

# Chapter 5

## A Closed-Economy One-Period Macroeconomic Model

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### Plan

#### **Build a MACRO MODEL**

Specs:

- Closed Economy (i.e., no foreign trade)

Agents:

- Representative Consumer (Chapter 4)
- Representative Firm (Chapter 4)
- Government (Chapter 5)

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### Government

- Purchase consumption goods  $G$ .
- Finance purchase using Taxes  $T$ .

Captures the idea that government spending uses up resources from the private sector (assumption).

For the moment, forget public goods.

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## Government Constraint

- G is exogenous
- Simply, someone stands up (outside the model) and decides on how much G will be. For example, see the state of the Union address. We do not model G. We do not ask questions such as: which variable is influential to G? which variable, if changed, will subsequently change G? Poly-Sci ask these questions.
- In Economics, G is given to us, outside the model.
- **Government Constraint**

$$G = T$$

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## Fiscal Policy

Refers to gov' choices over:

- Expenditures (G)
- Taxes (T) ← here must equal G “WHY?”  
Exlpain what will happen if  $T > G$  or  $T < G$
- Transfers ← no production, not part of GDP
- Borrowing ← here gov' can't borrow “WHY?”

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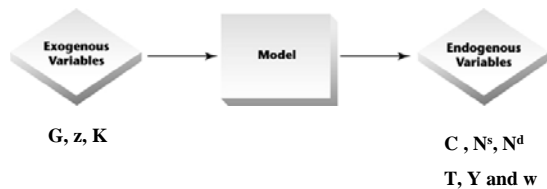
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Figure 5-1 A Model Takes Exogenous Variables and Determines Endogenous Variables



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## MODEL

- Behavior: Consumer, Firm and Government.
- Consistency: given market prices, demand equals supply in each market in the economy. Market Clearing.

The actions of the agents must be consistent.

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## COMPETITIVE EQUILIBRIUM

**COMPETITIVE**

**EQUILIBRIUM**

↑  
Agents are price-takers.

↑  
Economy is in equilibrium,  
when the actions are consistent.  
Markets clear.

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## The CE for this economy

A CE is:

- a set of endogenous quantities:  $C$ ,  $N^s$ ,  $N^d$ ,  $T$  and  $Y$
- and endogenous real wage  $w$ , such that
- Given the exogenous variables  $G$ ,  $z$  and  $k$ ,

**The following is satisfied**

- The consumer max  $U$  s/c budget
- The firm max profits s/c technology
- The labor market clears  $N^s = N^d$
- The government budget is satisfied.

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## In General

A CE is:

- A set of endogenous quantities ...
- and endogenous prices ... such that
- Given a set of exogenous variables ...
- The following is satisfied**
- Agents follow an optimizing behavior
- All markets clear and constraints are satisfied.

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Show why the Income-Expenditure identity holds in equilibrium?

Start with the consumer's budget

$$C = wN^s + \pi - T$$

In Equilibrium,  $\pi = Y - wN^d$  (from the firm)

Also,  $G = T$  (from the gov)

Therefore  $C = wN^s + Y - wN^d - G$

Now, add Labor market clearing  $N^s = N^d$

Which gives  $Y = C + G$

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Figure 5-2 The Production Function

$$Y = z F(K, N)$$

Keep Track of changes in the labels of the Y-Axis and the X-Axis

Y as function of Leisure  
 $Y = z F(K, h-l)$

### PPF

Since  $C = Y - G$  then

$$C = z F(K, h-l) - G$$

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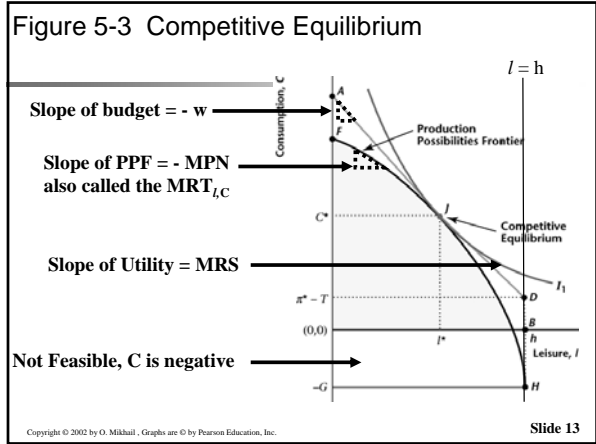
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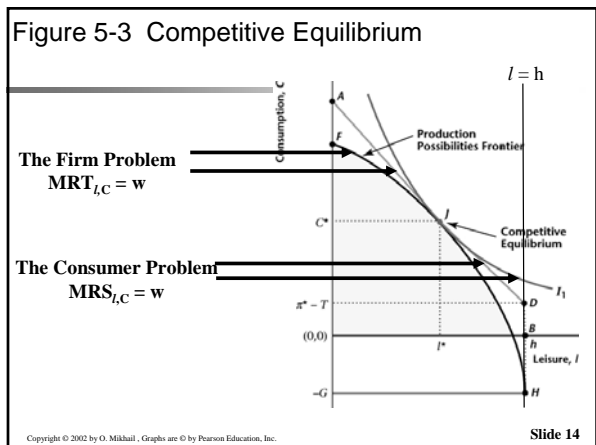
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CE and Economic Efficiency

Important connection:

- 1) Free markets produce socially optimal outcomes.
- 2) Easier to analyze a social optimum than a CE.

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## Efficiency Criterion

### Pareto Optimality:

**Pareto Optimal (PO) if there is no way to rearrange production or to reallocate goods so that someone is made better off without making someone else worse off.**

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## Is it Pareto Optimal?

- Is the CE allocation Pareto Optimal?  
No need to consider a rearrangement, there is only ONE representative consumer.

So here, focus solely on how production is arranged to make the rep consumer as well off as possible.

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## Construct Pareto Optimal allocation

Create the Social Planner:

- Does not deal with markets.
- Benevolent, chooses quantities to make the consumer as well off as possible.
- Act as a fair Judge.
- The Pareto Optimum allocation is the point that a social planner will choose.

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## Social Planner Problem

Choose  $C$  and  $l$ , given the technology for converting  $l$  into  $C$ , to make the representative consumer as well off as possible.

Choose the point on PPF that will lead to the highest Utility for the rep consumer.

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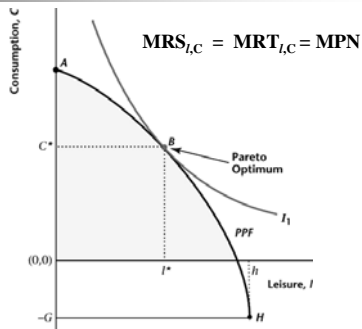
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## Figure 5-4 Pareto Optimality

Note that there is no budget constraint



**PO allocation is the same as the CE allocation**

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## Key Result of this Chapter

In this economy,

The Competitive Equilibrium (CE) allocation is the Pareto Optimal (PO) allocation

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## Two Fundamental Principles

- The First Welfare Theorem:  
Under certain conditions, a CE is PO.
  
- The Second Welfare Theorem:  
Under certain conditions, a PO is a CE.

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## Why would a CE fail to be PO?

Whenever the First Welfare Theorem fails

- Externalities (e.g., pollution).
- Distorting Taxes (not lump-sum)
  - e.g., wage income tax
  - $MRS_{C,l} = w(1-t) < MPN = MRT_{C,l}$
- Market Structure is not competitive (e.g., monopoly power).

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## Figure 5-5 Using the Second Welfare Theorem to Determine a Competitive Equilibrium

Analyze the CE by working out the PO

### CHAIN OF EVENTS

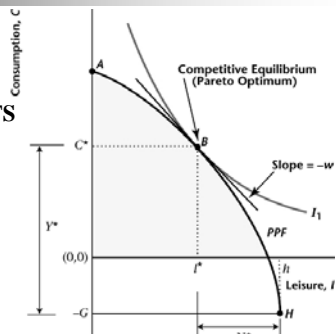
PO → Point B

Point B →  $C^*$  and  $l^*$

Then

$C^* + G \rightarrow Y^*$

$l^* \rightarrow N^* = h - l^*$



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## Notes

- You can compute the prices (i.e.,  $w$ ) from the PO allocation.
- We work with PO, because it is easier. Once we have the PO, we can go back to the CE using the Second Welfare Theorem.
- The model here is simple. One period, rep consumer, rep firm, no externalities, no distortion taxes and competitive.

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## Comparative Statics (THE GAME)

Track the effect of a change in the exogenous variables on the endogenous variables.

Recall Slide # 6.

What will happen if there is a change in

- Government Spending
- Total Factor Productivity

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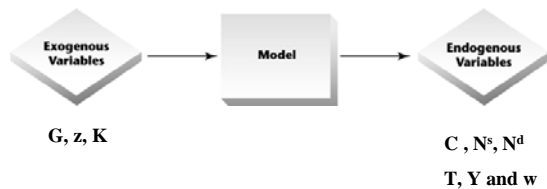
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## THE ONLY GAME



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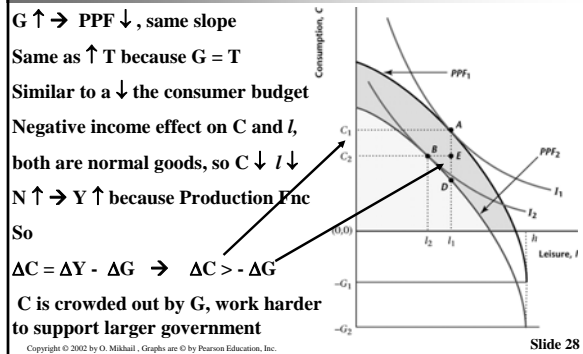
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Figure 5-6 Equilibrium Effects of an Increase in Government Spending




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Effects of an increase in  $G$

$C \downarrow I \downarrow N \uparrow Y \uparrow$   
**What happens to the real wage  $w$ ? (Getting the CE price from PO allocation)**  
**At point B, PPF is less steep than at point A**  
**As  $N$  increases,  $w$  decreases along the MPN.**  
**Therefore,  $w \downarrow$**

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Is the Model Ok?

Does the model produce predictions/results similar to the empirical facts?

**PROBLEM:  $C$  is COUNTERCYCLICAL**

**$G$  is not a good candidate to cause business cycles**

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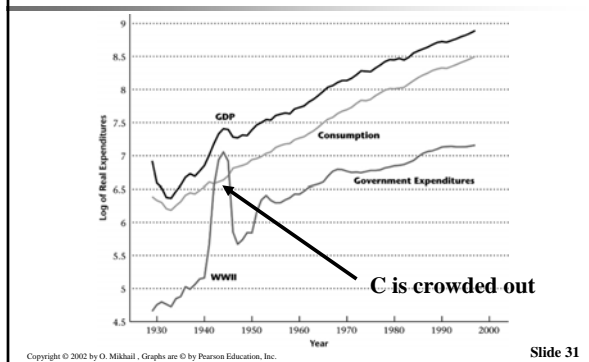
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Figure 5-7 GDP, Consumption, and Government Expenditures, 1929-1997




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GAME II

Do the same for Total Factor Productivity.

- Consequences?
- Model predictions?
- Theory confronts data?

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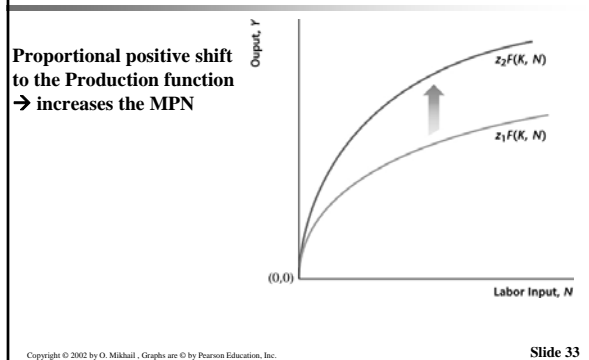
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Figure 5-8 Increase in Total Factor Productivity




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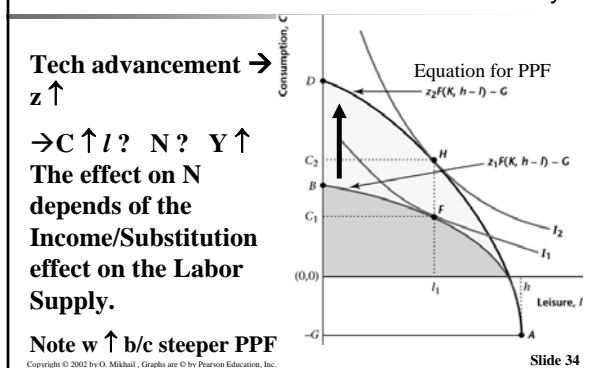
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Figure 5-9 Competitive Equilibrium Effects of an Increase in Total Factor Productivity




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Income / Substitution Effects of a Change in z

The twist in the production function  $\rightarrow$  Change in MPN  $\rightarrow$  change in relative costs, leisure now is expensive relative to consumption. One extra hour of leisure is more expensive. If you are very productive, you watch less TV. Therefore,  
**Substitution Effect  $\rightarrow$  more Labor Supply, i.e.,  $l \downarrow$**

The // change in the Production function  $\rightarrow$  no change in MPL  $\rightarrow$  only effect is the **income effect**  $\rightarrow$  more income + C and l are normal goods  $\rightarrow$  more of each good, i.e.,  **$C \uparrow$  and  $l \uparrow$**

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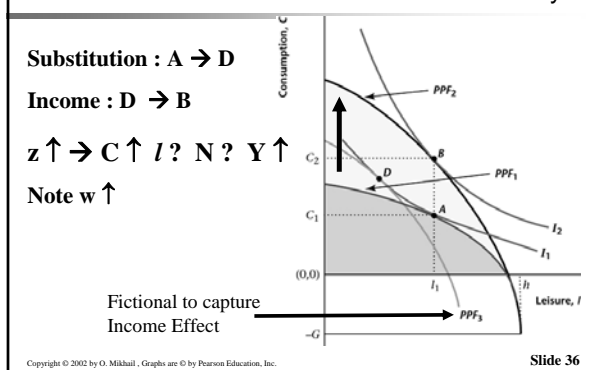
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Figure 5-10 Income and Substitution Effects of an Increase in Total Factor Productivity




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Model vs. Data

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To match BC data, substitution effect must dominate, i.e., to produce procyclical employment.

**REAL BUSINESS CYCLE THEORY**

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