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Advanced Macroeconomics II | Lecture| SS 2013

UNIVERSITÄT LEIPZIG
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1. Basic Macroeconomic Models

- Textbook (static) macromodel
- Dynamic AS-AD model
- Basic dynamic macromodel with expectations
- Schools of macroeconomic thought

Preliminaries (1)

- **Macroeconomics: two defining characteristics**
  - studies the **economic interactions** in society as a whole
  - aims at **understanding empirical regularities** in the behavior of aggregate economic variables such as production, investment, unemployment, price level…

- **Macroeconomics: three purposes**
  - **explain** the level of the aggregate variables as well as their movement over time in the short run and the long run
  - make well-founded **forecasts** possible
  - provide foundations for rational **macroeconomic policy**

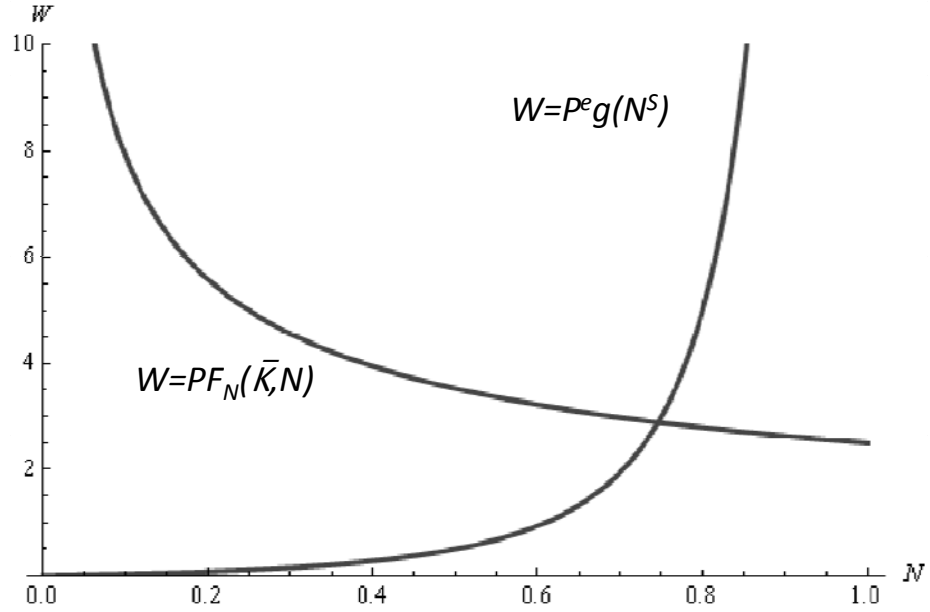
Preliminaries (2)

- **The short run…**
  - concentrates on the behavior of the macroeconomic variables within a **time horizon of a few years**.
  - focuses on mechanisms that determine how fully an economy uses its productive capacity and are typically **demand dominated**.
  - shifts in aggregate demand tend to be accommodated by **changes in the produced quantities** rather than in the prices of goods.

- **The long run…**
  - deals with a time horizon long enough such that changes in the capital stock, population, and technology have a dominating influence on the level of production.
  - uses analytical frameworks which are **supply dominated**. Variations in the employment rate for labor and capital due to demand fluctuations are ignored.

- **The medium run…**
  - medium run models (business cycle models) attempt to understand the pattern of **economic fluctuations**.
  - focuses on the dynamic interaction between demand and supply factors.
  - equally important is the formation of expectations, and the adjustment of wages and prices.

Textbook (static) macromodel: aggregate labor market



- The **problem of the typical firm** reads

$$\max_{N}\left\{PF(\bar{K},N)-WN\right\}$$

  - The firm can observe (hence knows) the **going price of its own output good** (P) and the wage rate (W).
  - The demand schedule may be expressed as: $W/P=F_N(\bar{K},N)$.

- The **problem of the typical household** is

$$\max_{C,N^S} U(C,1-N^S) \quad \text{s.t.} \quad P^eC=WN^S$$

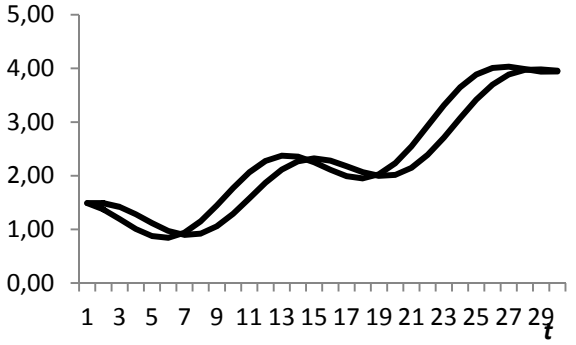
  - The household cannot observe the **prices of all consumption goods** and hence bases its decision on the expected price level (P^e).
  - Optimal N^S results from $W/P^e=U_{1-N}/U_C=:g(N^S)$.
  - The labor supply curve may be expressed as $W=P^eg(N^S)$ with $g'(N^S)>0$, i.e. we assume that the substitution effect dominates the income effect.

Textbook (static) macromodel: aggregate goods supply (1)

- The **adaptive expectations hypothesis** (AEH)

$$P_{t+1}^e = P_t + (1-\lambda)\underbrace{\left(P_t^e - P_t\right)}_{\text{expectational error in } t}$$

$$\Delta P_t^e = P_{t+1}^e - P_t^e = \lambda\left(P_t - P_t^e\right) \qquad 0 \le \lambda \le 1$$



- Under the AEH the expected price level (P^e) is adjusted to correct for past expectational errors.
- The problem with the AEH is that it may lead to permanent incorrect expectations.
- In the face of informational and cognitive constraints, the AEH may represent a valid approximation.

- The **perfect foresight hypothesis** (PFH)

$$P_t^e = P_t$$

- The PFH simply states that households expect the price level that actually holds.
- The PFH is the deterministic counterpart to the **rational expectations hypothesis** (REH).

Textbook (static) macromodel: aggregate goods supply (2)

nominal wage!

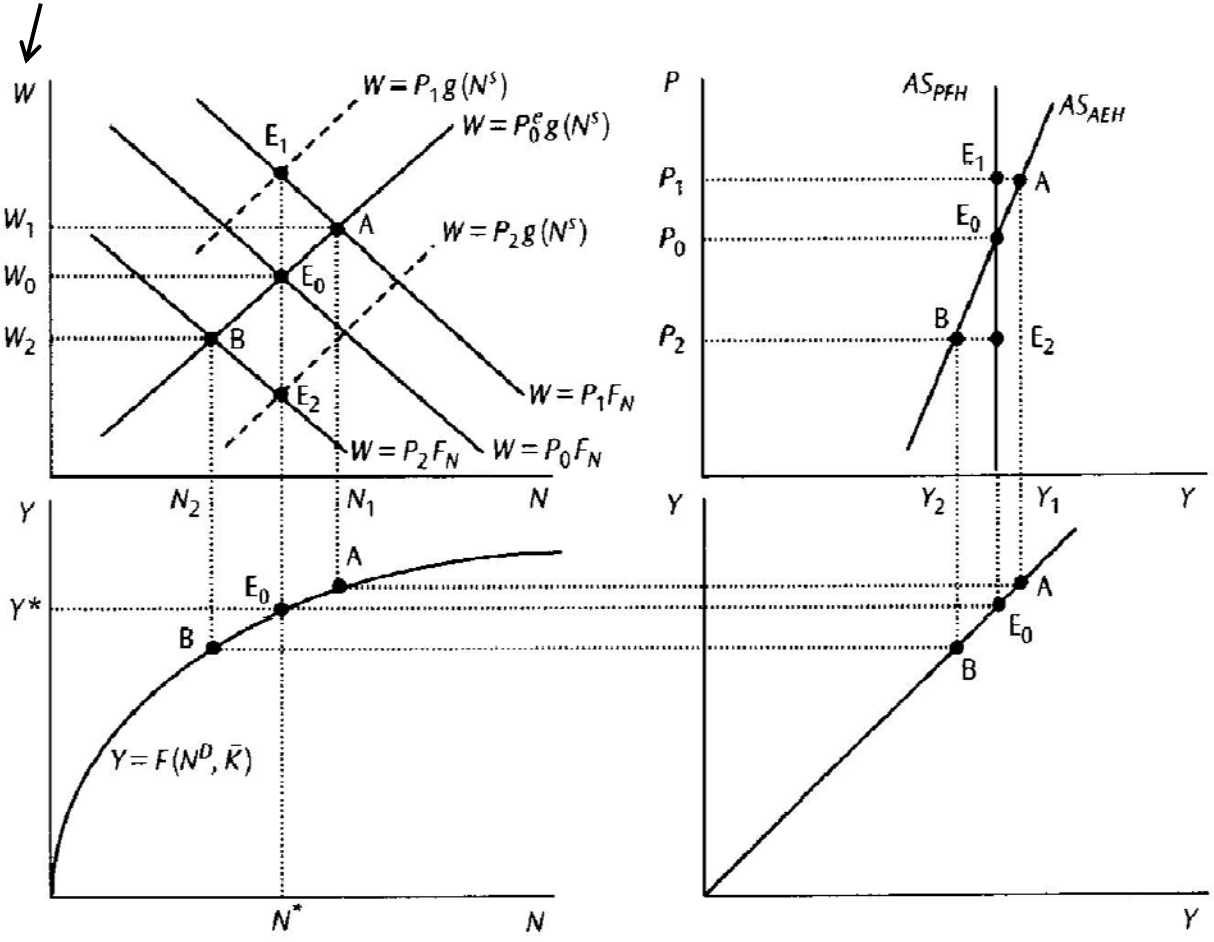


Figure 1.5. Aggregate supply and expectations

- The **AS-curve under AEH**
  - Suppose $P_0^e = P_0$. HH make no expectational error, supply the "correct" amount of labor (N^*) and output is at its potential level Y^* (point E_0).
  - Assume now that P increases to $P_1 > P_0$, while $P_0^e = P_0$ initially implying that the labor supply curve is unchanged.
  - However, the demand for labor shifts up so that labor market equilibrium is at point A. Associated output is $Y_1 > Y^*$.
  - Employment and output increase. The reason is that the real wage decreased such that firms demand more labor. HH must accept this lower real wage (they have underestimated P and overestimated W/P).

- The **AS-curve under PFH**
  - Expected and actual P always coincide and, hence, labor supply is always based on correct estimations of W/P.
  - Employment is always N^* and output equals Y^*. The AS curve is vertical.

Textbook (static) macromodel: aggregate goods supply (3)

nominal wage!

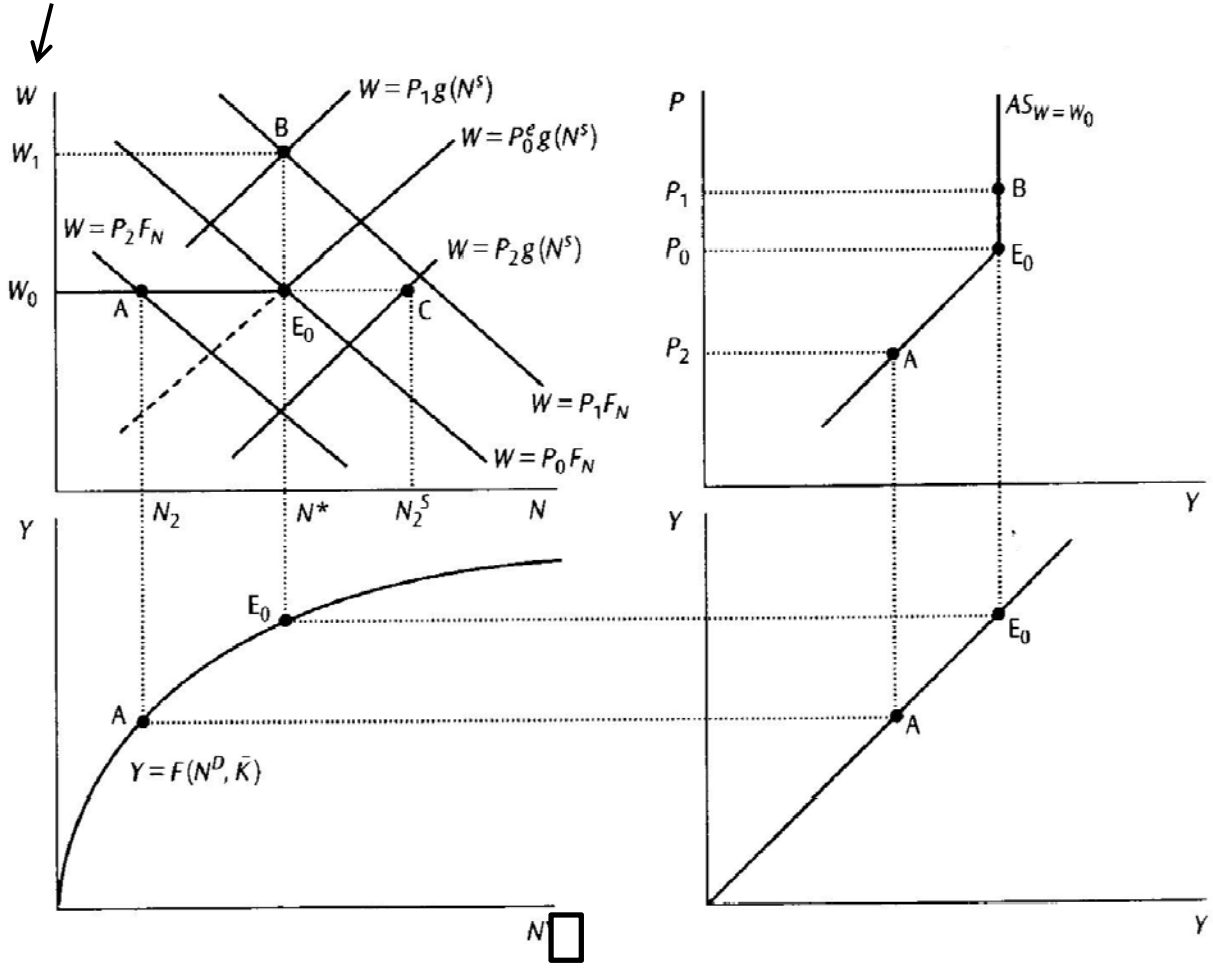


Figure 1.6. Aggregate supply with downward nominal wage rigidity

- AS-curve under **downward nominal wage rigidity**
  - The rigid nominal wage equals W_0.
  - P_0 is the price level such that full employment holds (point E_0).
  - The PFH is assumed to hold, i.e. $P_t^e = P_t$.
  - For $P_1 > P_0$, the nominal wage rises such that the real wage and employment remain constant (point *B*).
  - For $P_2 < P_0$, the demand for labor is $W = P_2 F_N$ but the effective labor supply is horizontal at the segment $W_0 C$ (point *A*).
  - Since it is assumed that the wage is not allowed to fall, employment equals N_2 ($< N^*$), while unemployment equals $N_2^S - N_2$.

Textbook (static) macromodel: aggregate goods demand (1)

- The **demand side** of the economy can be described by means of the **IS-LM model**

$$\text{IS}: \quad \underbrace{Y}_{\text{output=income}} = \underbrace{C(Y-T)+I(R)+G}_{\text{goods demand}} \qquad 0<C_Y<1,\ I_R \le 0$$

$$\text{LM}: \quad \underbrace{M/P}_{\text{money supply}} = \underbrace{L(Y,R)}_{\text{money demand}}, \qquad L_Y>0,\ L_R \le 0$$

- There are two endogenous variables: *Y* (aggregate demand) and *R* (interest rate).
- These two equations define *Y* and *R*.
- Usually, the (inverse) AD curve in (*Y*,*P*)-plane is negatively sloped.
- Provided that L_R=-∞ (liquidity trap) and / or I_R=*0* (investments are insensitive w.r.t. *R*), the AD curve is vertical in (*Y*,*P*)-plane (→ goods market equilibrium may not exist).

Textbook (static) macromodel: aggregate goods demand (2)

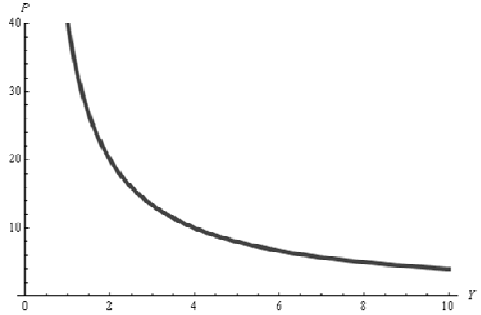
- Assume the following specific (linear) functional forms

$$\text{IS}: \quad Y = \bar{C} + cY + \bar{I} - bR, \qquad 0 < c < 1,\ b \geq 0$$

$$\text{LM}: \quad M / P = kY - hR, \qquad k > 0,\ h \geq 0$$

- The (inverse) AD-curve then reads

$$P = \frac{bM}{[(1-c)h + bk]Y - h(\bar{C} + \bar{I})}$$



  - Usually, this is a hyperbola in (*Y,P*)-plane (we focus only on the positive branch).
  - For *h=0* one gets *P=M/(kY).* This AD curve is basically the same as *P=(VM)/Y* (resulting from *PY=VM*).

- Two special cases: AD curve independent of *P*, i.e. AD is vertical in (*Y,P*)-plane.
  - For *b=0*, one gets $Y=(\bar{C}+\bar{I})/(1-c)$.
  - For $h=\infty$, one gets (→ quotient rule)

$$\frac{\partial Y}{\partial P} = -\frac{bM}{[(1-c)h + bk]P^2} \quad \Rightarrow \quad \frac{\partial Y}{\partial P} = 0 \ \text{ for } h = \infty$$

$$Y = \frac{bM + h(\bar{C} + \bar{I})P}{[(1-c)h + bk]P}$$

Dynamic AS-AD model: AD-curve

- The goods market (IS-Curve)

$$C = C_0 + b(1-\tau)Y$$
$$I = I_0 - h(i - \pi^e)$$
$$Y = C + I + G$$

real interest rate (Fisher-equation)

- The money market (LM-Curve)

For technical reasons we assume that the demand for real money balances is non-linear.

$$\ln M_d = kY - qi \qquad (\Leftrightarrow \; M_d = e^{kY-qi})$$
$$\ln M_s = \ln M - \ln P \qquad (\Leftrightarrow \; M_s = \frac{M}{P})$$
$$\ln M_s = \ln M_d$$

- The AD-Curve

$$Y = \frac{C_0 + I_0 + G + \frac{h}{q}\cdot \ln\left(\frac{M}{P}\right) + h\cdot\pi^e}{1 - b(1-\tau) + \frac{h\cdot k}{q}}$$

$$= a_0 + a_1 \cdot (\ln M - \ln P) + a_2 \cdot \pi^e$$

$$a_0 := \frac{C_0 + I_0 + G}{1 - b(1-\tau) + \frac{h\cdot k}{q}}$$

$$a_1 := \frac{h/q}{1 - b(1-\tau) + \frac{h\cdot k}{q}}$$

$$a_2 := \frac{h}{1 - b(1-\tau) + \frac{h\cdot k}{q}}$$

Dynamic AS-AD model: AS-curve and inflationary expectations

- **The AS-Curve**

$$\pi = \alpha(Y - Y_n) + \pi^e, \ \alpha > 0$$

➢ This AS-Curve results from a **modified Phillips-Curve**, $\pi=\pi^e-a(u-u_n)$, together with **Okun's law** of the form $u-u_n=-b(Y-Y_n)$, where $a,b>0$.

- **Inflationary expectations**

$$\dot{\pi}^e = \beta(\pi - \pi^e), \quad \beta > 0$$

Definition
$\dot{x}(t):=dx(t)/dt$

➢ If the actual inflation rate exceeds the expected inflation rate, $\pi-\pi^e>0$, inflationary expectations are revised upwards, i.e. $\dot{\pi}^e>0$.

➢ Written in time discrete form this expectations hypothesis can be expressed as

$$\pi^e_{t+1} - \pi^e_t = \beta(\pi_t - \pi^e_t) \qquad \Rightarrow \qquad \pi^e_{t+1} = \pi^e_t + \beta(\pi_t - \pi^e_t)$$

Dynamic AS-AD model (3)

- **Reduced form**

$$\dot{\pi}^e = \beta\alpha(Y - Y_n) \qquad (*)$$

$$\dot{Y} = a_1\hat{M} - \alpha(a_1 - a_2\beta)(Y - Y_n) - a_1\pi^e \qquad (**)$$

  - Equation (*) shows that a positive output gap, Y-Y_n>0, induces an increase in expected inflation π^e.
  - Reason: According to the AS-Curve Y-Y_n>0 requires π-π^e>0. The latter induces a revision of inflationary expectations.
  - Equation (**) shows that
    - Output increases, $\dot{Y}$>0, if $\hat{M}$>0: an increase of nominal money supply increases AD.
    - Output decreases, $\dot{Y}$<0, if Y-Y_n>0 and a_1-$a_2\beta$>0. Reason: Y-Y_n>0 unfolds two opposing effects: (i) π increases, which reduces M/P and hence AD falls, (ii) π^e increases, which reduces the real interest rate and hence AD goes up.

- **Steady State ($\tilde{Y}$, $\tilde{\pi}^e$): time invariant solutions**

$$\dot{\pi}^e = \beta\alpha(Y - Y_n) = 0 \quad \Rightarrow \quad \tilde{Y} = Y_n$$

$$\dot{Y} = a_1\hat{M} - \alpha(a_1 - a_2\beta)(Y - Y_n) - a_1\pi^e = 0 \quad \Rightarrow \quad \tilde{\pi}^e = \tilde{\pi} = \hat{M}$$

Dynamic AS-AD model (3a)

- **Determination of the reduced form: elimination of π**

$$\dot{\pi}^e = \beta \underbrace{(\pi - \pi^e)}_{\alpha(Y - Y_n)} \quad \Rightarrow \quad \dot{\pi}^e = \beta\alpha(Y - Y_n) \qquad (***)$$

$$Y = a_0 + a_1 \cdot (\ln M - \ln P) + a_2 \cdot \pi^e \quad \Rightarrow \quad \dot{Y} = a_1 \cdot (\underbrace{\hat{M}}_{\frac{d\ln M}{dt}} - \underbrace{\pi}_{\frac{d\ln P}{dt}}) + a_2 \cdot \dot{\pi}^e$$

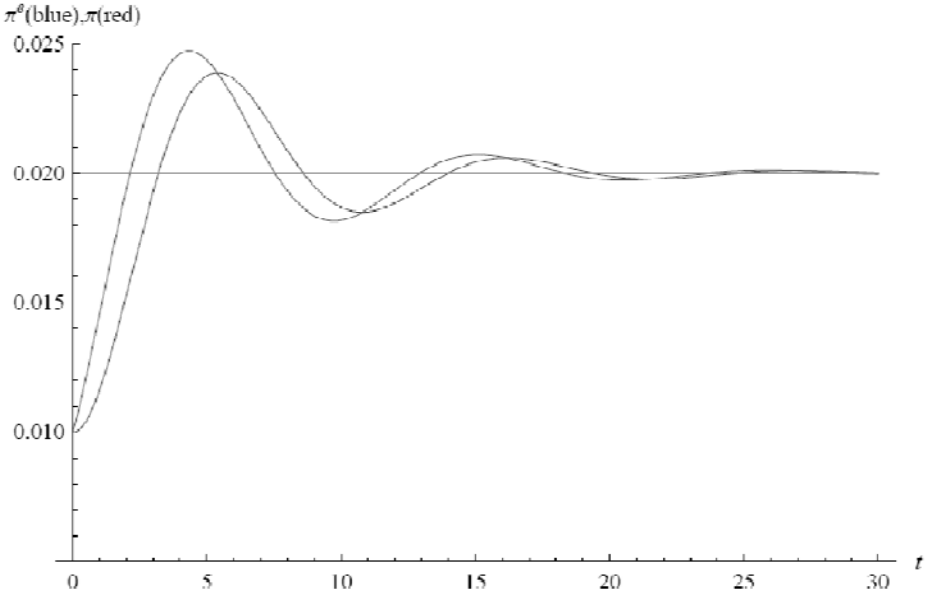
$$\dot{Y} = a_1[\hat{M} - \underbrace{(\alpha(Y - Y_n) + \pi^e)}_{\pi}] + a_2 \underbrace{\beta\alpha(Y - Y_n)}_{\dot{\pi}^e} = a_1\hat{M} - \alpha(a_1 - a_2\beta)(Y - Y_n) - a_1\pi^e \qquad (****)$$

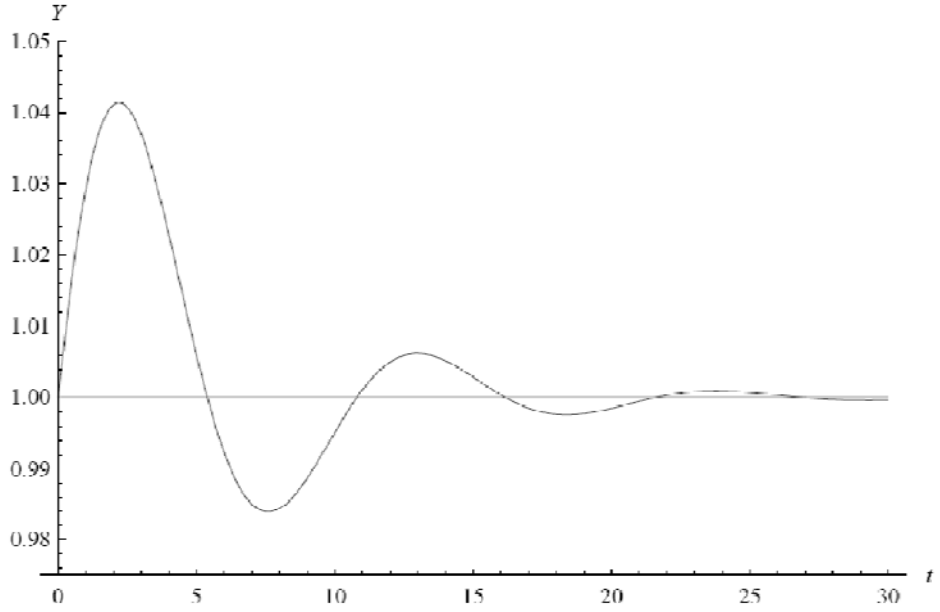
- Equ. (***) and (****) represent two linear differential equations in Y and π^e.
- Boundary conditions are given by the steady state solutions.
- On $\hat{M}$ and π. Recall:

$$\frac{d\ln x(t)}{dt} = \underbrace{\frac{1}{x(t)}}_{\text{outer derivative}} \underbrace{\frac{dx(t)}{dt}}_{\text{inner derivative}} = \frac{\dot{x}(t)}{x(t)} =: \hat{x}(t)$$

Dynamic AS-AD model (4)

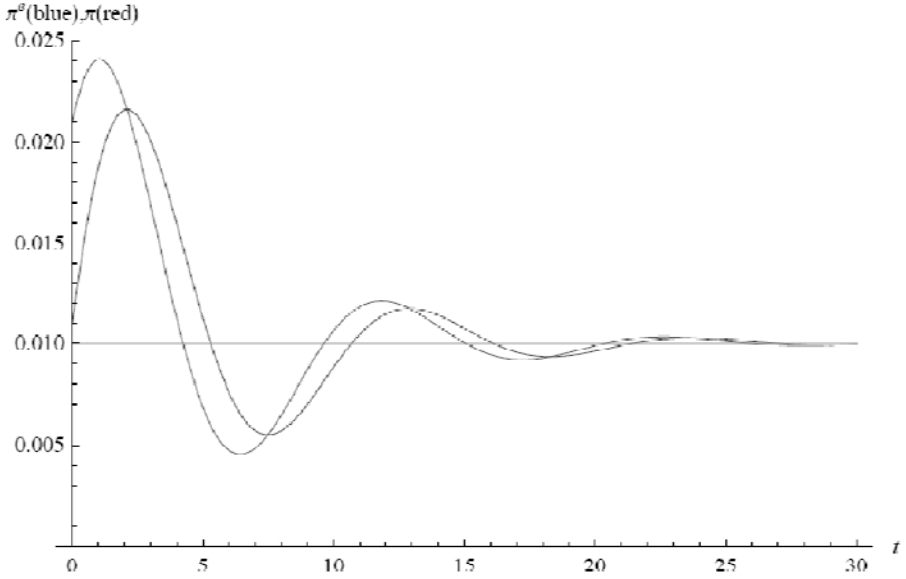
- **Dynamic responses (1): expansionary monetary policy (permanent increase of $\hat{M}$)**

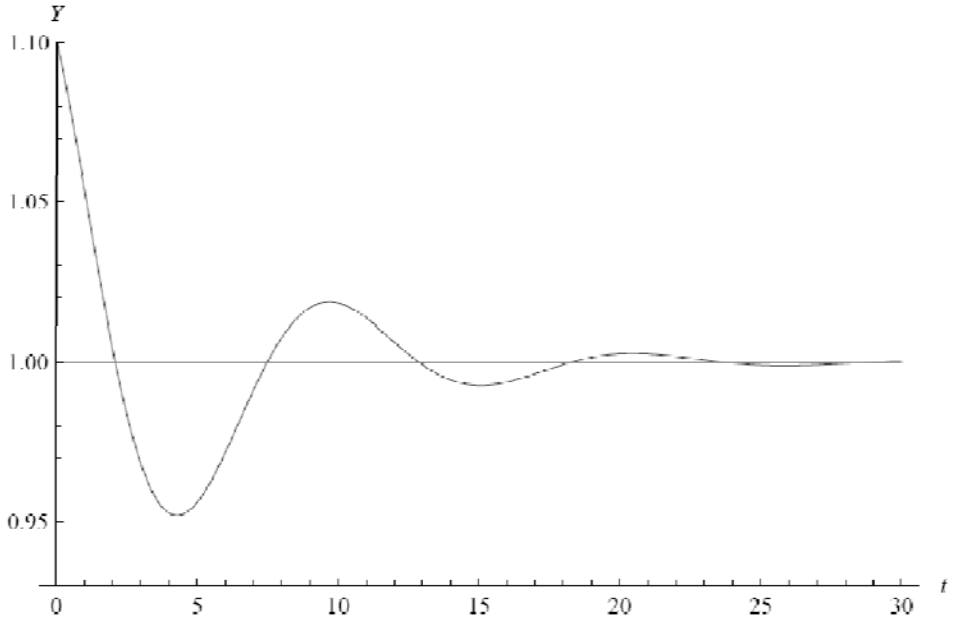




Dynamic AS-AD model (5)

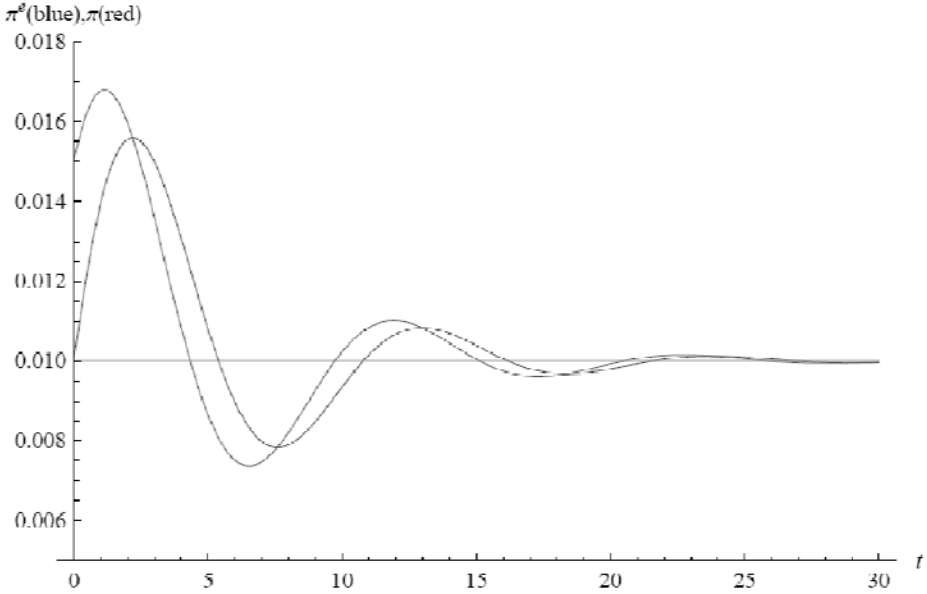
- **Dynamic responses (2): expansionary fiscal policy (temporary increase of *G*)**

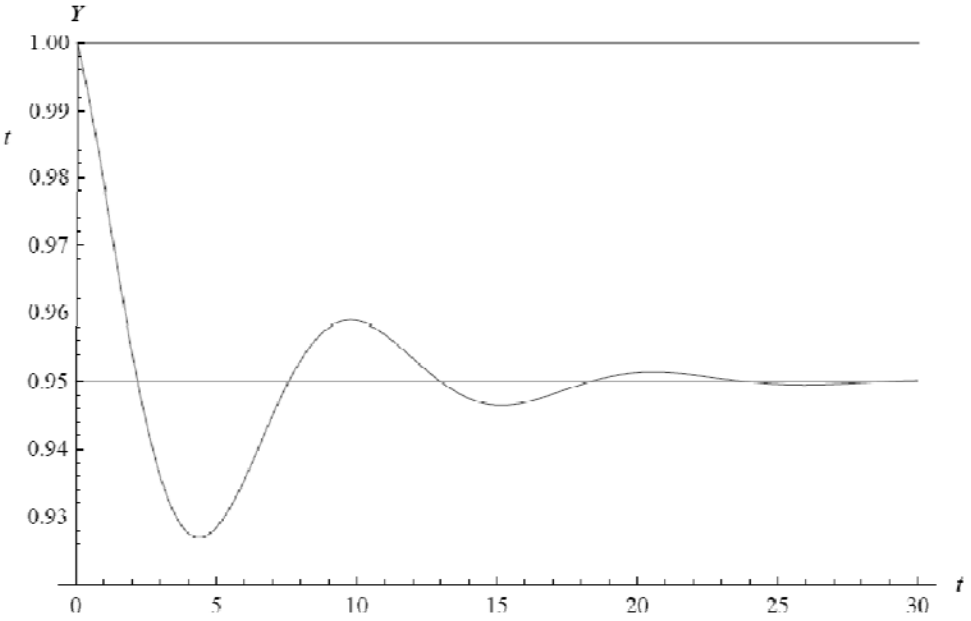




Dynamic AS-AD model (5)

- **Dynamic responses (3): negative supply shock (permanent)**





Basic dynamic macromodel with expectations: model setup (1)

- Firms produces a homogenous output good **under perfect competition** using

$$Y_t = L_t^{\alpha}, \ 0 < \alpha < 1$$

- Firms are assumed to **maximize profits** given by

$$\Pi_t = P_t Y_t - W_t L_t$$

- The first-order condition (FOC) for optimal labor input implies

$$\alpha L_t^{\alpha-1} = \frac{W_t}{P_t} \quad \Rightarrow \quad L_t = \alpha^{\frac{1}{1-\alpha}} \left(\frac{W_t}{P_t} \right)^{\frac{1}{\alpha-1}}$$

- The **indirect production function**, *Y=F(W/P)*, is hence given by

$$Y_t = \alpha^{\frac{\alpha}{1-\alpha}} \left(\frac{W_t}{P_t} \right)^{\frac{\alpha}{\alpha-1}}$$

Basic dynamic macromodel with expectations: model setup (2)

- Labor unions have a **target real wage**, which is normalized to one, i.e. $W_t/P_t=1$. Moreover, labor unions have the power to set $W_t/P_t=1$. Hence, labor unions set W_t, negotiated at the beginning of each period t, such that

$$W_t = P_t^e$$

  - There is "substantial unemployment" at $W_t/P_t=1$. Accordingly, if the real wage falls below one, the additional labor demand by firms can be satisfied.
  - This assumption is compatible with collective bargaining models of unemployment.

- The **AS-curve** can hence be expressed as

$$Y_t = \alpha^{\frac{\alpha}{1-\alpha}} \left(\frac{P_t}{P_t^e} \right)^{\frac{\alpha}{1-\alpha}}$$

$$y_t = \underbrace{y^*}_{=\ln \alpha^{\frac{\alpha}{1-\alpha}}} + \underbrace{a}_{=\frac{\alpha}{1-\alpha}} (p_t - p_t^e)$$

  - Lower case letters denote (natural) logarithms, i.e. $x_t := \ln X_t$.

Basic dynamic macromodel with expectations: model setup (3)

- The **AD-schedule** is described by the **quantity equation of money**, $M_tV_t=Y_tP_t$, expressed in logarithms

$$m_t + \underbrace{v_t}_{=0} = y_t + p_t$$

  - nominal transaction volume per period, Y_tP_t, must equal the nominal money supply times the velocity of money per period, M_tV_t.
  - assuming that $V_t=1$ for all t, we have $v_t=0$.

- **Price expectations** are formed according to an **adaptive expectations** scheme

$$p_t^e = p_{t-1}^e + \beta(p_{t-1} - p_{t-1}^e),\ 0 \le \beta \le 1$$

- Alternatively, we consider the **rational expectation hypothesis** such that

$$p_t^e = E(p_t \mid \Omega_{t-1})$$

  - $E(.)$ denotes the expectations operator.
  - Ω_{t-1} the information set at the end of period $t-1$.

- **Monetary policy** controls nominal money supply according to $M_t=M^*exp(\varepsilon_t)$ or

$$m_t = m^* + \varepsilon_t$$

  - ε_t represents an i.i.d. error term with $E(\varepsilon_t)=0$, $V(\varepsilon_t)=const.$ and $Cov(\varepsilon_t, \varepsilon_{t+i})=0$ for all t and i.

Basic dynamic macromodel with expectations: dynamic system and steady state

- **The complete dynamic system**

$$\text{AS}: \; y_t = y^* + a(p_t - p_t^e), \;\; 0 < a < 1$$

$$\text{AD}: \; m_t = y_t + p_t$$

$$\text{MP}: \; m_t = m^* + \varepsilon_t$$

$$\text{Expectations}: \; p_{t+1}^e = p_t^e + \beta(p_t - p_t^e), \;\; 0 \le \beta \le 1$$

- **Steady state**

The steady state is defined by $y_t=y_{t-1}$, $p_t=p_{t-1}$, $p_t^e=p_{t-1}^e$ for all t. Letting $\tilde{x}$ denote the (pseudo) steady state value of variable x_t (assuming $\varepsilon_t=0$ for all t), one can express the steady state as follows

$$\tilde{y} = y^*, \;\; \tilde{p} = m^* - y^*, \;\; \tilde{p}^e = \tilde{p}$$

Basic dynamic macromodel with expectations: reduced-form dynamic system

- Combining the AS curve, the AD curve, and the monetary policy schedule one gets

$$m^* + \varepsilon_t = y^* + a(p_t - p_t^e) + p_t$$

- Solving for p_t gives

The equilibrium price level (AD=AS), given p_t^e.

$$p_t = \frac{1}{1+a}\left(m^* + \varepsilon_t - y^*\right) + \frac{a}{1+a}\,p_t^e \qquad (*)$$

- Next, substitute p_t^e by the RHS of the adaptive expectations scheme to yield

$$p_t = \frac{1}{1+a}\left(m^* + \varepsilon_t - y^*\right) + \frac{a}{1+a}\left[\,p_{t-1}^e + \beta(p_{t-1} - p_{t-1}^e)\right]$$

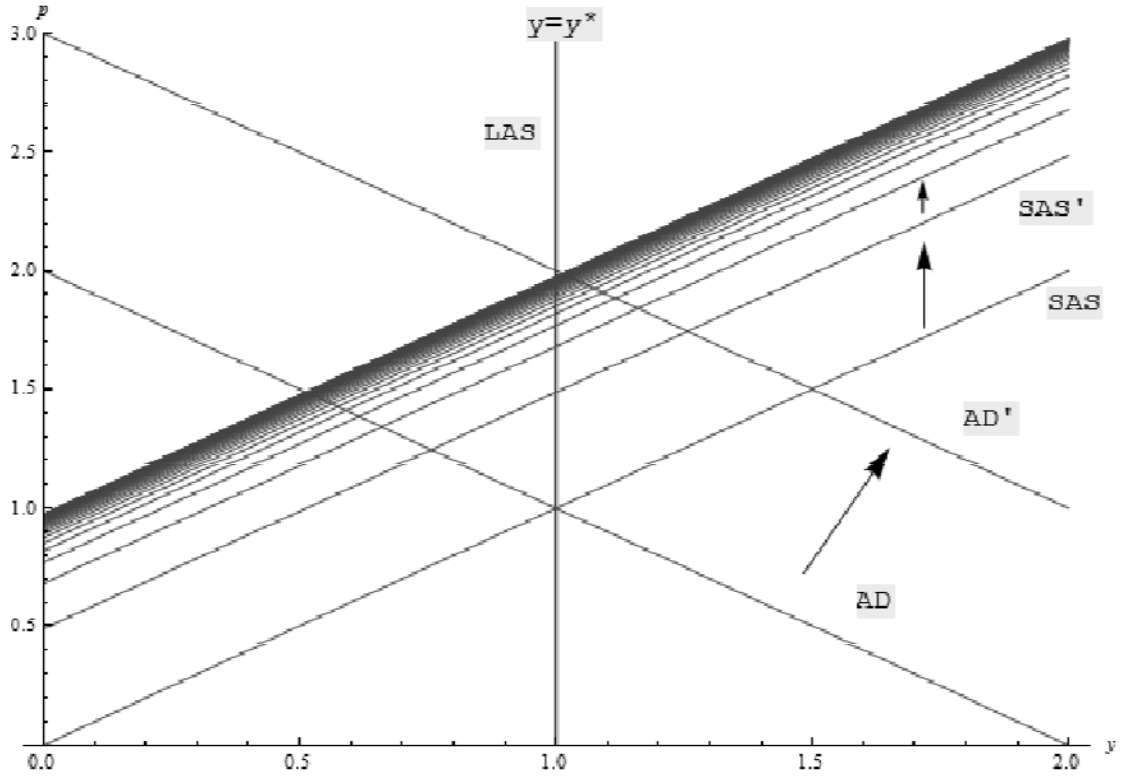
- The **reduced-form dynamic system** then comprises

$$p_t^e = p_{t-1}^e + \beta(p_{t-1} - p_{t-1}^e) \qquad (**)$$

$$p_t = \frac{1}{1+a}\left(m^* + \varepsilon_t - y^*\right) + \frac{a}{1+a}\left[\,p_{t-1}^e + \beta(p_{t-1} - p_{t-1}^e)\right] \qquad (***)$$

Basic dynamic macromodel with expectations: monetary policy (1)

- **Adaptive expectations**



- Assuming that the economy is in a steady state initially, we have the following initial conditions $p_0=p_0^e=\tilde{p}$.
- The complete time paths $\{p_t\}$ and $\{p_t^e\}$ for $t \in \{0,\ldots, \infty\}$ can then be traced out by recursively solving (**) and (***).
- The time path $\{y_t\}$ can be calculated by evaluating the AS-curve.
- The associated excel file illustrates the dynamic consequences of an expansionary policy in the sense of a permanent increase in m^*.

Basic dynamic macromodel with expectations: monetary policy (2)

- **Rational expectations (RE)**
  - Rational expectations are taken to represent **model consistent expectations**.
  - To determine the **expected price level** under REH, we simply determine the equilibrium price level, implied by the underlying model, and then form the expected value, denoted $E(p_t)$.
  - Taking expectations on both sides of (*), noting that $E(\varepsilon_t)=0$ and that $p_t^e=E(p_t)$ is a fixed number, one gets

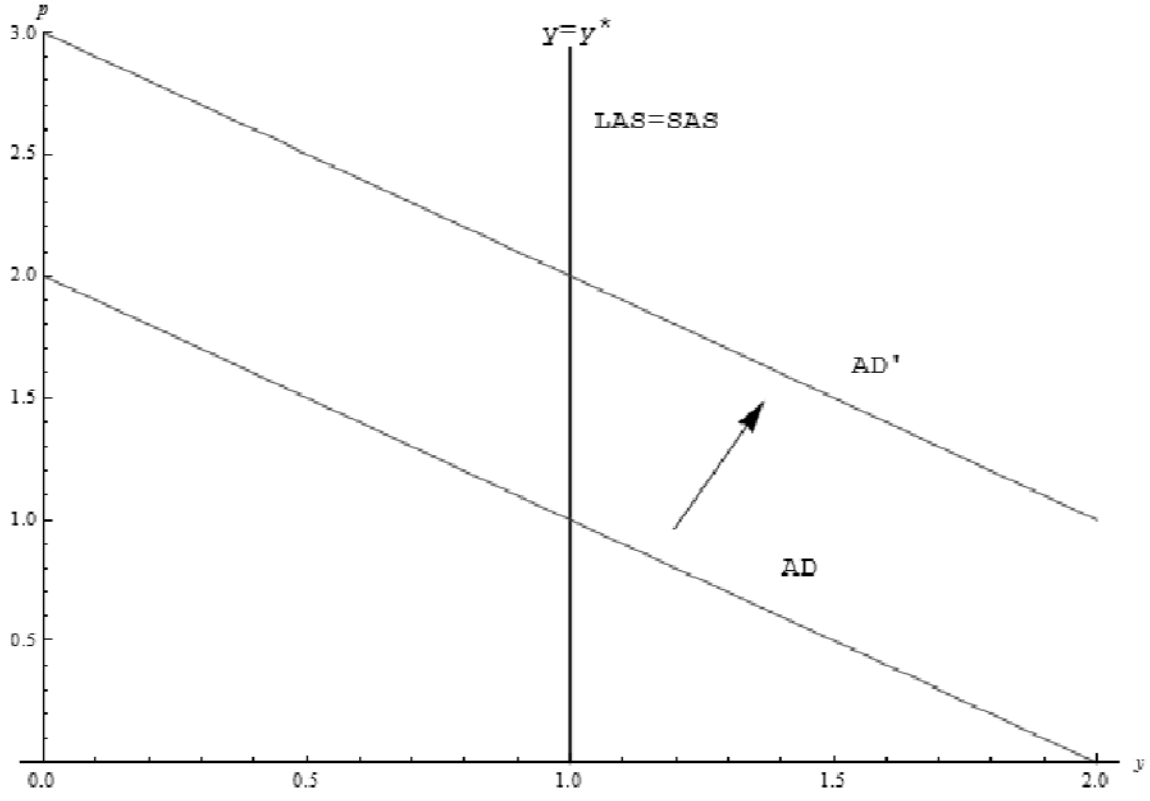
$$E(p_t)=\frac{1}{1+a}\left(m^*-y^*\right)+\frac{a}{1+a}E(p_t)$$

$$\left[1-\frac{a}{1+a}\right]E(p_t)=\frac{1}{1+a}\left(m^*-y^*\right)$$

$$E(p_t)=m^*-y^*$$

Basic dynamic macromodel with expectations: monetary policy (3)

- **Rational expectations**



- Assume that the economy is in a steady state initially, i.e. $y=y^*$, $p=m^*-y^*$, $p^e=p$.
- Monetary authorities increase the money supply from m^* to $m^{**}>m^*$ at the end of period t.
- Agents can anticipate this policy action. Initially, $E(p_t)=m^*-y^*=p_t$.
- Right after the monetary expansion, the expected price level jumps up such that $E(p_{t+1})= m^{**}-y^*=p_{t+1}$.
- As a result, an expected expansionary policy does not exert any real effects under the REH, but increases only the price level. The adjustment to the new steady state is immediate.

Schools in Macroeconomics: Classical Macroeconomics

- **Demand side**: Quantity theory of money implies a demand function like $L=kPY$.
  - Money demand is not interest sensitive.
  - The velocity of circulation ($V=1/k$) is constant.
  - The (inverse) AD curve reads: $P=M/(kY)$.

- **Supply side**: Strong belief in markets and the efficacy of the price mechanism.
  - Wages and prices are flexible, there is perfect foresight.
  - The labor market clears (at every instant of time), such that $N=N^*$, the AS curve is vertical at $Y=Y^*$.
  - Fiscal and monetary policy cannot affect output and employment.

- **Policy implications**
  - $L_R=0$ implies that the LM-curve is vertical.
  - Expansionary fiscal policy crowds out, via an increase in R, private investment (no shift in AD).
  - Expansionary monetary policy shifts AD, but does not exert any real effects (only P rises).

Schools in Macroeconomics: Keynesianism

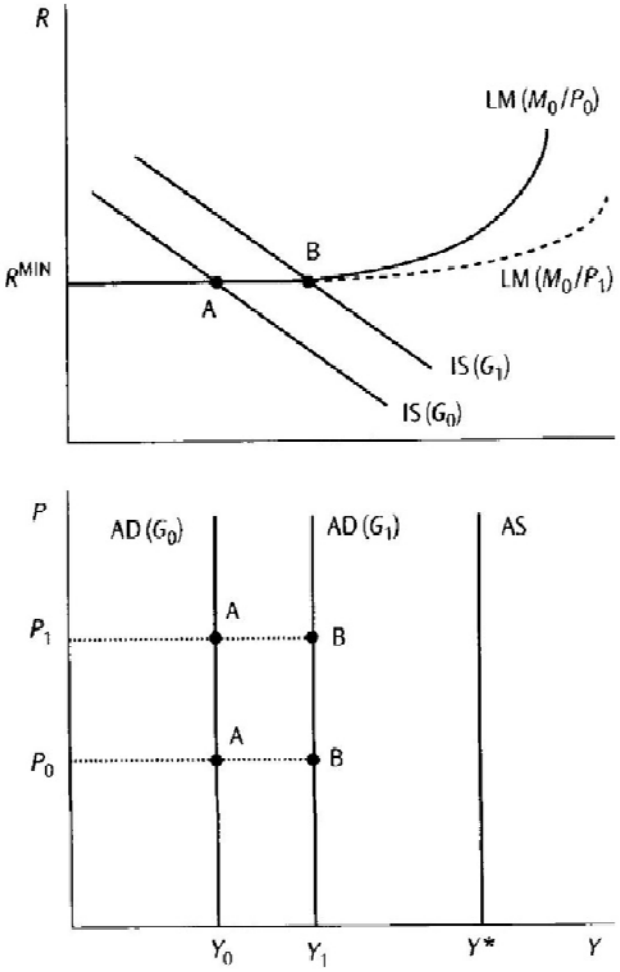


Figure 1.10. Monetary and fiscal policy in the Keynesian model

- One prominent Keynes interpretation is based on the **liquidity trap.**
  - Suppose that *R* is so low that the economy is on the horizontal part of the LM-curve.
  - Suppose also that the level of spending is too low to support full employment and that prices and wages are flexible.
  - The interest rate is R^{MIN} and output is $Y_0<Y^*$.
  - AS is vertical at $Y=Y^*$, but demand falls short of Y^*, and no price/wage change can restore equilibrium (goods market).
  - Monetary policy would be ineffective in increasing AD. Fiscal policy, on the other hand, is effective in increasing AD.
  - Pigou pointed out that this result (no equilibrium in goods market) disappears once wealth effects are taken into account. The position of the IS curve then depends on *M/P*, the AD curve will slope downward and full employment will be restored provided that *P* and *W* are flexible.

Schools in Macroeconomics: Neoclassical Synthesis

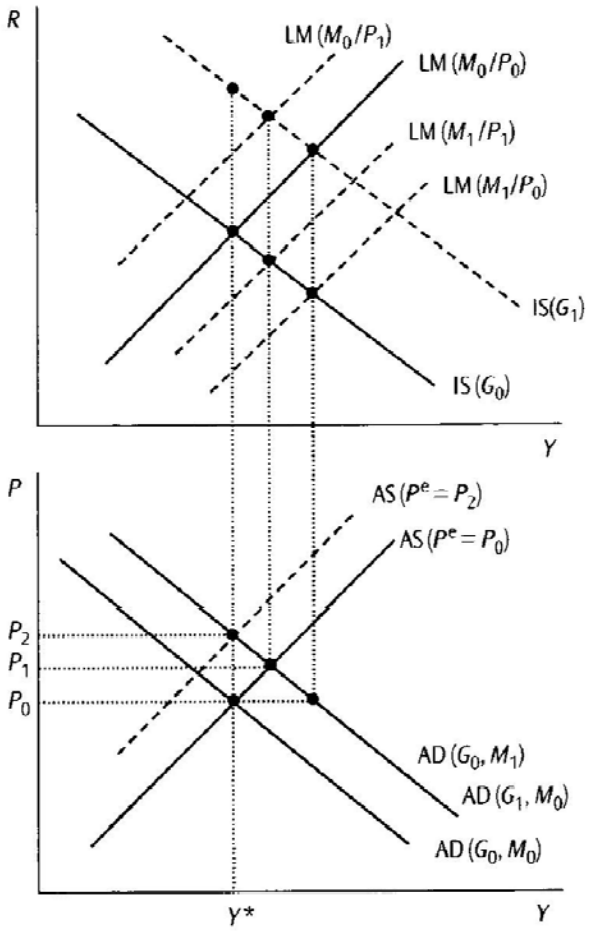


Figure 1.11. Monetary and fiscal policy in the neo-Keynesian synthesis model

- A synthesis of **short run Keynesian elements** and **long run classical elements**. There are different versions of the Neoclassical Synthesis.
- The 1st version maintains that **nominal wages are rigid downwards**.
  - The AS curve has an upward sloping branch.
  - To get some adjustment over time, one can add a Phillips curve, i.e. $\dot{W}=\alpha(N^S-N)/N^S$ with $\alpha<0$.
  - There may be temporary unemployment, but full employment will be restored over time.
- The 2nd version allows **nominal wages to be fully flexible**, but uses the **AEH** to make P a slowly moving variable.
  - The model comprises the AS curve, the AD curve and the AEH (see figure on the left).
  - For instance, an increase in bond financed public spending *G* shifts the AD curve outwards.
  - Output rises temporarily above Y^* and the price level increase from P_0 to P_1. The increased *P* implies a contraction in *M/P* such that AD falls.
  - Since *P* has increased, the short run AS curve shifts up as soon as P^e rises. This process lasts until $Y=Y^*$.

Schools in Macroeconomics: Monetarism

- **Monetarism**: basic "assumptions and tenets"
  - The interest sensitivity of investment is very high ($I_R \leq 0$ large in absolute value) so that the IS curve is flat.
  - The interest sensitivity of money demand is very low ($L_R \approx 0$), i.e. money demand looks like, say, $L=kPY$.
  - Expectations follow the AEH.

- **Monetarism**: policy implications
  - Fiscal policy is largely ineffective in increasing AD. An increase in G leads to a strong crowding out of private investment.
  - Monetary policy may exert real effects: $M=kPY$ implies that $dM>0$ leads to $d(PY)=(1/k)dM>0$.
  - The relative importance of real effects, dY, and nominal effects, dP, depends on the assumptions made about the labor market and the formation of expectations.
  - Under AEH there are temporary effects on real output and employment. Policy makers may be tempted to use monetary expansion to combat unemployment. Policymakers are, however, not very good at timing monetary policy and there are long and variable lags.
  - As a result, monetary policy is likely to accentuate business cycle fluctuations. Hence, Friedman suggested that the central bank should follow a constant growth rate rule for some monetary aggregate.

Schools in Macroeconomics: New Classical and New Keynesian Economics

- **New Classical Economics**: basic "assumptions and tenets"
  - Prices and wages are flexible.
  - Expectations are formed rational.
  - Macroeconomic theory should be based on microeconomic principles.

- New Classical Economics: main implications
  - The decentralized allocation of resources is efficient and full employment prevails.
  - Observed fluctuations are not caused by nominal rigidities. Instead rational agents respond to (possibly changing) economic incentives.
  - Policy ineffectiveness proposition (PIP) applies: Either policy makers cannot (strong version of the PIP) or should not (weak version of the PIP) use countercyclical policy to smooth business cycle fluctuations.

- **New Keynesian Economics**: basic "assumptions and tenets"
  - Markets may not be as perfect as classical economics suggests.
  - Early New Keynesians accepted the REH but stressed nominal wage rigidities (e.g., "multi-period wage contracts").
  - The most recent wave of New Keynesian economics is more micro-based.
  - The predominance of imperfect competition, coordination failures and credit constraints are stressed.

- New Keynesian Economics: main implications
  - The decentralized allocation of resources may be inefficient and full employment may not prevail.
  - The PIP is invalidated: The government can and should stabilize the economy, even under REH.

Notation and abbreviations

Notation

$0<c<1$	consumption rate
$0<\lambda<1$	constant parameter
$b\geq 0$	sensitivity of I w.r.t. R
$\beta>0$	sensitivity of I w.r.t. π
C	consumption
$h\geq 0$	sensitivity of L w.r.t. R
I	investment
K	physical capital
$k>0$	sensitivity of L w.r.t. Y
L	money demand
M	money
N	labor
N^S	labor supply
P	price level
P^e	expected price level
τ	tax rate
R	interest rate
U	utility
V	velocity of circulation
W	nominal wage
$\dot{W} := dW/dt$	rate of change of W per period dt
Y	output
$\alpha>0$	constant parameter

Abbreviations

AD	aggregate demand
AEH	adaptive expectations hypothesis
AS	aggregate supply
IS	goods market equilibrium condition
LM	money market equilibrium condition
PFH	perfect foresight hypothesis
PIP	policy ineffectiveness proposition
REF	rational expectations hypothesis