ECO208Y Macroeconomics Notes

Chapter 2 Measurements

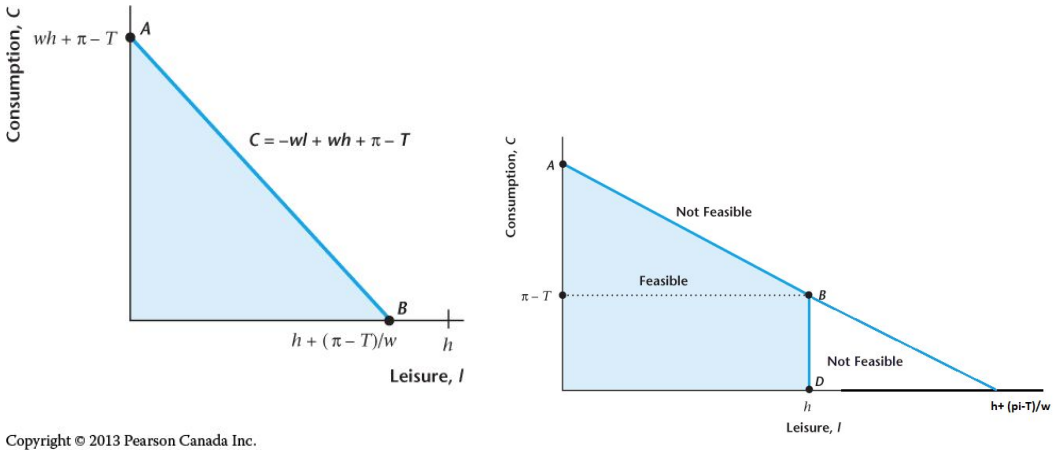
- Product
  - $GNP = GDP + NFP$
  - Real GDP
    - Using base year prices.
    - Chain-weighted real GDP. (Rolling base year)
  - $RGDPod = GDP_t \times (1 + g_c)$ where g_c is the geometric average of growth rate using previous year and current year variable.
    - $1 + g_c = \sqrt{(1 + g_t) \times (1 + g_{t+1})}$
- Price Level
  - $GDP\ Deflator = \frac{Nominal\ GDP}{Real\ GDP} \times 100$
  - $CPI = \frac{Q_{base} \cdot P_{new}}{Q_{base} \cdot P_{base}} \times 100$
  - $Inflation = \frac{P_{t+1} - P_t}{P_t}$
- National Accounts
  - $$Y^d = \underbrace{Y}_{GDP} + \underbrace{NFP}_{\substack{net\ factor \\ payments}} + \underbrace{TR}_{\substack{gov't \\ transfers}} + \underbrace{INT}_{\substack{interest \\ on\ gov't \\ debt}} - \underbrace{T}_{taxes}$$
  - $\Leftarrow$ *Disposable Income*
  - $CA = NX + NFP$
  - $S = I + CA$
- Labor Markets
  - Unemployment rate $:= \frac{\#Unemployed}{Labor\ Force}$
  - Participation rate $:= \frac{Labor\ Force}{Working\ Age\ Population}$
  - Employment/Population rate $:= \frac{\#Employment}{Working\ Age\ Population}$

Chapter 4 Consumer-Firm One Period

CONSUMERS

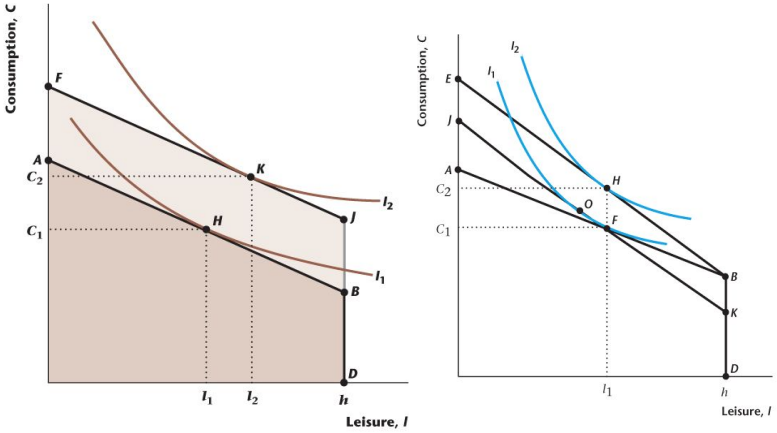
Consumer Setups

- $max_{c,l}\ u(c, l)$
  - Abstract **normal** good(C) against **normal** leisure(l)
  - Assumptions on preference
    - Monotonicity.
    - Convexity.
- s.t. $w(h - l) + \pi - T = C$



Experiment on Consumers

- Pure income effect



- Labor Supply: Assumed to be upwards sloping (SE dominates IE)
- $L = ln(c) + \eta ln(l) + \lambda [w(h-l) + \pi - T - C]$
- Comparative Statistics on C^*, l^*
  - T, π (Pure income)
  - w (IE + SE)

FIRMS

Firm Setup

- $max_{N^d} \{\pi = zF(\overline{K}, N^d) \times p - w \times N^d\}$
  - Take $p = 1$
  - Take cost on K as LR, sunk
  - $\overline{K}$ exogenous
- **Assumptions on technology.**
  - **CRS**

    - **Positive 1st ord. Der.**
    - **Negative self 2nd ord. Der.**
    - **Positive cross 2nd ord. Der.**
- FOC. $MP_N = w$

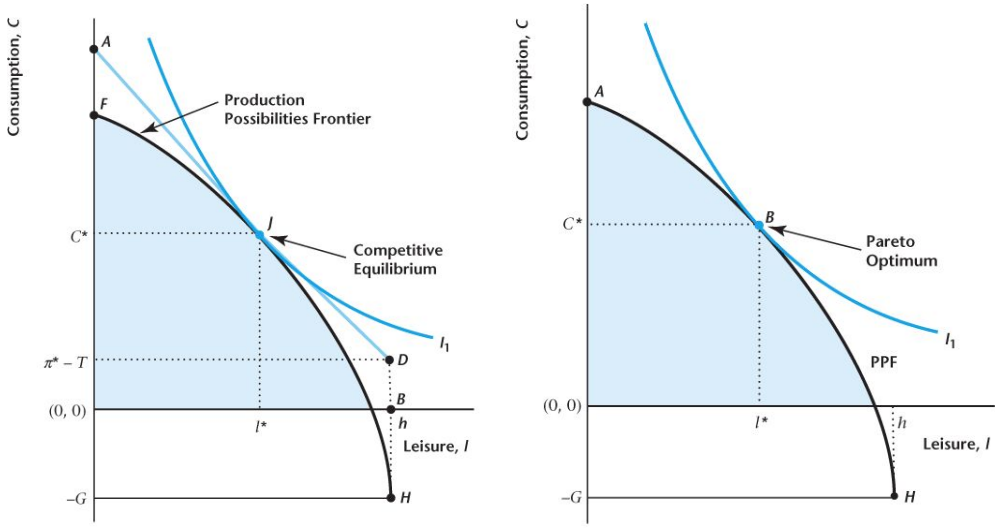
Experiments on N^d

- z, $\overline{K}$, Tax on REVENUE $(1-\tau)$
- w, Tax on labor $w(1+\tau_N)$

Chapter 5 Closed Economy One-Period General Equilibrium Model

Competitive Equilibrium

- **All** Market (Good/Labor) Clearing: $C^* + \overline{G} = Y^* \ \wedge \ N^{s*} = N^{d*}$
- Agents take price as given and optimize.
    - Consumer: $MRS_{l,C} = w$
    - Firm: $MRT_{l,C} = w$
- Only price here is w , price for C is normalized to 1.
- Exo Var: $G,\ z,\ K$
- Endo Var: $C,\ N^s,\ N^d,\ T,\ \pi,\ Y$
- Walras' Law
- Production Possibility Frontier
    - $C = zF(K,\ h-l) - G$



- Government
    - $\overline{G} = T$
    - $Y = C + G$

Economic Efficiency

- Pareto efficient: there is no way to do Pareto improvement
- Pareto optimal ∈ Perfect Information + No friction.
- Solve Social Planner's Optimization: Choosing N to maximize consumption $Y - G$
    - Utilitarian Social Welfare Function: $\sum_i U_i(C_i)$
    - Rawlsian Social Welfare Function: $min\{U_i(C_i)\}$

Welfare Theorems

- **First welfare theorem**: Competitive equilibrium ⇒ Pareto optimal.
- **Second welfare theorem**: Pareto optimal ⇒ Competitive equilibrium by redistribution.
- ~~Economic inefficiencies~~
    - ~~Externalities.~~
    - ~~Distortionary taxes.~~
    - ~~Market power.~~
    - ~~Information Asymmetries.~~

Experiments

- Change G
- Change z
- Lump-sum Tax: parallel shift, same as ΔG
- Income Tax: Effective a reduce in real wage

Chapter 6a One-side Model of Job Search

Setup

- N := working age population.
- Q := labor force.
- U := fraction of unemployment.
- $V_e(w)$:= utility from employment as a function of w.
- s := job separation rate.
- V_u := value from unemployment. (e.g. unemployment benefit b, prob of getting job offer)
- p := prob. Of receiving job offer.
- w^* := reservation wage: cutoff for accepting job offer.
- $H(w^*)$:= fraction of unemployed workers who receive a wage offer greater than their reservation wage $(w > w^*)$. Offer Acceptance Rate
- **Job creation flow** $:= U \times p \times H(w^*)$
- **Job destroy flow** $:= s \times (1 - U)$

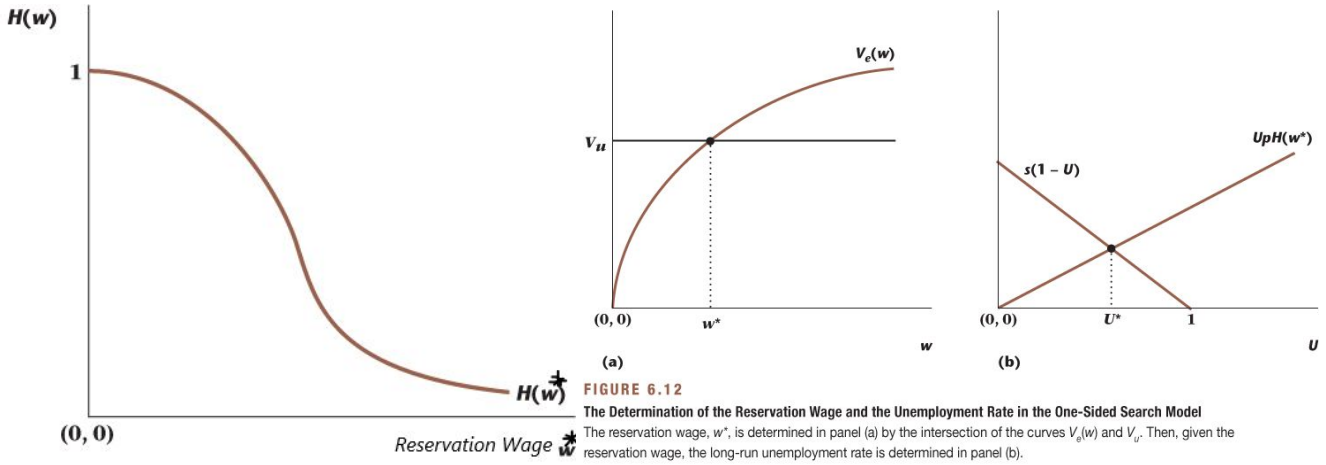
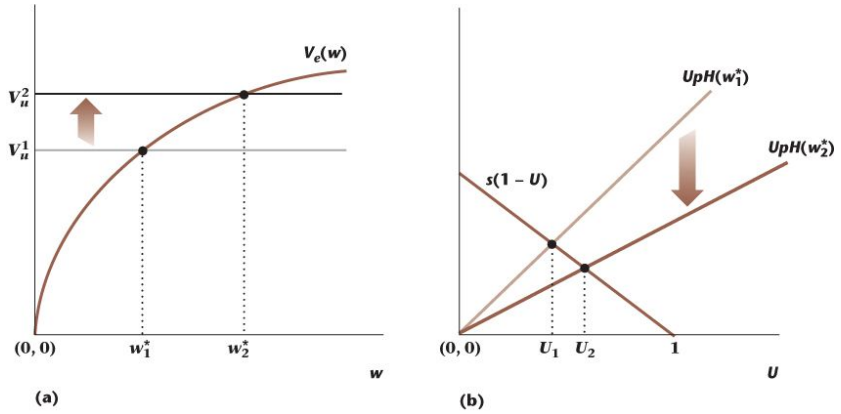


FIGURE 6.12

The Determination of the Reservation Wage and the Unemployment Rate in the One-Sided Search Model

The reservation wage, w^*, is determined in panel (a) by the intersection of the curves $V_e(w)$ and V_u. Then, given the reservation wage, the long-run unemployment rate is determined in panel (b).



Chapter 6b Two-side Model of Job Search

Setup

- A := aggregate number of vacancies posted by firms.
- Q := people looking for job.
- $Q-U$:= currently employed.
- Vacancy rate = $\frac{A}{A+Q-U}$
- Each firm post one vacancy.
- Consumer choose to search for work or not.
  - Heterogeneous in home production payoff.
  - Same in expected payoff from searching for jobs.
- $v(Q)$ expected payoff from searching for job.
- Firms pay k to post vacancy.
- Total A firms posting vacancy.

Measurements

- $v = \frac{A(1-p_f)}{A} = 1 - p_f$ vacancy rate

- $u = \frac{Q(1-p_c)}{Q} = 1 - p_c$ unemployment rate
- $Y = zM = zem(Q, A)$ total output

Matching Function

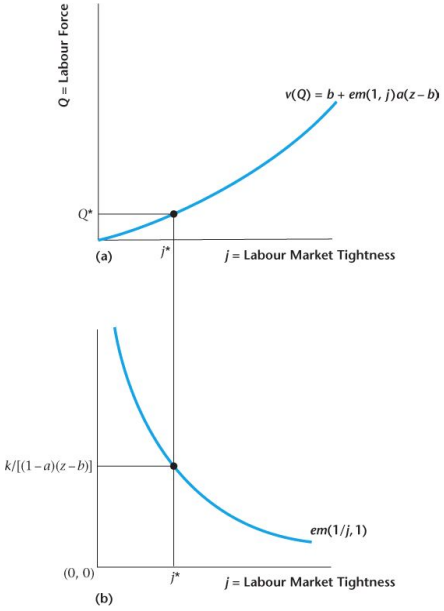
- $M = em(Q,\ A)$
  - CRS ⇒ $M = Qem(1,\ j)$
  - Increasing func.
  - Neg. 2nd ord. Der.
  - All argument essential.
  - $M = eQ^{\alpha}A^{1-\alpha}$
- All job seekers share the same probability to be matched.
  - $j := \frac{A}{Q}$ labor market tightness
  - $p_c = \frac{M}{Q} = em(1,\ j)$

Consumer Optimization

- Choose between home production and searching for work
  - $v(Q) = b + em(1, j)\ (w - b)$

Firm Optimization

- $p_f = \frac{M}{A} = em(\frac{1}{j}, 1)$
- If matched, a worker and a firm produce output z
  - ⇒ Profit := $z - w$
- Net gain from posting job $p_f(z - w) - k = 0$ at equilibrium (the free entry condition)
- Nash Bargaining
  - Total surplus $z - b$
  - $v(Q) = b + em(1, j) \times a \times (z - b)$
  - $p_f = em(\frac{1}{j}, 1) = \frac{k}{(1-a)(z-b)}$
  - $j = \frac{A}{Q}$



Experiments

- Change in b
- Change in z
- Change in e

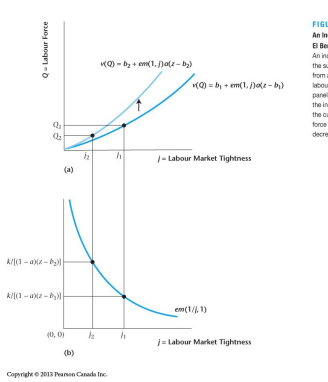


FIGURE 6.11
An Increase in the Ei Benefit, *b*
An increase in *b* reduces the surplus the firm receives from a match, which reduces labour market tightness in panel (b). Then, in panel (a), the increase in *b* acts shifts the curve up. The labour force could increase or decrease.

FIGURE 6.12
An Increase in Productivity, *z*
An increase in productivity acts to increase the surplus from a match for both workers and firms. In panel (b), labour market tightness increases, and the curve shifts up in panel (a), so that the labour force must increase.

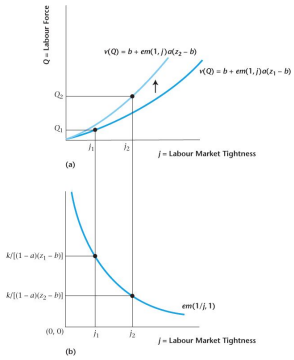
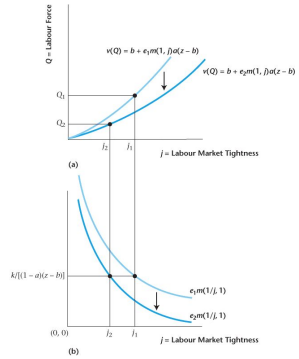


FIGURE 6.13
A Decrease in Matching Efficiency, *e*
This acts to shift the curves down in panels (a) and (b). Labour market tightness and the labour force must both decrease.



Chapter 7 Economic Growth

Setup

- Production function $Y = zF(K, N)$
  - K := Assets, at their purchase prices.
  - N := # of total hours worked.
  - z := Residual
    - Solow Residual $\hat{z} = \frac{\hat{Y}}{\hat{K}^{\alpha}\hat{N}^{1-\alpha}}$
- Economic Growth ⇒ Growth in output per capita.
- Solow Growth Model setup
  - $N' = (1 + n)N$
  - $C = (1 - s)Y$
  - CRS $F(K, N) \Rightarrow y = zf(k)$
  - $K' = (1 - \delta)K + I$
  - $Y = C + I$

Equilibrium & Steady State

- **Steady state**: all endogeneous variables are growing at a constant rate.
- Solve $k' = k := k^*$
- $k' = \frac{K'}{N'} = \frac{1}{1+n}\frac{(1-\delta)K + szF(K,N)}{N} = \frac{K}{N}$
- $\Rightarrow (1 - \delta)k + szf(k) = (1 + n)k$
- $\Rightarrow szf(k^*) = (n + \delta) \times k^*$

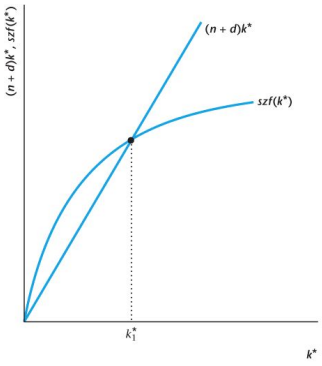


FIGURE 7.14
Determination of the Steady State Quantity of Capital per Worker
The steady state quantity of capital, k_1^* is determined by the intersection of the curve $szf(k^*)$ with the line $(n + d)k^*$.

Experiments

- Increase s
  - $g_Y = g_N + g_y$
  - $g_y > 0 \in$ **transition** to new steady state.
- Increase n
- Increase z

FIGURE 7.15
Effect of an Increase in the Savings Rate on the Steady State Quantity of Capital per Worker
An increase in the savings rate shifts the curve $szf(k^*)$ up, resulting in an increase in the quantity of capital per worker from k_1^* to k_2^*.

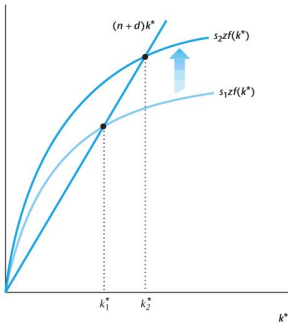


FIGURE 7.16
Effect of an Increase in the Savings Rate at Time T
The figure shows the natural logarithm of aggregate output. Before time T, the economy is in a steady state. At time T, the savings rate increases, and output then converges in the long run to a new higher steady state growth path.

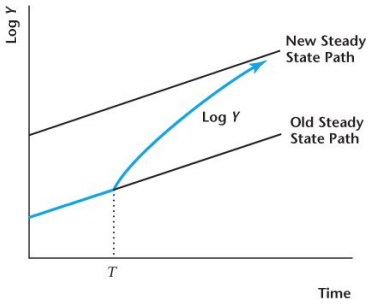
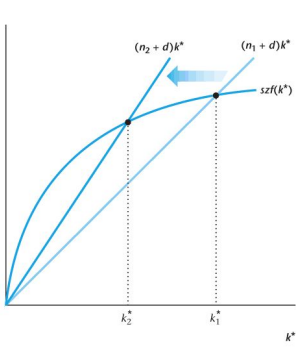


FIGURE 7.19
Steady State Effects of an Increase in the Labour Force Growth Rate
An increase in the labour force growth rate from n_1 to n_2 causes a decrease in the steady state quantity of capital per worker.



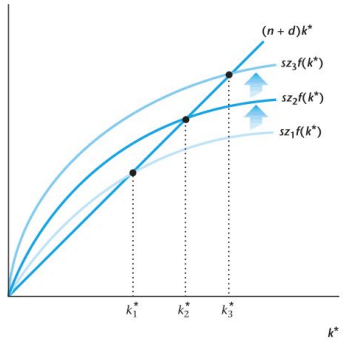
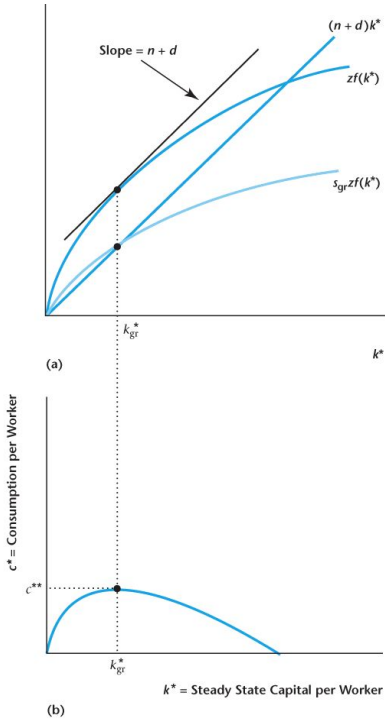


FIGURE 7.20
Increases in Total Factor Productivity in the Solow Growth Model
Increases in total factor productivity from z_1 to z_2, and from z_2 to z_3, cause increases in the quantity of capital per worker from k_1^* to k_2^*, and from k_2^* to k_3^*. Thus, increases in total factor productivity lead to increases in output per worker.

Golden Rule Level of Capital per Worker / Golden Rule of Saving

- $k_{GR}^* = argmax_{k^*}\{c^* = (1-s) \times zf(k^*)\}$
- $s_{GR}^* = argmax_s\{c^* = (1-s) \times zf(k^*)\}$

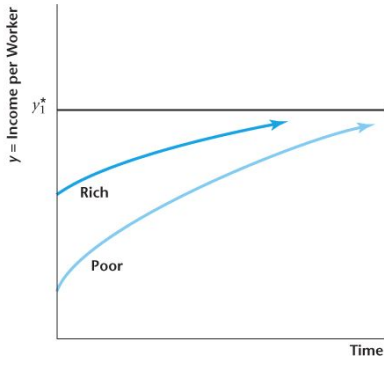


- **Conclusion**: z is thought to be the main driver of per capita GDP growth in developed countries.

Chapter 8 Convergence in the Solow Model

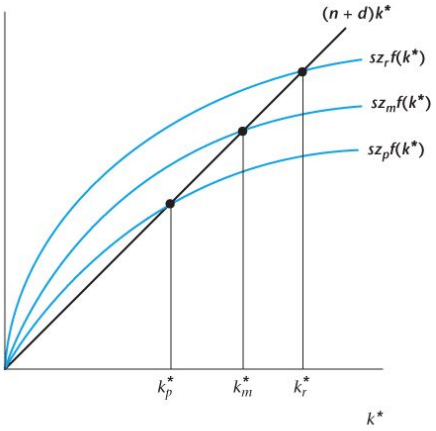
- Steady State: $\Delta y = \Delta c = \Delta k = 0$ defined over per capita values.
- Different initial k_0 converge to the same k^*

FIGURE 8.2
Convergence in Income per Worker across Countries in the Solow Growth Model
Two otherwise identical countries, one with lower income per worker (the poor country) than the other (the rich country), converge in the long-run steady state to the same level of income per worker, y^*_1.



- Different TFP z converges to different k^*

FIGURE 8.4
Differences in Total Factor Productivity Can Explain Disparity in Income per Worker across Countries
If countries have different levels of total factor productivity because of differing barriers to technology adoption, then capital per worker and income per worker differ across countries in the steady state.



- Causes of different TFP across countries.
  - Technology adoption.
  - Trade liberalization.
  - Market imperfections.
  - Institutions: private property.
  - Education.
  - Misallocation.

Chapter 9 Two-Period Model: Consumption-Saving Decision and Credit Markets. Exogenous Income $y - t$

Setup

- Preference $max_{c,\,c'}\{u(c) + \beta u(c')\}$
  - Assumptions
    - Monotonicity
    - c, c' are normal goods
    - Convexity ⇒ Consumption smoothing
- Budget
  - $c + s = y - t$ P.1
  - $c' = y' - t' + (1 + r) \times s$ P.2
  - $c + \frac{c'}{1+r} = y - t + \frac{y'-t'}{1+r}$ Life-time PDV.
- $c > y - t$ ⇒ Borrower.
- $c < y - t$ ⇒ Lender.
- $we := y - t + \frac{y'-t'}{1+r}$

Model Solution

$max_{c,c'}\{ln(c)+\beta ln(c')\},\ s.t.\ c+\frac{c'}{1+r}=y-t+\frac{y'-t'}{1+r}$

Solve.

$\mathcal{L}=ln(c)+\beta ln(c')+\lambda(y-t+\frac{y'-t'}{1+r}-c-\frac{c'}{1+r})$

FOC:

$\frac{\partial\mathcal{L}}{c}=\frac{1}{c}-\lambda=0$

$\frac{\partial\mathcal{L}}{c'}=\frac{\beta}{c'}-\lambda\frac{1}{1+r}=0$

$\frac{\partial\mathcal{L}}{\lambda}=y-t+\frac{y'-t'}{1+r}-c-\frac{c'}{1+r}=0$

=>

$\frac{c'}{c}=(1+r)\beta$

Plut in to constraint

Solve...

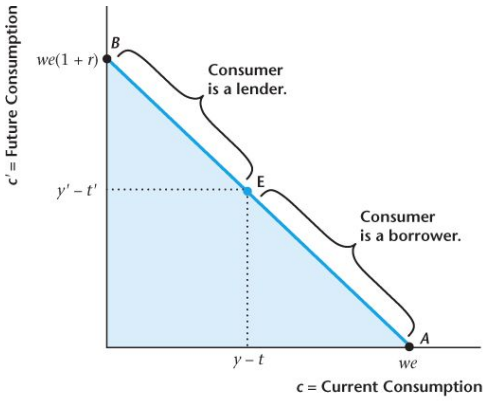
$c^*=\frac{1}{1+\beta}(y-t+\frac{y'-t'}{1+r})$

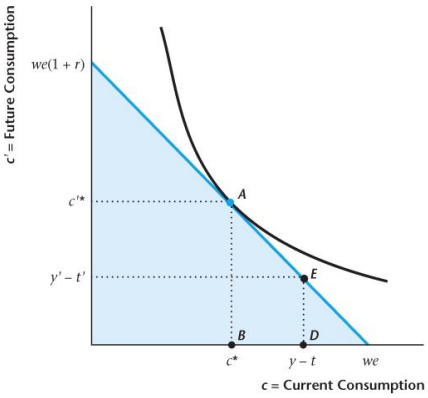
And

$c'^*=\frac{\beta(1+r)}{1+\beta}(y-t+\frac{y'-t'}{1+r})$

■

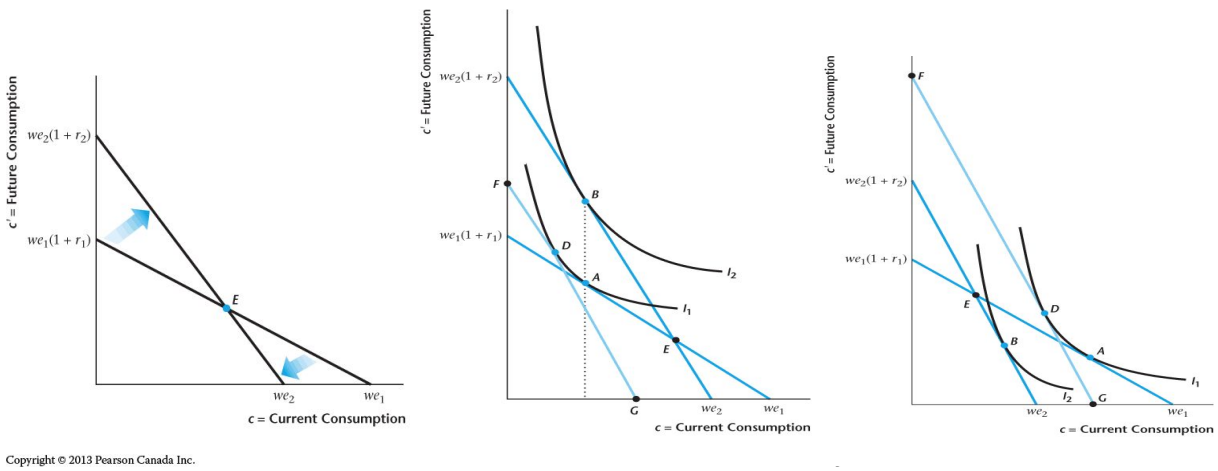
Graphics





Experiment

- Increase y, y', t, t' ⇒ Pure IE
- Increase r ⇒ IE + SE
  - SE: more c' and less c
  - IE:
    - Positive for lenders
    - Negative for borrowers



Permanent Income Hypothesis

- main determinant of consumption is **permanent income**, which is closely related to lifetime wealth we.
- Permanent increase in income leads to a **small** increase in saving.

Ricardian Equivalence Theorem

- Holding government spending $(G,\ G')$ fixed (equivalently, hold PDV of taxation fixed), change in $T,\ T'$ will leave $r,\ c,\ c'$ unchanged. (Timing of the taxes do not matter)
- **Rational expectations** (Lucas Critique): foreseeing the future tax and reduction in lifetime wealth ⇒ adapt saving.
- Proof.

  By government budget constraints in both period,

  as (G, G') is exogenous and unchanged, then

  $\Delta t + \frac{\Delta t'}{1+r} = 0$

  $m\Delta t + \frac{m\Delta t'}{1+r} = 0$

  $\Delta T + \frac{\Delta T'}{1+r} = 0$

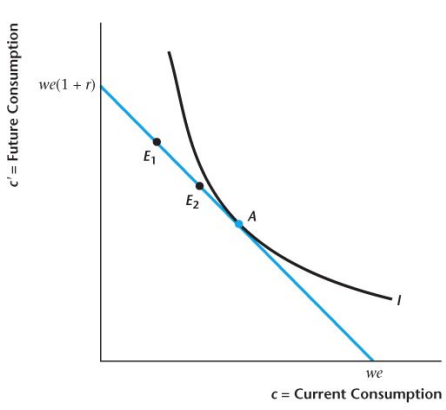
  Therefore, if above equations hold, there would be **no change**

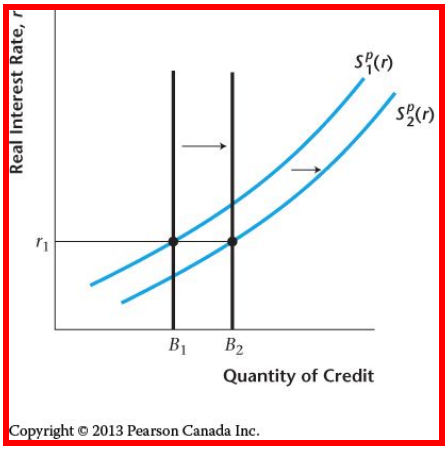
  In consumers' PDV of life time wealth and therefore the consumptions

  (C^*, C'^*) Will be **unchanged** with tax change Δt in current period.

  ■

- Lifetime budget constraint: $c + \frac{c'}{1+r} = y + \frac{y'}{1+r} - \frac{1}{m}\left[G + \frac{G'}{1+r}\right]$
- Change in timing of taxation
  - ⇒ Effective moving the endowment along the original budget line
  - ⇒ No change in lifetime wealth.
  - Implications: no free lunch in tax cut.





Martingales

- $E[p_{t+1} | p_t, p_{t-1}, \cdots, p_{t-n}] = p_t$
- Prove by contradiction, self-fulfilling hypothesis.
- Implication: consumers assume that any changes in the value of stocks is **permanent**.

~~Ricardian Equivalence Failure~~

- ~~Individuals may not paying the same taxes ⇒ Redistribute lifetime wealth among individuals. (**INTRA-generational redistribution**)~~
- ~~**INTER-generational redistribution** of wealth.~~
- ~~Distortionary taxation. (i.e. not lump-sum tax).~~
- ~~Credit market imperfection.~~

Chapter 11 Two Periods model with Leisure-Consumption choice

Real intertemporal model with investment

- ~~Markets.~~
  - ~~Current Labor Market ⇒ Output Supply Curve~~
  - ~~Current Good Market ⇒ Output Demand Curve~~

Representative Consumer

- Budget
  - P1. $C + S^P = w \times (h - l) + \pi - T$
  - P2. $C' = w' \times (h - l') + \pi' - T' + (1 + r) \times S^P$
  - Life-time $C + \frac{C'}{1+r} = w \times (h - l) + \pi - T + \frac{w' \times (h - l') + \pi' - T'}{1 + r}$
- Solution
  - $max_{C, C', l, l'} \{\ln(C) + \eta \times \ln(l) + \beta \times [\ln(C') + \eta \times \ln(l')]\}$

- S.t. $C + \frac{C'}{1+r} = w \times (h - l) + \pi - T + \frac{w' \times (h - l') + \pi' - T'}{1+r}$

$$
\begin{aligned}
C: &\quad \frac{1}{C} - \lambda = 0 \\
C': &\quad \frac{\beta}{C'} - \frac{\lambda}{1+r} = 0 \\
l: &\quad \frac{\eta}{l} - \lambda w = 0 \\
l': &\quad \frac{\beta\eta}{l'} - \frac{\lambda w'}{1+r} = 0 \\
\lambda: &\quad w(h - l) + \pi - T + \frac{w'(h - l') + \pi' - T'}{1+r} - C - \frac{C'}{1+r} = 0
\end{aligned}
$$

Current period labor supply

- Assumptions
  - Increase in w
  - Decrease in we
  - Increase in r

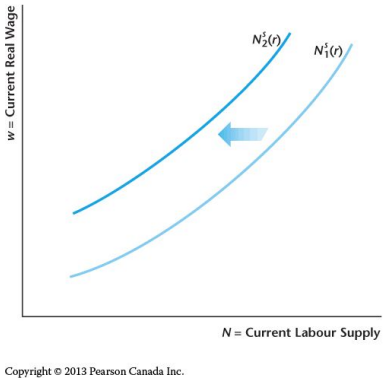
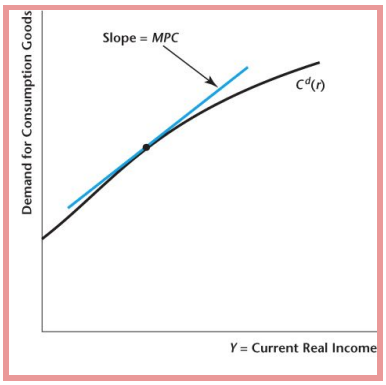


FIGURE 11.3
Effects of an Increase in Lifetime Wealth
More leisure is consumed in the present, because of the income effect, and the current labour supply curve shifts to the left.



Consumption demand

- Assumptions
  - Increase in lifetime wealth we
  - Decrease in r

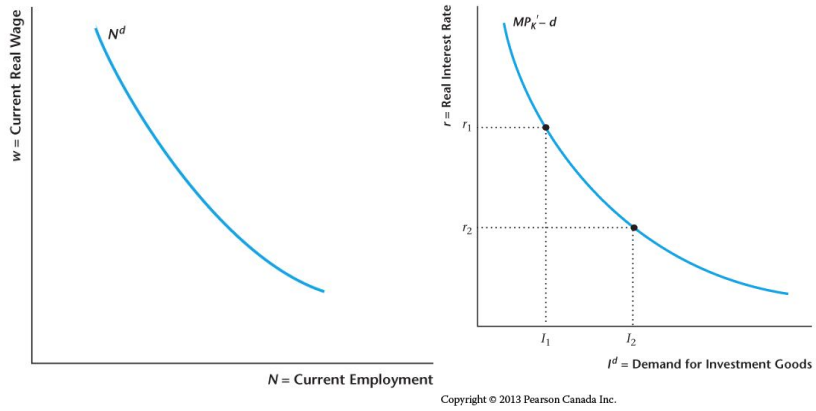
Representative firms.

Firm Setup

- Maximize PDV of lifetime profit $V = \pi + \frac{\pi'}{1+r}$ by choosing N, N', K'
- Setup:
  - Capital Transition: $K' = (1 - \delta)K + I$
  - P1: $\pi = z\,F(\overline{K},\ N)\ - wN - I$
  - P2: $\pi' = z'\,F(K',\ N')\ - w'\,N'\ + (1 - \delta)K'$
  - LT: $V = zF(\overline{K}, N) - wN - K' + (1 - \delta)\overline{K}\ + \frac{z'\,F(K', N') - w'\,N' + (1-\delta)K'}{1+r}$
- Solution
  - FOC
    - $MP_N = w$

- $MP_N' = w'$
- $MP_K' = r + \delta$

Current Labor Demand



- Decrease in w
- Increase in z
- Increase in $\overline{K}$

Firm's investment scheme

- Final K'^* s.t. $r = MP_K' - \delta$
- And $I^* = K'^* - (1-\delta) \times \overline{K}$
- I^* decreases in r
- Increases in z'
- Decrease in $\overline{K}$

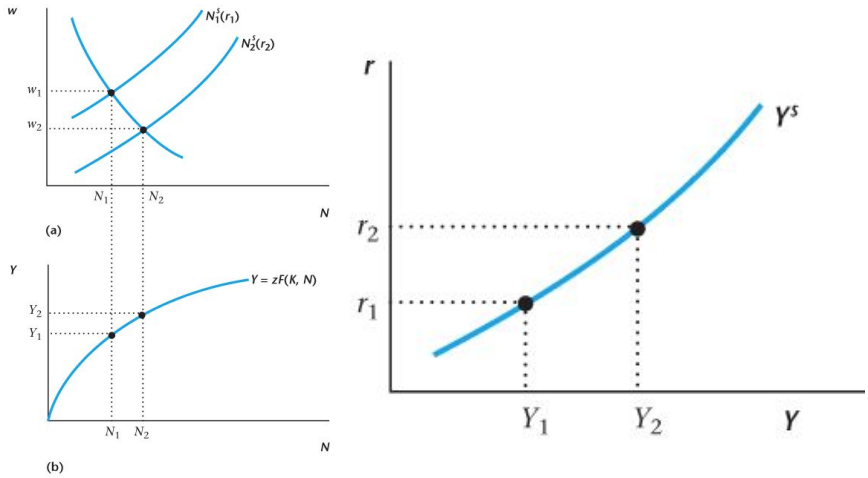
Government

- $G + \frac{G'}{1+r} = T + \frac{T'}{1+r}$

Competitive Equilibrium

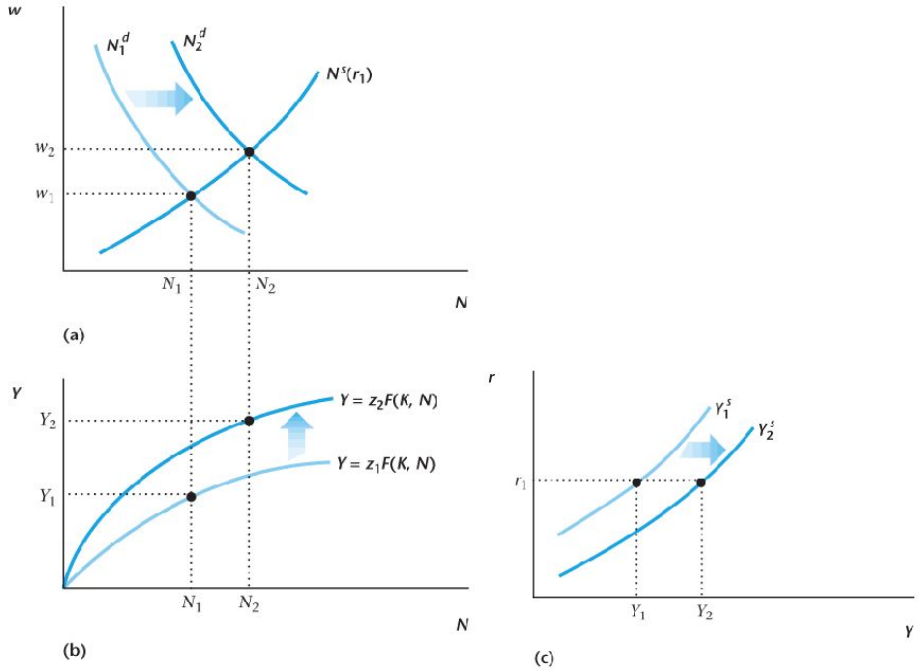
1. All markets clear.
2. PDV of government budget balanced.
3. All agents optimize.

Output Supply Curve



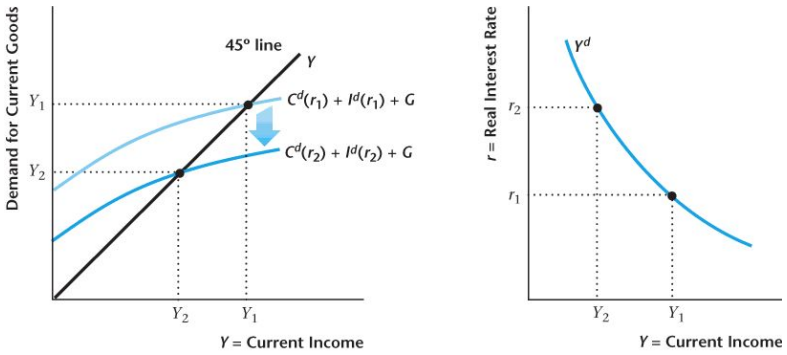
Experiments on output supply

- Increases in G (temporal) or permanent change: change both $G,\ G'$
  - we falls ⇒ N^s shifts right ⇒ Y^s shifts right.
- Increase in $z\ or\ K$
  - MP_N rises ⇒ N^d shifts right ⇒ Y^s shifts right

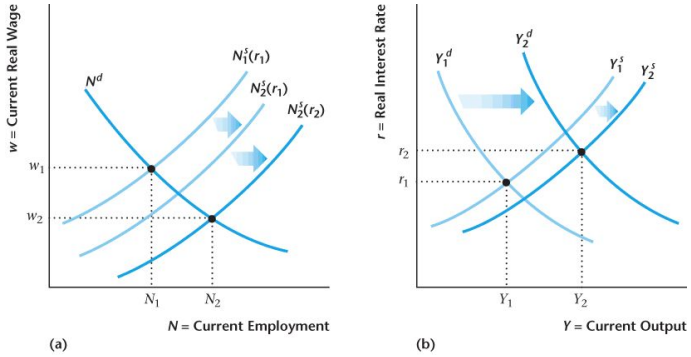


Current good demand curve

- $Y^d = C^d(r) + I^d(r) + G$



- Experiments on output demand
  - Increasing in G
    - G increases and $C^d(r)$ falls ⇒ by consumption smoothing mechanism ⇒ increase in G is greater than falling in C^d ⇒ Y^d increases.
- Complete Model
  - Labor market clearing at r ⇒ $Y^s(r)$
  - $Y^d = C^d(r) + I^d(r) + G$ holds at r ⇒ $Y^d(r)$
- Experiments with the Complete Model
  - **Temporal increase in** G



Y	C	lei	N	I	K'	w	r
↑	↓	↓	↑	↓	↓	↓	↑

  - Assume smaller change in Y^s since ΔG is temporal.
  - Government Multiplier $\frac{\Delta Y}{\Delta G} < 1$ since temporal shocks have small income effect.

Chapter 12 Money & Monetary Policy

- ~~Functions.~~
  - ~~Medium of exchange~~
  - ~~Store of value~~
  - ~~Unit of account~~
- ~~Cash in advance model: money is necessary for exchange.~~
- ~~Classical ⇒ Neutrality of money~~
- Inflation $i = \frac{P' - P}{P}$
- Fisher's relation: $r \approx R - i$

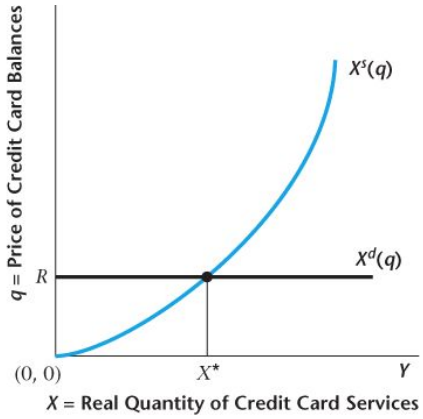
- Assume zero inflation ⇒ $R > 0$ ⇒ rate of return on nominal bonds dominates the rate of return on money.

Model setup

Banks

- Quantity of credit card balances
- Credit card costs q per nominal unit of credits
- Credit card market
  - $X^s(q)$: supply of credit card services.
  - $X^d : q == R$: perfectly elastic credit card service demand.

FIGURE 12.3
Equilibrium in the Market for Credit Card Services
The demand curve for credit balances is horizontal at the price $q = R$, the equilibrium price of credit card services is $q = R$ and the quantity is X^*.



Demand for Money

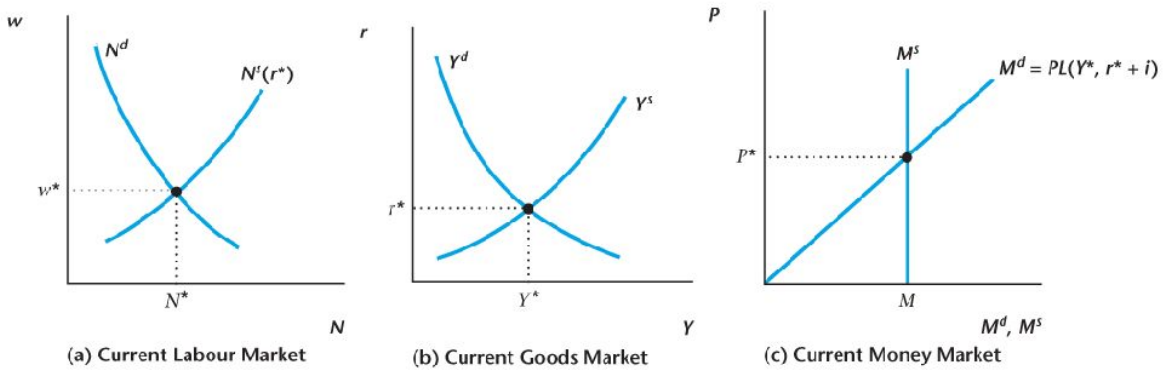
- $M^d = P[Y - X^*(R)]$
- $M^d = P \times L(Y, R)$
  - $L(\cdot)$ real demand for money, increases in Y and decreases R.

Representative consumer/firm

- Transaction Constraint $P(C + I + T) + B^d = M^- + (1 + R^-)B^- + PX^d$
- Budget Constraint $P(C + I + T) + B^d + M^d + qPX^d = M^- + (1 + R^-)B^- + PY$

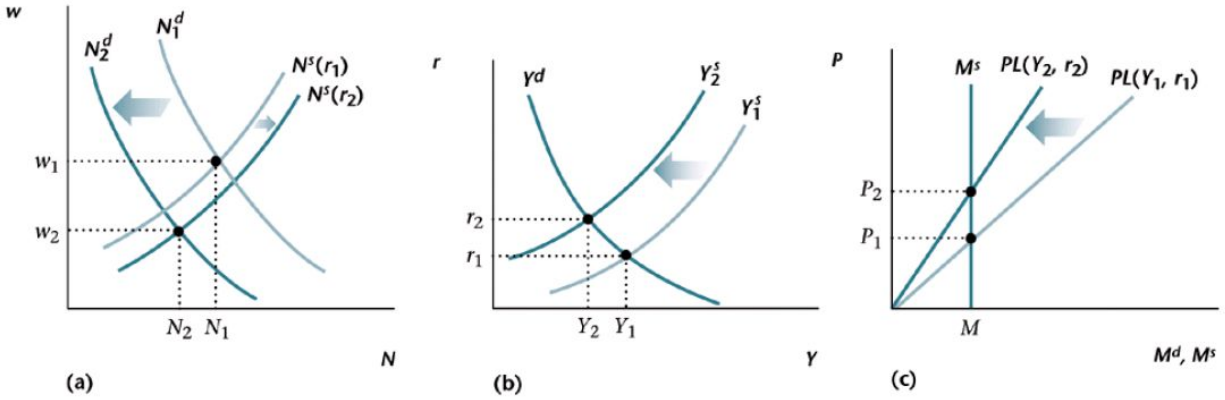
Government

- Budget $PG + (1 + R^-)B^- = PT + B + (M - M^-)$
- **Seigniorage Revenue**: revenue from direct money supply.
- Increase Money supply
  - Reduce T (Helicopter drop)
  - Increase G (Seigniorage)
  - Reduce B (Open market operation)



- **Classical Dichotomy**: Equilibrium in the money market does not affect <u>real</u> macroeconomic variables.

- Experiment: temporary exogenous decrease in z
    - <u>Empirically N falls and lei increases.</u>



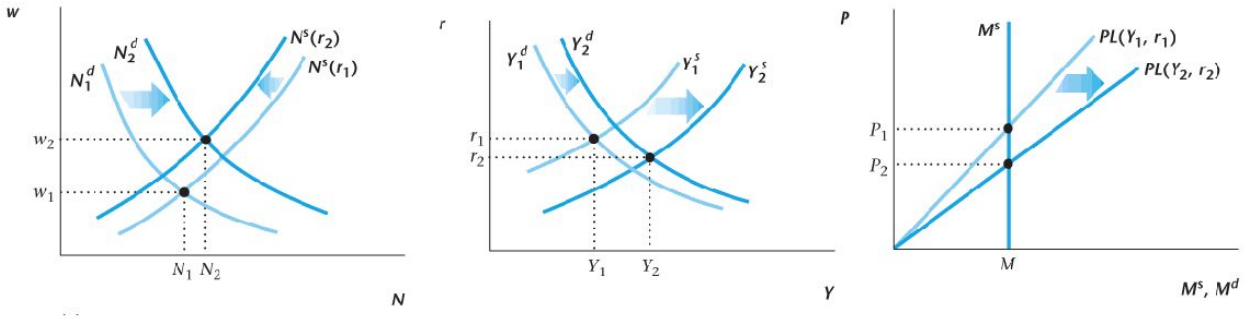
Y	C	lei	N	I	K'	w	r	P
↓	↓	?	?	↓	↓	↓	↑	↑

Chapter 13 Business Cycle Models

Standard Real Business Cycle Model

- Agent respond optimally to <u>real</u> productivity shocks.
- No <u>Government</u> intervention (Central bank still works).
- **Productivity shocks**
    - Persistent shock (both $z \; and \; z'$)
- Positive productivity shocks $z \uparrow, z' \uparrow$
    1. N^d increases (Larger as the primary shock source).
    2. Y^s increases (Direct result from primary shock)

3. Y^d increases as $I \uparrow$, $C \uparrow$ from positive wealth effect.
4. **Overall**: Positive expansionary shocks. $r \downarrow (empirically)\ Y \uparrow$



- Data ⇒ Higher employment level ⇒ Higher labor productivity (average) ⇒ N^* should increase in positive productivity shock.

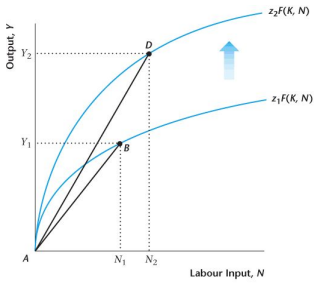


FIGURE 13.3
Average Labour Productivity with Total Factor Productivity Shocks
When output and employment are high, average labour productivity is also high, as in data.

- Policies:
  - Endogeneous Procyclical Money Supply: Central Bank targeting price level.

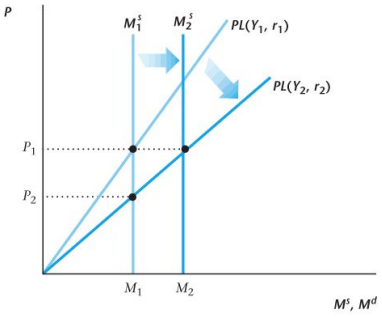


FIGURE 13.4
Procyclical Money Supply in the Real Business Cycle Model with Endogenous Money
A persistent increase in total factor productivity increases aggregate real income and reduces the real interest rate, causing money demand to increase. If the central bank attempts to stabilize the price level, this will increase the money supply in response to the total factor productivity shock.

- ~~Assessment~~
  - ~~Misleading Solow Residual z measurement.~~
  - ~~Labour Hoarding: sticky labor market.~~
  - ~~Capital Utilization: change in capital utilization during different sessions.~~

Keynesian Coordination Failure Model (Multiple Equilibria)

Setup

- (Firm outputs) **Strategic complementarities** ⇒ increasing return to scale (At the aggregate level) production function. ⇒ Upward-sloping $N^d(w)$

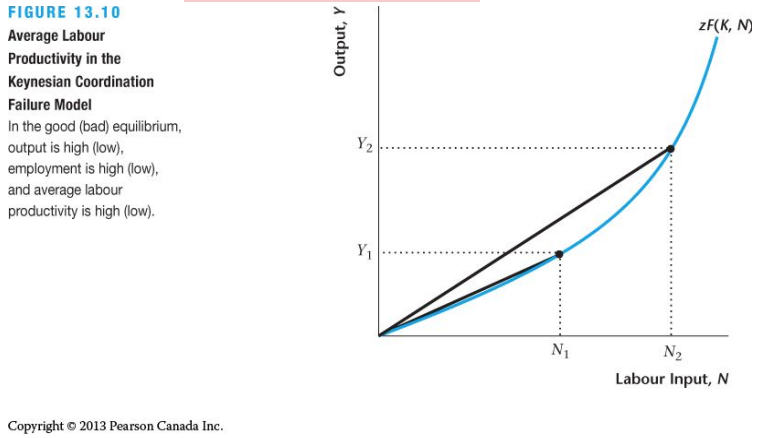
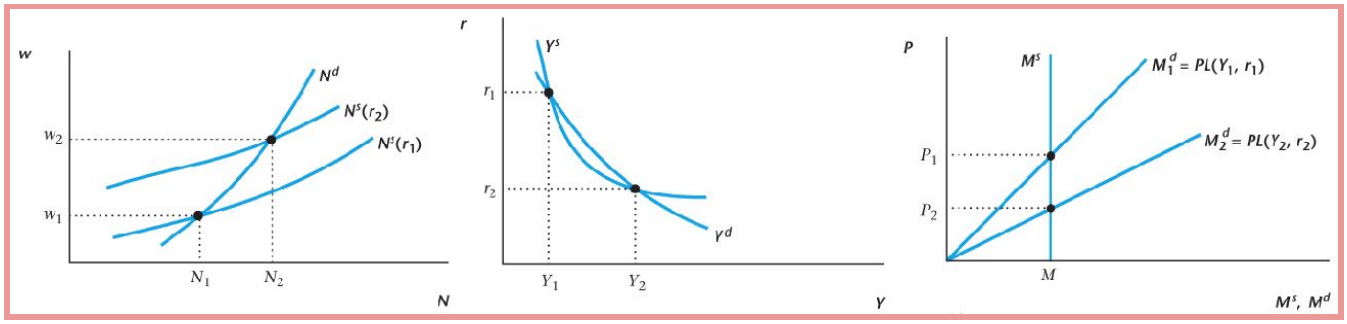


FIGURE 13.10
Average Labour Productivity in the Keynesian Coordination Failure Model
In the good (bad) equilibrium, output is high (low), employment is high (low), and average labour productivity is high (low).

- Self-fulfilling perception ⇒ Animal Spirits
- N^d is steeper than N^s is required for coordination failure model to work.



- Both equilibria are steady, the movement between is determined by **sunspot**.

Government

- Indirect ⇒ Sunspot ⇒ Announcement.
- Alter government expenditure G to affect Y^d ↓ But the new equilibrium outcome is **not** necessarily better.

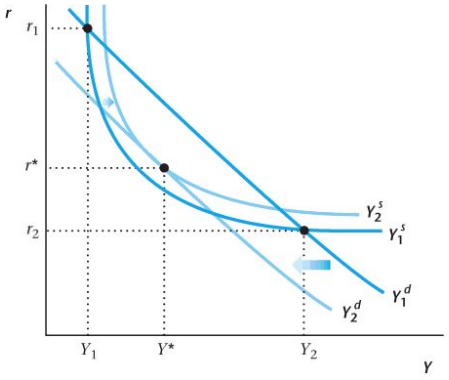
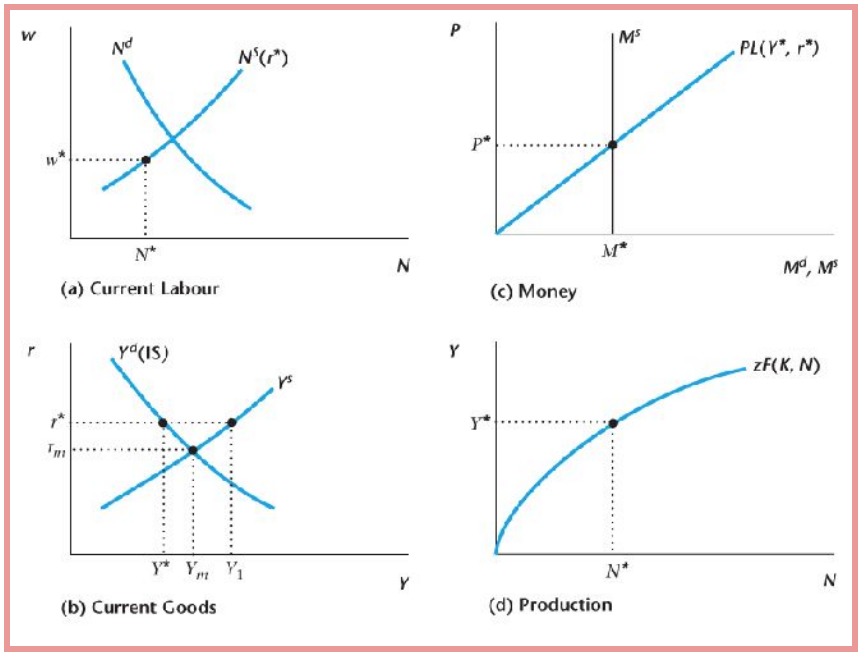


FIGURE 13.12
Stabilizing Fiscal Policy in the Coordination Failure Model
Fiscal policy can stabilize output in the coordination failure model by eliminating multiple equilibria. Here, with a decrease in government spending, the output demand curve shifts to the left and the output supply curve shifts to the right, and this can produce a unique equilibrium where $Y = Y^*$ and $r = r^*$.

Chapter 14 New Keynesian Sticky Price Model

Model Setup

- **Sticky Prices** real and nominal prices $w,\ r,\ P$ do not adjust to clear the markets in the short run.
  - Firms produce **however much** output is demanded at given prices.
  - Workers must work the exact hours demanded by firms although we will allow the real wage to vary.
    - (Process $r^* \Rightarrow Y^s/Y^* \Rightarrow (F) \Rightarrow N^* \Rightarrow (N^s) \Rightarrow w^*$)
  - **Consumer side matters (N^s and $Y^d(IS)$).**



- $Y^d(IS)$ and r^* determines the actual output.
- **Output gap**

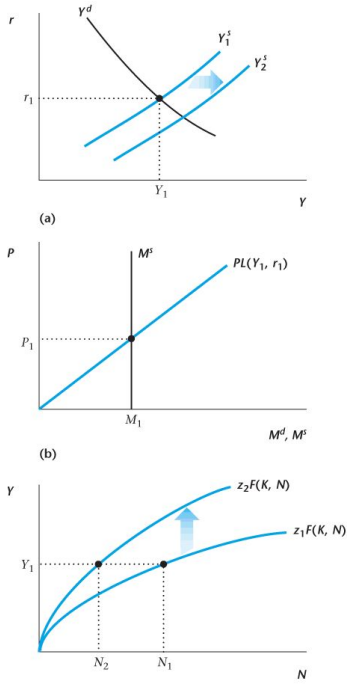
- **Natural rate of interest**

Government Policies

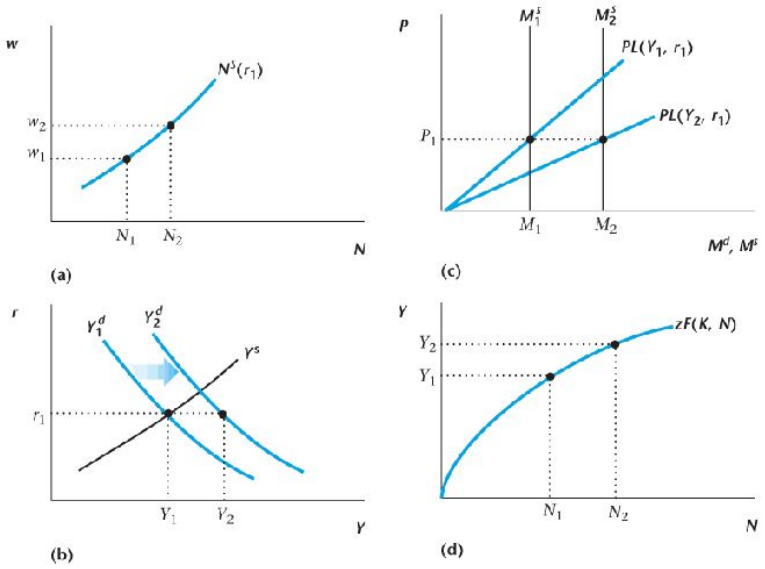
- **Central bank**:
  - Announce interest rate r^*
  - Support it by setting money supply M^s so that $\overline{P}$ is unchanged. ($\overline{P}$ does not change by our assumption).
  - $r \downarrow$ associated with $M^s \uparrow \Rightarrow \Delta P = 0$
- Process
  1. Central bank claim new interest rate.
  2. Y^*, N^* changes.
  3. N^s changes, w^* changes.
  4. Central bank adjust M^s to keep $\overline{P}$.
- Keynesians and all orthodox agree that money is natural in the long-run. (Since price stickiness is released in the long run)

Current period TFP Shocks $z \uparrow$

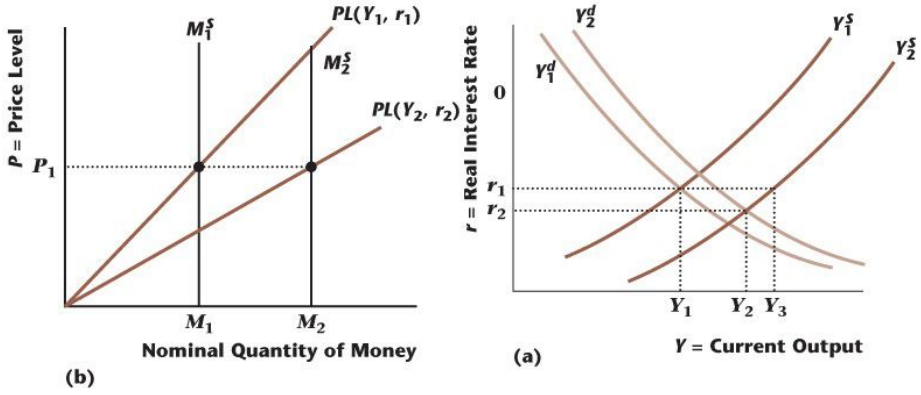
- Y^s changes and leaves Y^d unchanged.
- The main determination is left unchanged.
- N^* falls as production function shifts up.



Demand shock from Future TFP Shocks ($z' \uparrow \Rightarrow I^d \uparrow$)



Persistent TFP Shocks ($z \uparrow z' \uparrow \Rightarrow I^d \uparrow$)

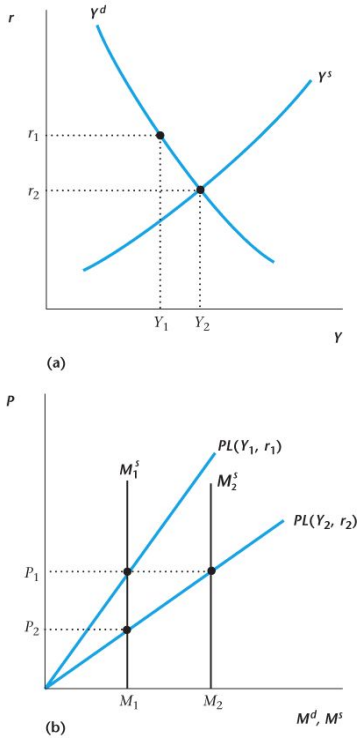


- (In persistent TFP shocks) If the central bank cut the interest rate to r_2 and increase M^s it can eliminate the output gap.
- The outcome in a Neo-Keynesian model with the central bank eliminating output gaps gives the same result as the RBC model with a central bank targeting the price level.

Government Policy

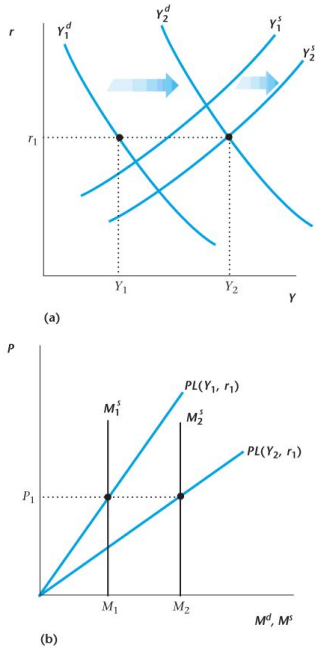
Monetary Policy: claiming r_{new} and adjust M^s

- Indirect change in C, I (others constant)
- (Keep price level $\overline{P}$ constant)



Fiscal Policy

- Direct change in G (others constant)
- $G \uparrow \Rightarrow Y^d \uparrow$ and negative wealth effect $\Rightarrow N^s \uparrow \; Y^s \uparrow$
- $M^s \uparrow$ to keep price level constant $\overline{P}$.



Claims of New Keynesians (from sticky price model)

- In the short-run private markets do **not** always work efficiently on their own (price stickiness).
- **Demand(IS)** is an important determinant of output.

Chapter 16 International Trade in Goods and Assets

Topic 1: SOE w/ two goods (Single Period)

- **Autarky**
- $TOT_{a,b} = \frac{{P_a}^T}{{P_b}^T}$ exogenous international prices
- Budget constraints ${P_a}^T \times c_a + {P_b}^T \times c_b = {P_a}^T \times q_a + {P_b}^T \times q_b$
    - Markets clear on international scale.
- Opening to trade makes the economy weakly better than Autarky.
    - Special case where $TOT_{a,b} = \frac{P_a}{P_b}$ ⇒ the economy is indifferent between two.

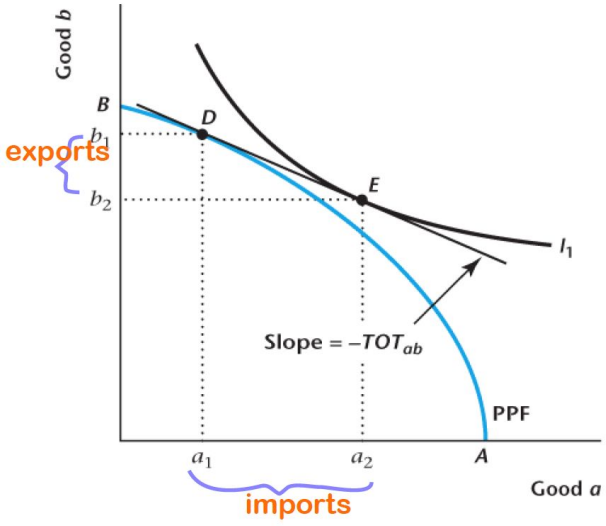
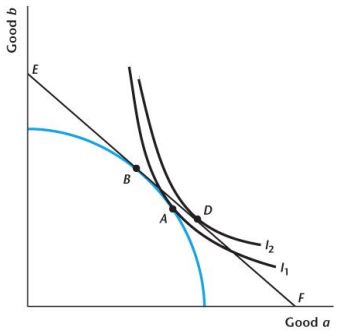


FIGURE 15.5
An Increase in Welfare when Good *a* Is Imported
When there is no trade, consumption and production occur at point *A*, but when the SOE trades with the rest of the world, production occurs at *B* and consumption at *D*. In this case, good *a* is imported, and welfare is higher with trade, as the representative consumer attains a higher indifference curve.



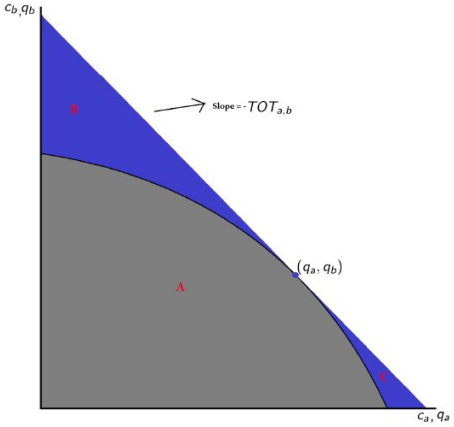
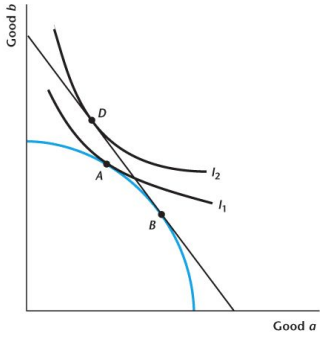
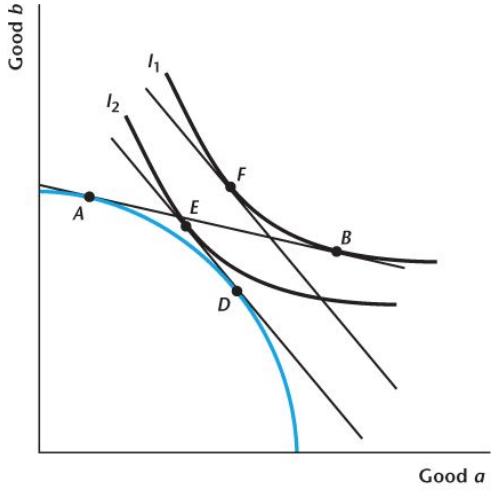


FIGURE 15.6
An Increase in Welfare when Good *b* Is Imported
Here, in contrast to Figure 15.5, good *b* is imported when the SOE can trade with the rest of the world. Trade improves welfare, as the consumer attains a higher indifference curve.



- Substitution Effects and Income Effects when TOT changes.
  - Draw SE hypothetical on the **original** indifference curve.
  - (Intuition) Beneficial if international (relative) price for the products with comparative advantages (exported) increases.



Topic 2: the Current Account in the Two Goods SOE Model

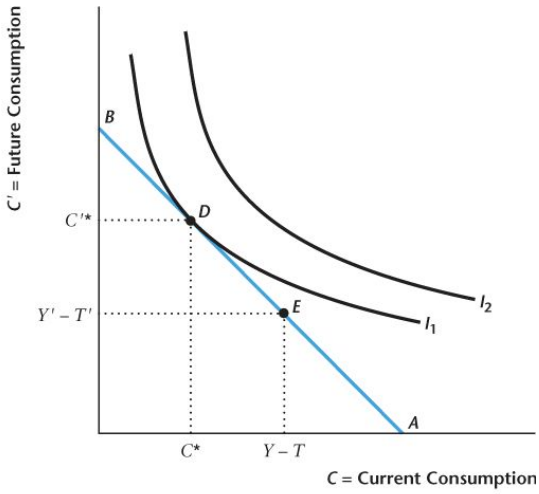
- Assuming $NFP = 0$
- $CA = NX = 0$
  - With single period, there's no borrowing/saving.
  - SOE consumers pay all consumption in single period.
  - Value of imports = value of exports.

Topic 3: SOE with two periods with no investment. (Single good)

Simply substitute saving to CA (using the international credit market)

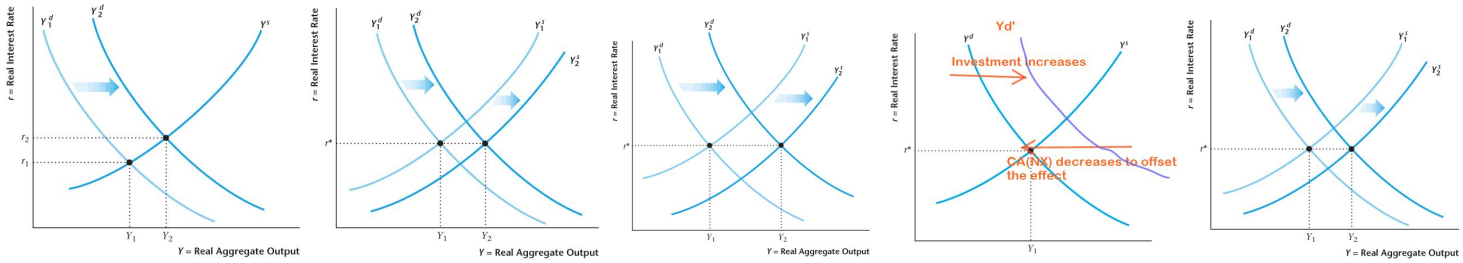
- Assume $TFP = 0 \Rightarrow S = CA = NX$
- World credit market clears and gives exogeneous r.
- Representative consumer budget $C + \frac{C'}{1+r} = Y - T + \frac{Y' - T'}{1+r}$
- Government budget $G + \frac{G'}{1+r} = T + \frac{T'}{1+r}$
- $S^p = Y - T - C$
- $S^g = T - G$
  - $\Rightarrow S^p + S^g = Y - G - C = CA$
- $G \uparrow \Rightarrow C, C' \downarrow$ (Consumption smoothing, normal consumption goods.)
- $T \uparrow$ **⇒ No Effect on** C, C' **(Ricardian Equivalence)**

FIGURE 15.9
The Two-Period Small Open Economy Model
The representative consumer's budget constraint is *AB*, the endowment point is *E*, and the consumer chooses point *D*.



Topic 4: SOE with production and investment

- World credit market clears and gives <u>exogeneous</u> r^*.
- Output demand $Y^d(r^*) = C^d(r^*) + I^d(r^*) + G + NX(r^*)$
  - CA and NX always adjust to clear output market.
- Experiment 1: $r^* \uparrow$
  - $NX \uparrow\ C \downarrow\ I \downarrow$
- Experiment 2 $G \uparrow$
  - $T \uparrow \Rightarrow we \downarrow, N^s \uparrow$ (negative lifetime income effect) $\Rightarrow Y^s \uparrow$
  - $C \downarrow$ and $\Delta C < \Delta G$ due to <u>consumption smoothing</u>
  - $NX/CA \downarrow$ *(Cannot see from the model) <u>Some of government spending was financed from the originally **exported** economic surplus(production), therefore **NX falls.**</u>*
- Experiment 3 $z \uparrow$
  - $N^d \uparrow \Rightarrow Y^s \uparrow$
  - $C \uparrow$ for <u>small magnitude</u> due to <u>consumption smoothing</u>
  - $CA/NX \uparrow$
- Experiment 4 : $z' \uparrow$
  - $I, C \uparrow$
  - Borrow from the rest of the world, and $NX/CA \downarrow$ to clear market.
- Experiment 5: $K \uparrow$
  - $N^d \uparrow\ Y^s \uparrow$
  - $I \downarrow$ since less investment needed to achieve target K'
  - $NX \uparrow\ Y^d \uparrow$ to clear market



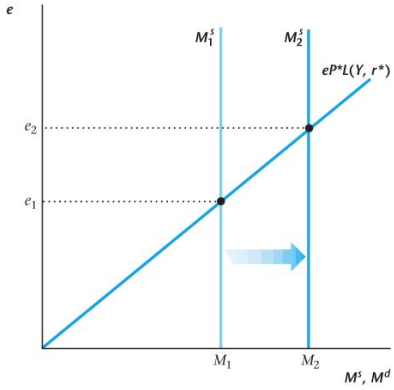
Chapter 17 Small Open Economy

Definitions

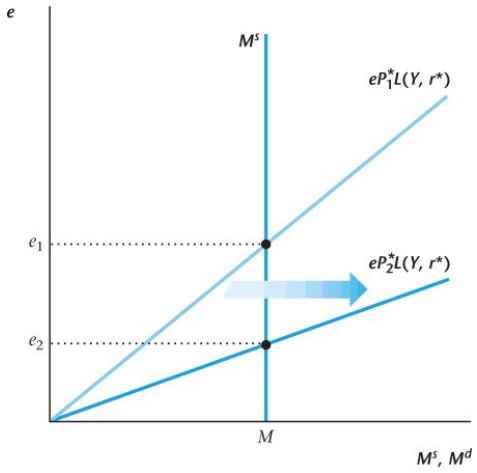
- P domestic price
- P^* foreign price
- e exchange rate
- $\frac{eP^*}{P}$ **real exchange rate / terms of trade**
- **Purchasing Power Parity**
  - $eP^* = P$ # Real Interest Rate = 1

Monetary SOE with flexible exchange rate

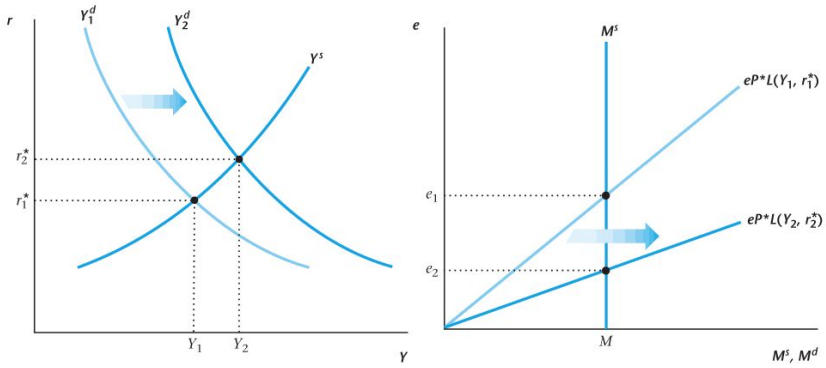
- Setup
  - Exogenous r^* ⇐ world credit market
  - Assume PPP holds $P = eP^*$
- Money market: devaluation by increasing M^s
  - e and P increase proportionally since $P^* = \frac{P}{e}$ is unchanged.
  - Real variables are unaffected by $\uparrow M^s$ ⇒ **Money is Neutral**



- Experiment 1 $P^* \uparrow$ (Nominal foreign shock)
  - P unchanged and other real variables unaffected.
  - ⇒ Insulate economy/ domestic price from nominal foreign shocks.

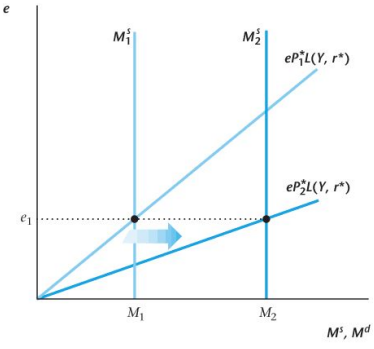


- Experiment 2 $r^* \uparrow$ (Real foreign shock)
  - ⇒ Flexible exchange rate **does not** insulate the domestic prices from **real** foreign shocks.

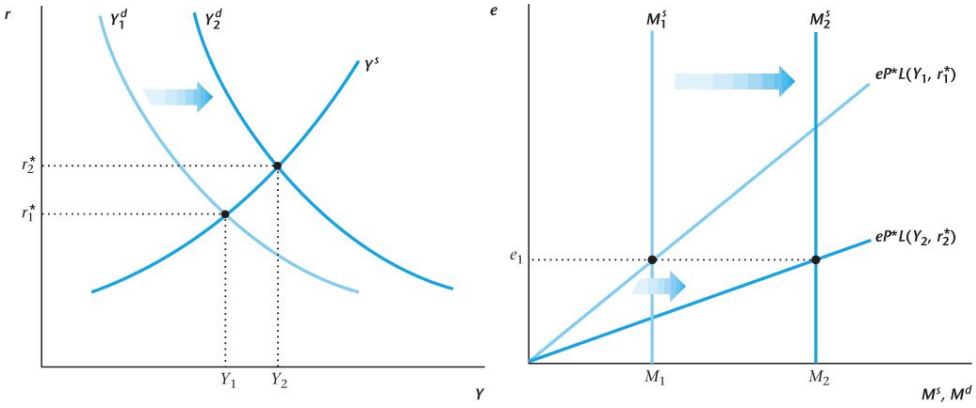


Monetary SOE with fixed exchange rate

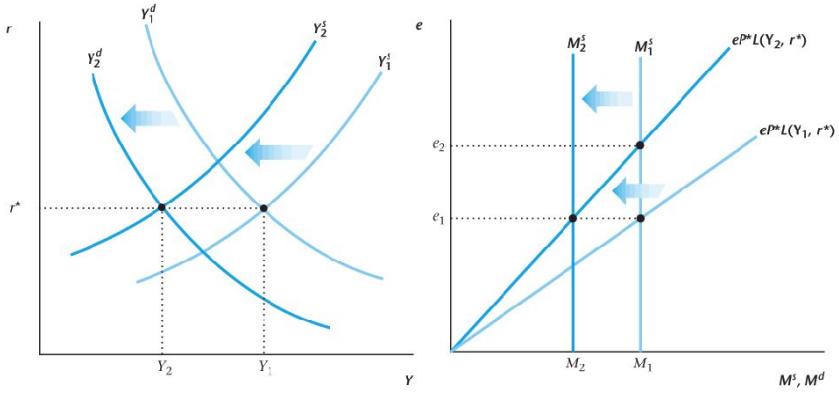
- Setup: Central bank target exchange rate $\bar{e}$ by adjusting M^S ⇒ endogenous M^S.
- Experiment 1 $P^* \uparrow$ (Nominal foreign shock)
  - Domestic price $P = \bar{e} \times P^* \uparrow$
  - ⇒ Fixed exchange rate **does not** insulate domestic prices from **nominal** foreign shocks.



- Experiment 2 $r^* \uparrow$ (Real foreign shock)
  - ⇒ Insulate domestic price (only price) with **real** foreign shocks.



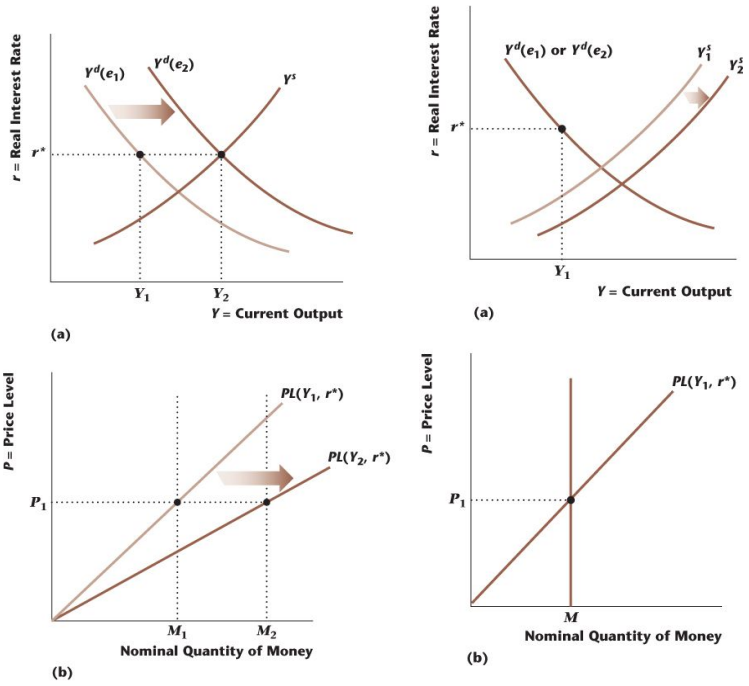
- Experiment 3 $z \downarrow$
  - Notice $C \downarrow$ for a little bit due to wealth effect.
  - $NX/CA \downarrow$



- Central bank choose to **devalues** currency in response to z shocks.
  - Central bank does not change M^s and reset exchange rate target to e_2.
  - $P \uparrow$
  - But the shocks to real variables (as primary shock absorber) **cannot** be prevented.

New Keynesian Sticky Price with Flexible exchange rate

- Output determined by the output demand curve.
- r^* exogenous from international credit market.
- (P, P^*) fixed ⇒ PPP does not hold.
- $M^s \uparrow$
  - Depreciation of money $e \uparrow$, since (P, P^*) does not change, real exchange rate $\frac{eP^*}{P}$ also depreciate.
  - Real Depreciation ⇒ $EX \uparrow$ ⇒ $Y^d(e) \uparrow$
  - Money is **not** neutral



- $G^s \uparrow$ **fiscal policy no use**.
  - $N^s \uparrow$ (wealth effect) ⇒ $Y^s \uparrow$
  - $G \uparrow \Rightarrow Y^d \uparrow$
  - Increase demand (domestic cash)
    - ⇒ Real Appreciation $e_1 \downarrow to\ e_2 \Rightarrow NX \downarrow \Rightarrow Y^d \downarrow$
  - Government spending crowds out an equal quantity of net exports. Therefore Y^d is unchanged.