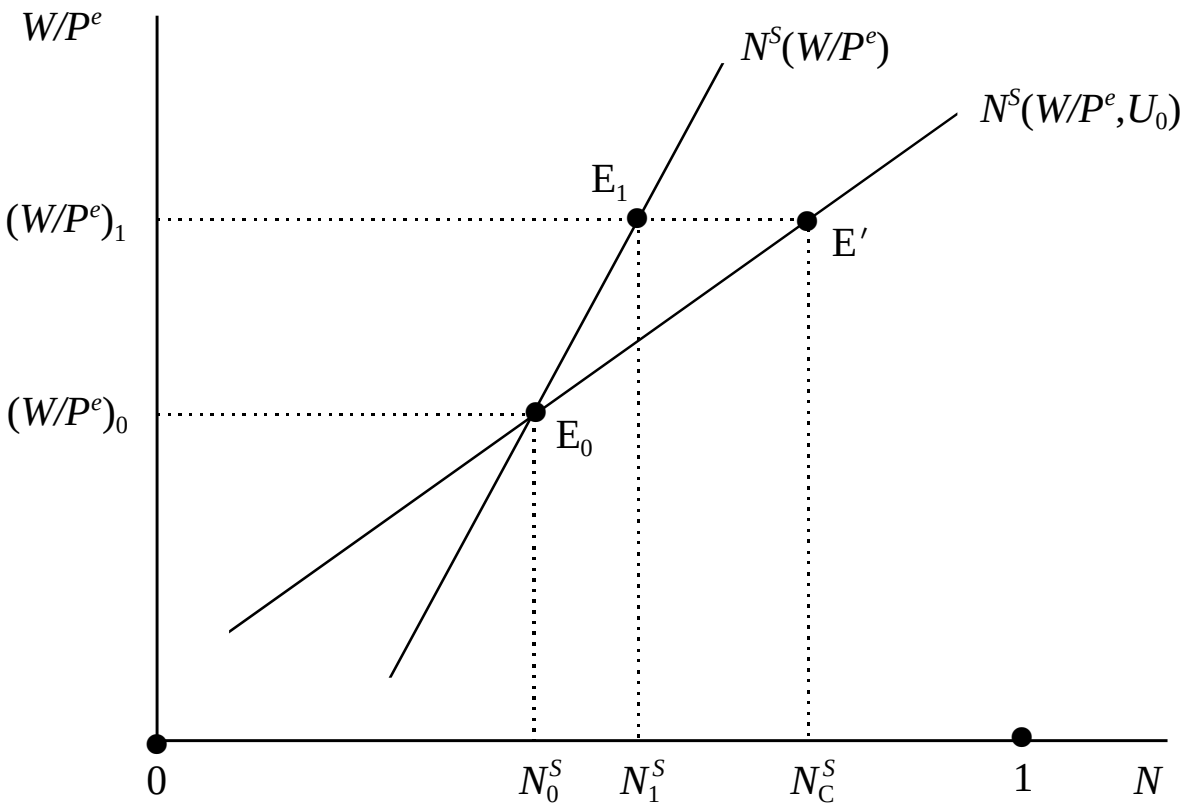


Figure 1.4: The supply of labour



Summary on labour supply

- Mathematically we summarize with general form:

$$\frac{W}{P^e} = g(N^S), \quad g_N \gtreqless 0 \Leftrightarrow \quad SE \gtreqless |IE|,$$

- Equivalently:

$$\frac{W}{P} = \frac{P^e}{P} g(N^S)$$

- *Supply side* of the model consists of the labour market plus the production function (link to the supply side of the goods market–hence the name). To complete the supply side model we must say something about expectations, i.e. about P^e.

Expectation Formation Hypotheses

- **AEH:** Adaptive expectations hypothesis:

$$P^e_{t+1} = P_t + (1-\lambda)\underbrace{\left[P^e_t - P_t\right]}_{(a)} \quad 0<\lambda<1 \quad \Longleftrightarrow$$

$$\Delta P^e_{t+1} = \lambda\left[P_t - P^e_t\right] \qquad \text{(AEH)}$$

  (a): expectational error. P^e_t is given in the short run but it adjusts slowly over time. If $P^e_t > P_t$ then expectations are adjusted downwards and vice versa if $P^e_t < P_t$

- **PFH**: Perfect foresight hypothesis:

$$P^e = P \qquad \text{(PFH)}$$

  Later in this course we will discuss the rational expectations hypothesis (REH) which is the extension of PFH to the stochastic economy.

Aggregate Supply Curves

- Four combinations possible:
  - Market clearing due to flexible wage and either (case 1) AEH or (case 2) PFH.
  - Market disequilibrium due to fixed wage and either (case 3) AEH or (case 4) PFH.
- Key feature: aggregate supply curve (AS) depends very much on whether we assume AEH or PFH! See **Figure 1.5** for a graphical derivation of AS under both AEH and PFH.
- PFH plus clearing labour market gives vertical AS curve (Classical).
- Modigliani (1944): even if PFH is used, AS may have an upward sloping segment if the nominal wage is downward inflexible–see **Figure 1.6**.
- Conclusion: PFH itself is not enough to get Classical conclusions! (Same with REH.)

Figure 1.5: Aggregate supply and expectations

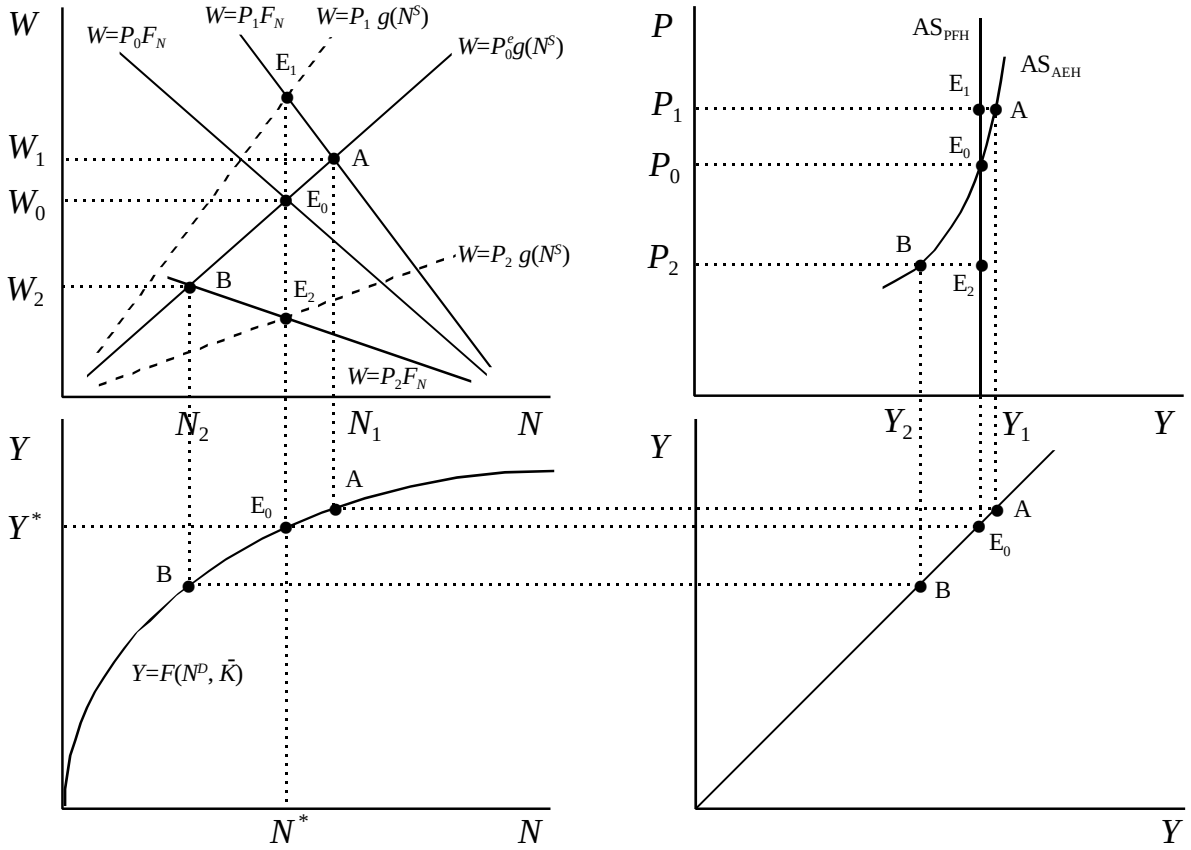
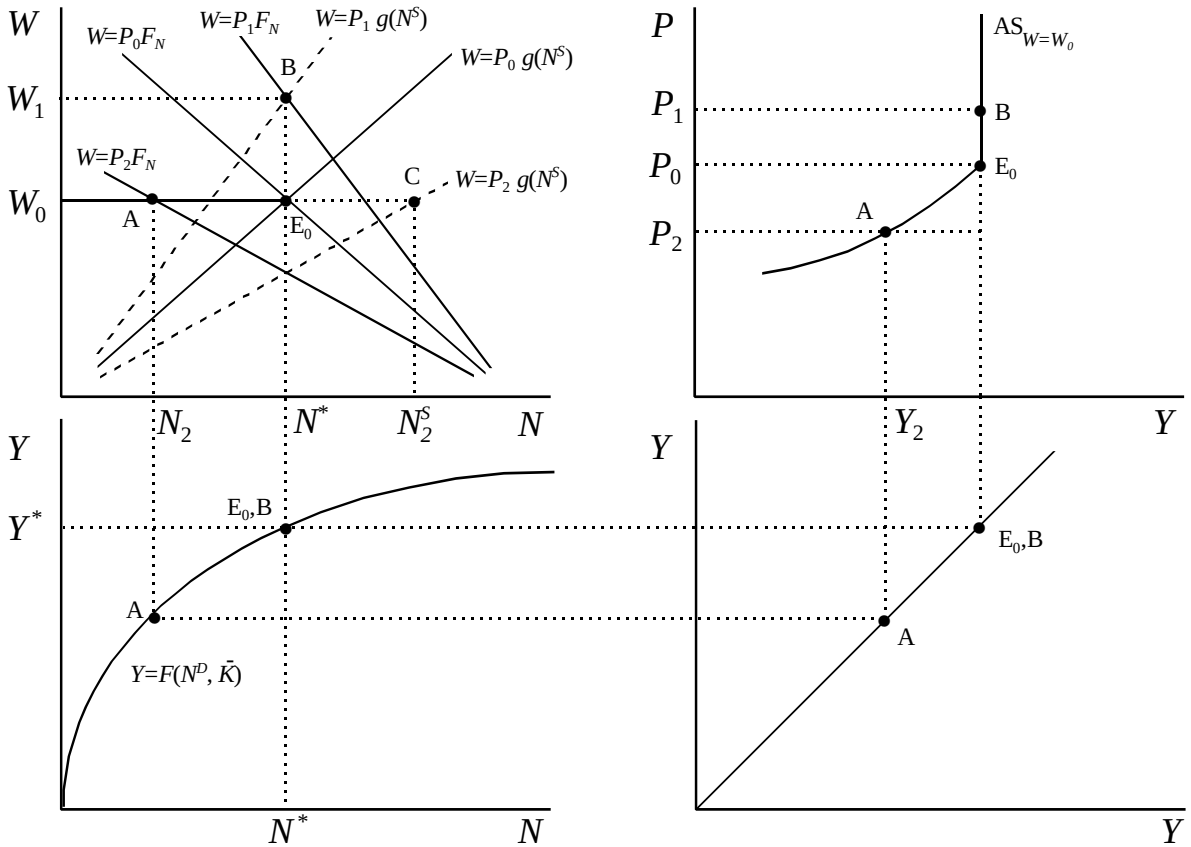


Figure 1.6: Aggregate supply with downward nominal wage rigidity



Test your understanding

****** Self Test ******

Derive the AS curve by graphical means under the assumption that the nominal wage cannot fall below W_0. Assume that the labour market is initially in equilibrium and that the initial price level is P_0.

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Theory of money

- Keynes claimed that his theory of money is very different from the Classical theory.
- Two motives for holding money in Keynes theory:
  - Transactions motive.

$$m_T^D \equiv \left(\frac{M}{P}\right)_T^D = k(Y), \qquad k_Y > 0$$

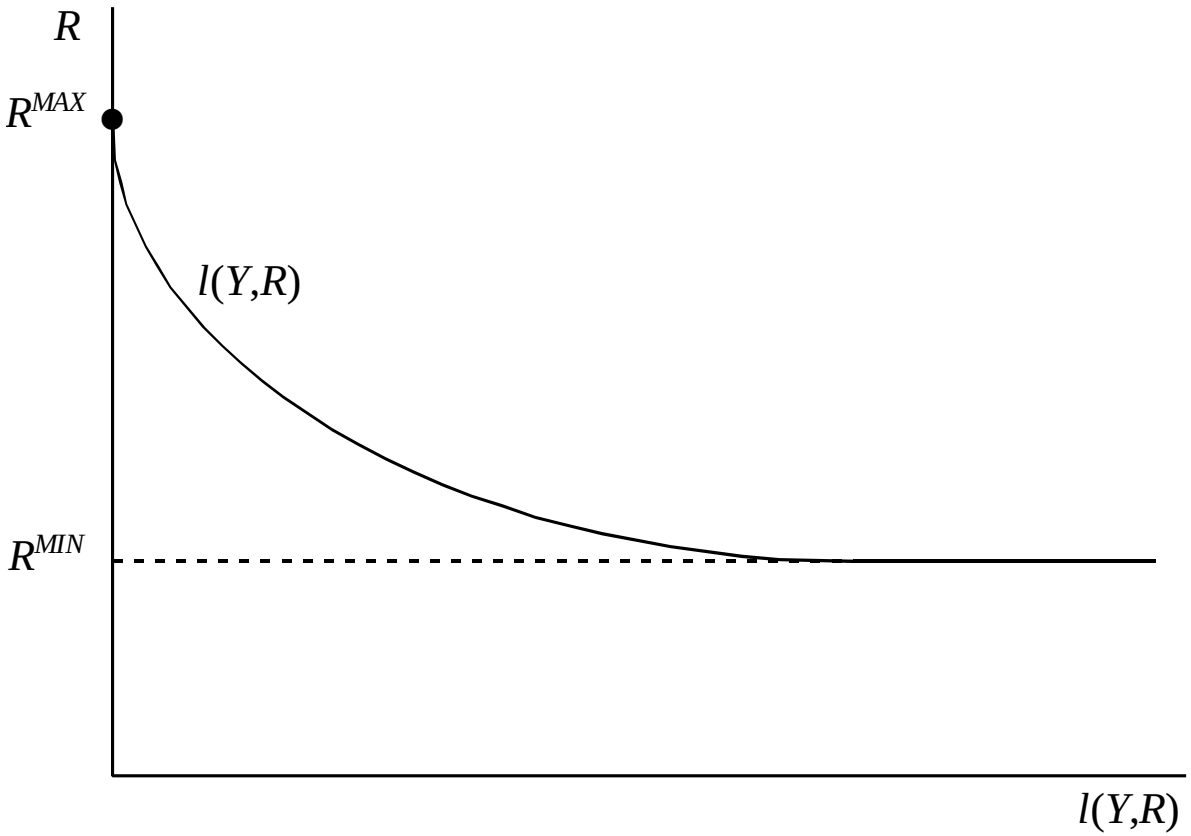
  - Speculative motive.

$$m_S^D \equiv \left(\frac{M}{P}\right)_S^D = l(R), \qquad l_R < 0$$

Money demand function

- **Figure 1.7** gives an illustration of a liquidity preference function.
  - A "liquidity trap" is a distinct possibility: the interest rate is so low ($R = R^{MIN}$) that people are indifferent between money and bonds. Additional money is willingly absorbed without the need to lower the interest rate.
  - If $R = R^{MAX}$ then people hold no money for speculative purposes. Bond prices are very low and are expected to rise. Hence capital gains on bonds are expected.

Figure 1.7: The liquidity preference function



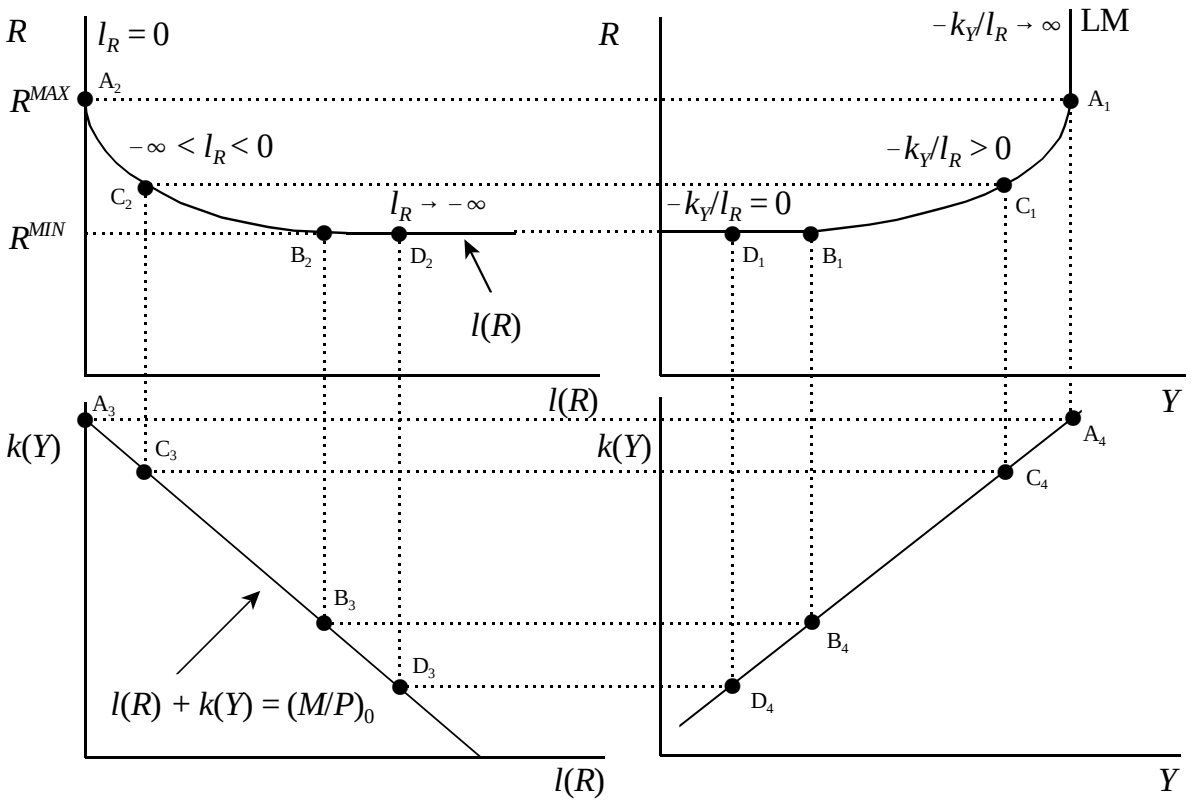
Money market model

- Money market model:

$$\begin{aligned} m^D &\equiv m_S^D + m_T^D = k(Y) + l(R) = L(Y,R) \\ m^S &= M/P \\ m^D &= m^S \end{aligned}$$

  - M is the exogenous **nominal** money supply (under control of the monetary authority).
  - m is **real** money (nominal money in terms of price level).
  - Real demand equals real supply of money.
- The LM curve summarizes money market equilibrium. See **Figure 1.8** for the derivation.
- As we shall see, the slope of the LM curve is an important source of disagreement among the different schools of thought in macroeconomics.

Figure 1.8: Derivation of the LM curve



The IS-LM Model

- Quick review of the IS-LM model:

$$
\begin{aligned}
Y &= C + I + G, \\
C &= C(Y - T), \quad 0 < C_{Y-T} < 1, \\
I &= I(R), \quad I_R < 0, \\
T &= T(Y), \quad 0 < T_Y < 1, \\
M/P &= l(Y, R), \quad l_Y > 0,\ l_R \leq 0,
\end{aligned}
$$

  - I is investment (in capital goods, e.g. machines, PCs, buildings).
  - G is government consumption.
  - T is taxes ($Y - T$ is after tax income).
  - $T(Y)$ is the tax function and T_Y is the marginal tax rate.

Slopes in (R, Y) space

- Slope of IS curve:

$$\begin{aligned} Y &= C(Y - T(Y)) + I(R) + G \quad \Rightarrow \\ dY &= C_{Y-T}\left(dY - T_Y dY\right) + I_R dR + dG \quad \Rightarrow \\ dY &= C_{Y-T}\left(1 - T_Y\right) dY + I_R dR + dG \quad \Rightarrow \\ dY &= \frac{I_R dR + dG}{1 - C_{Y-T}\left(1 - T_Y\right)} \end{aligned} \tag{A}$$

- Slope of LM curve:

$$\begin{aligned} M/P &= l(Y, R) \quad \Rightarrow \\ d(M/P) &= l_Y dY + l_R dR \quad \Rightarrow \\ dR &= \frac{d(M/P) - l_Y dY}{l_R} \end{aligned} \tag{B}$$

From IS-LM to the AD curve

- The IS-LM equilibrium represents (Y, R) combinations for which the money market and the demand side of the goods market are in equilibrium, given the exogenous variables M and G and the price level P.
- The aggregate demand (AD) curve is the IS-LM equilibrium expressed as combinations of Y and P (again given the exogenous variables M and G).

From IS-LM to the AD curve

- To find the slope of the AD curve we substitute (B) into (A):

$$\begin{aligned} dY &= \frac{I_R \frac{d(M/P) - l_Y dY}{l_R} + dG}{1 - C_{Y-T}(1 - T_Y)} \\ [1 - C_{Y-T}(1 - T_Y)]\, dY &= I_R \frac{d(M/P) - l_Y dY}{l_R} + dG \\ \left[1 - C_{Y-T}(1 - T_Y) + \frac{I_R l_Y}{l_R}\right] dY &= \frac{I_R}{l_R} d(M/P) + dG \end{aligned}$$

- Or, after simplifying:

$$dY = \frac{dG + (I_R/l_R)(M/P)\left[\frac{dM}{M} - \frac{dP}{P}\right]}{1 - C_{Y-T}(1 - T_Y) + l_Y I_R/l_R} \qquad \text{(AD)}$$

Test your understanding

****** Self Test ******

Test your understanding of the material by deriving the AD curve graphically. Pay attention to both the "normal" case (with $-\infty < l_R < 0$) and the liquidity trap case (with $l_R \to -\infty$)

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The most important schools of thought

- Classical economists
- Keynesians
- Neo-classical synthesis (a.k.a. neo-Keynesian synthesis)
- Monetarists
- New-Classical economists
- Supply-siders
- New-Keynesians

Distinguishing features

- The real dividing issues are:
  - **Can** the government influence the outcome of the economic process?
  - **Should** the government influence the economic process?
- To preview the broad answers:
  - "Keynesian economists" (broadly defined) generally answer "yes" to both questions.
  - "Classical" economist (broadly defined) generally answer "yes" to the first and "no" to the second question.

Classical Economists

- *Names:* Adam Smith (1723-1790), David Hume (1711-1776), David Ricardo (1772-1823), John Stuart Mill (1806-1873), Knut Wicksell (1851-1926), Irving Fisher (1867-1947).
- Quantity theory of money; Fisher's equation of exchange:

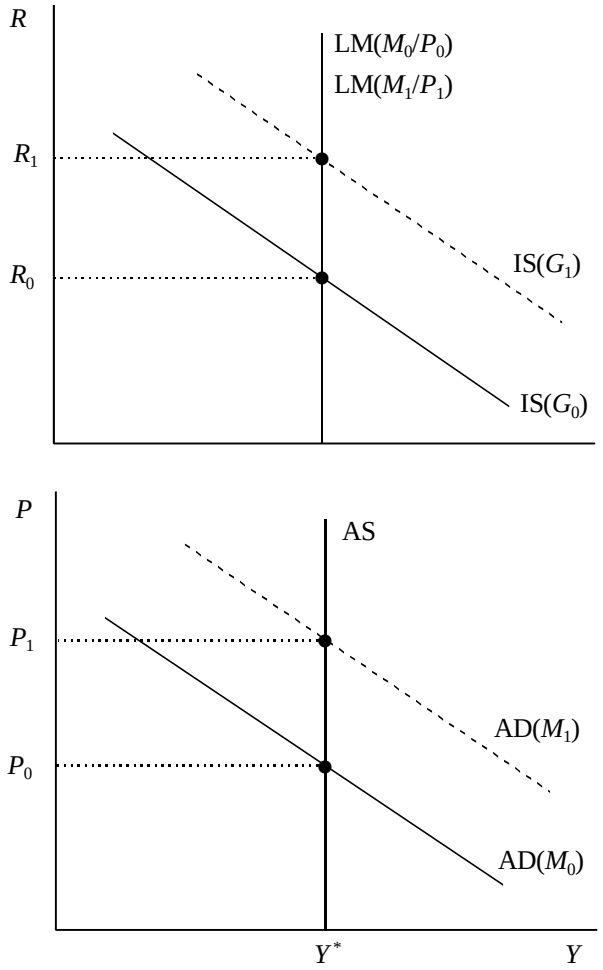
$$M = kPY$$

  with k constant.
- LM curve vertical ($l_R = 0$ in our notation).
- AD curve independent of government consumption G .

Classical Economists

- Fiscal policy useless. Just raises interest rate and crowds out investment (see **Figure 1.9**).
- Monetary policy useless. Just raises prices and does nothing to "real" things (see **Figure 1.9**).
- *Classical dichotomy*: money is a veil which determines nominal prices but does not affect real quantities and relative prices. Monetary neutrality.
- **Conclusion**: no need for macroeconomic policy. Leave well-enough alone. "Laissez-faire" economics.

Figure 1.9: Monetary and fiscal Policy in the classical model



Keynes?

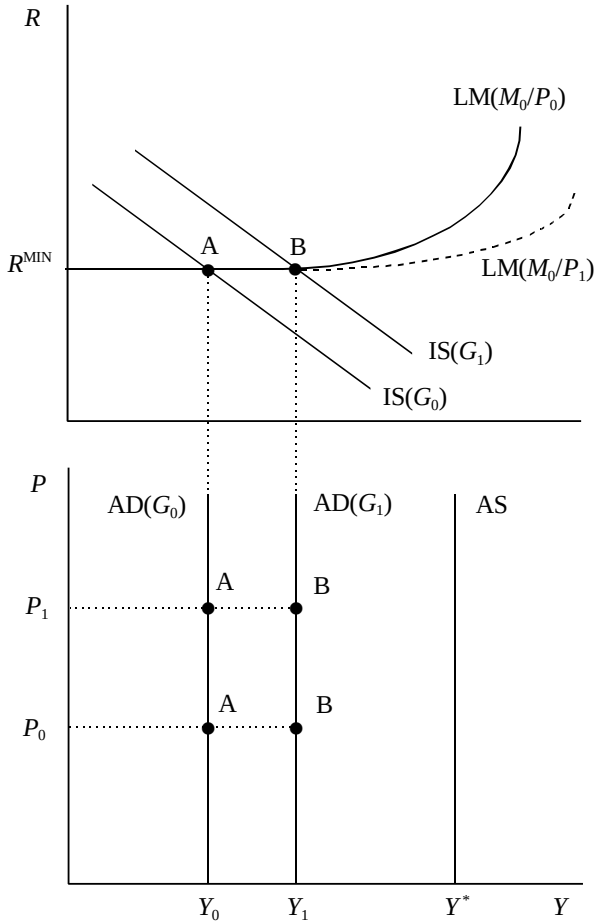
- *Names:* too many interpreters to mention.
- Gimmick of the liquidity trap.
- Horizontal segment in the LM curve.
- AD curve independent of nominal money supply M.
- Classical model is inconsistent! There is no price level consistent with full employment. See **Figure 1.10**.

Keynes?

- Fiscal policy very useful. Raises demand (and thus moves economy towards full employment); no interest rate change and thus no crowding out investment (see **Figure 1.10**).
- Monetary policy useless. Does nothing (see **Figure 1.10**).
- But: liquidity trap not relevant in real life and, according to Pigou, the real balance effect in consumption will render AD downward sloping and will ensure logical consistency of the Classical model.

$$C = C(\underset{+}{Y - T}, \underset{+}{M/P})$$

Figure 1.10: Monetary and fiscal policy in the Keynesian model



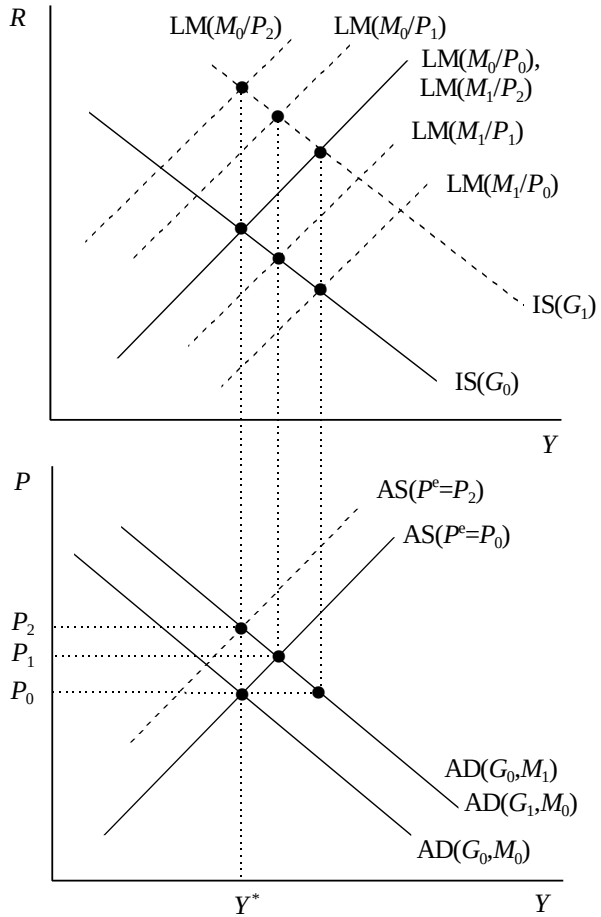
Neoclassical synthesizers

- *Names:* Paul Samuelson (1915-2009), James Tobin (1918-2002), Franco Modigliani (1918-2003), Robert Solow (1924-) plus virtually all economists in 1950s and 1960s except Milton Friedman (1912-2006).
- Pick best elements of Classical and Keynesian approaches.
- Economy is "Keynesian" in the short run but "Classical" in the long run.
- Long-run AS curve vertical, short-run AS curve upward sloping.

Neoclassical synthesizers

- Various sub-species exist, depending on the rationalization of the upward sloping short-run AS curve.
  - Nominal wage, W, sticky downward in the short run.
  - Expected price level, P^e, sticky in the short run (adaptive expectations).
- Both monetary and fiscal policy can affect the economy (see **Figure 1.11**).
- Underlying presumption is that the government should pursue a counter-cyclical policy.

Figure 1.11: Monetary and fiscal policy in the neo-Keynesian synthesis model



Monetarists

- *Names:* Milton Friedman (1912-2006) and his "Chicago boys".
- Interest sensitivity of investment high ($|I_R|$ large and IS flat) strong crowding out of I by G.
- Quantity theory of money ($l_R \approx 0$ in our notation; near vertical LM curve).
- Friedman hates the REH.
- Monetary policy is potent but...
- Policy maker makes timing errors ("long and variable lags") and may exacerbate the cycle.
- Constant money growth rule.

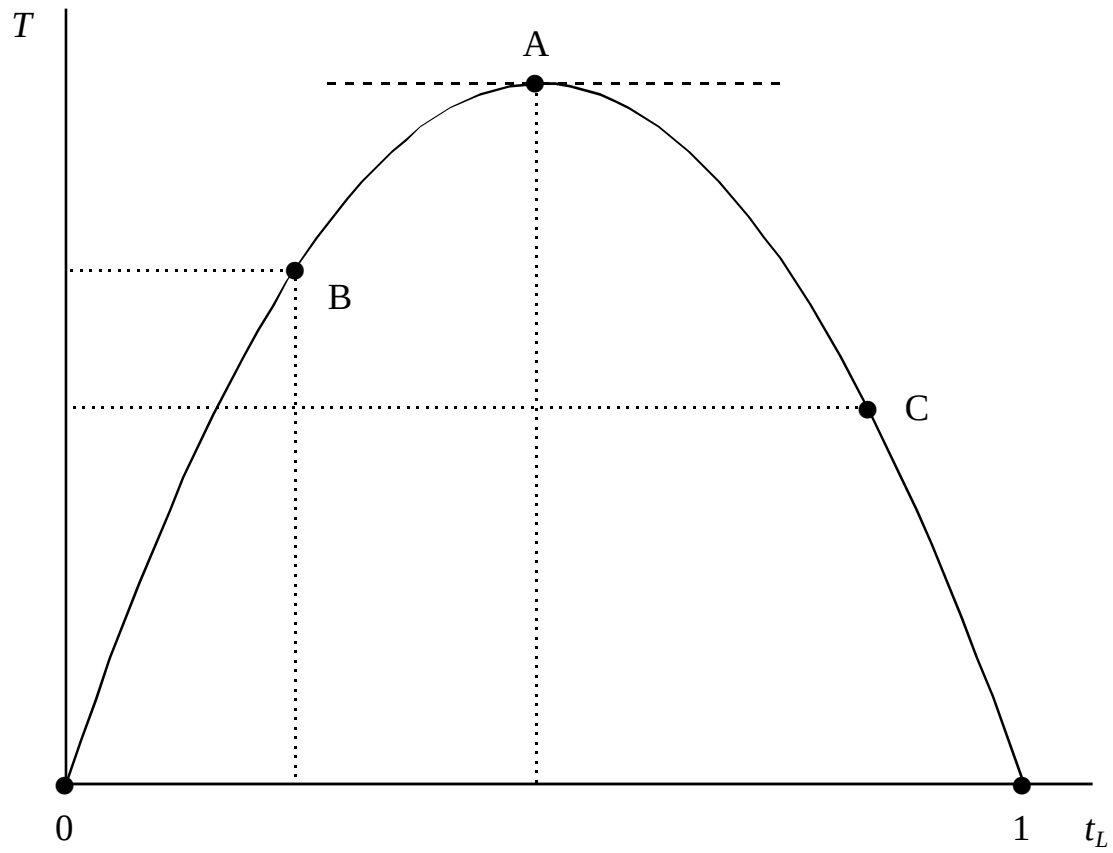
New Classical economists

- *Names:* Robert Lucas (1937-), Thomas Sargent (1943-), Edward Prescott (1940-), Robert Barro (1944-).
- Natural successors to the classical economists.
- Flexible prices/wages, REH (or PFH), full employment, efficient markets.
- Micro-foundations of macro-relations (e.g. investment demand, consumption demand, money demand, labour demand and supply).
- PIP as gimmick early on (see again in Chapter 3).

Supply siders

- *Names:* Arthur Laffer, Robert Mundell (1932-).
- Radical conservatives.
- Strong distrust of "the government" (Leviathan).
- Emphasis on distorting aspects of taxation.
- Policy advice *too good to be true*: you can cut the tax rate without reducing government spending. The tax cut pays for itself–see the so-called Laffer curve in **Figure 1.12**.
- Reagan loved it and ran huge deficits! Revisited by Bush Jr.
- Are they closet Keynesians?

Figure 1.12: The Laffer curve



New Keynesian economists

- *Names:* Edmund Phelps (1933-), Stanley Fischer (1943-), John B. Taylor (1946-), Olivier-Jean Blanchard (1948-), Greg Mankiw (1958-).
- Derive their inspiration from John Maynard Keynes.
- Markets are prone to fail or to be incomplete.
- After initial hesitation acceptance of the REH (or PFH).
- Government can and should intervene in the macro-economy.
- Keen attention to microfoundations.