

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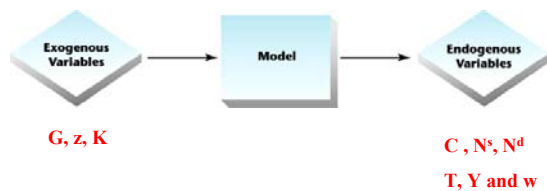
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Figure 5-1 A Model Takes Exogenous Variables and Determines Endogenous Variables



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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

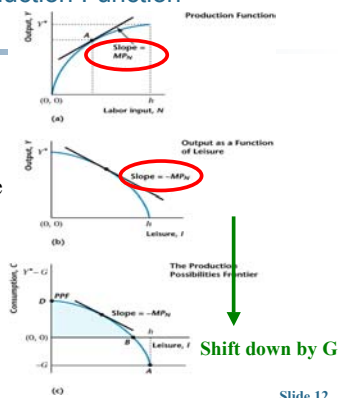
Y as function of Leisure

$$Y = z F(K, h-l)$$

**PPF**

Since  $C = Y - G$  then

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



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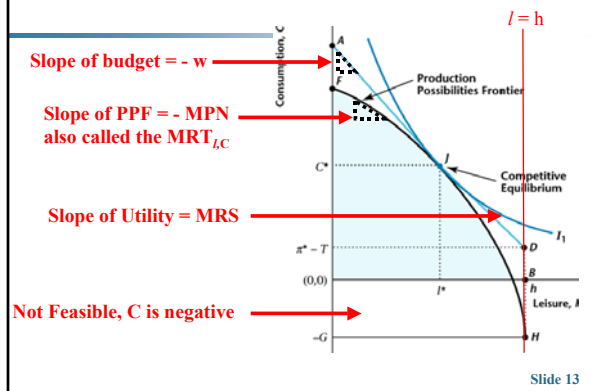
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Figure 5-3 Competitive Equilibrium




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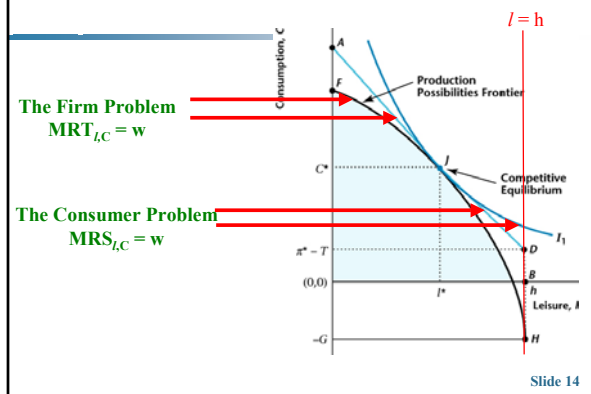
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Figure 5-3 Competitive Equilibrium




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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:

**A Competitive Equilibrium (CE) is 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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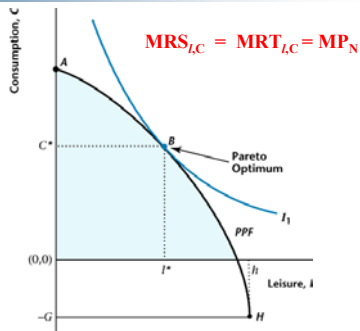
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### Figure 5-4 Pareto Optimality

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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## The First Welfare Theorem and Philosophy

**Adam Smith's Invisible Hand at work.**

**Individuals motivated by greed and firms motivated by profit maximization, could achieve some kind of social utopia.**

**Remember that the social planner is very knowledgeable regarding the state of the economy.**

**Pareto is a narrow concept of social optimality. A trade-off between equity as well as efficiency might be desirable.**

**What do you think?**

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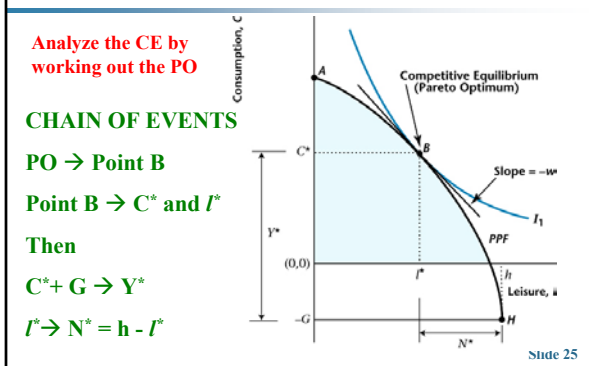
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Figure 5-5 Using the Second Welfare Theorem to Determine a Competitive Equilibrium




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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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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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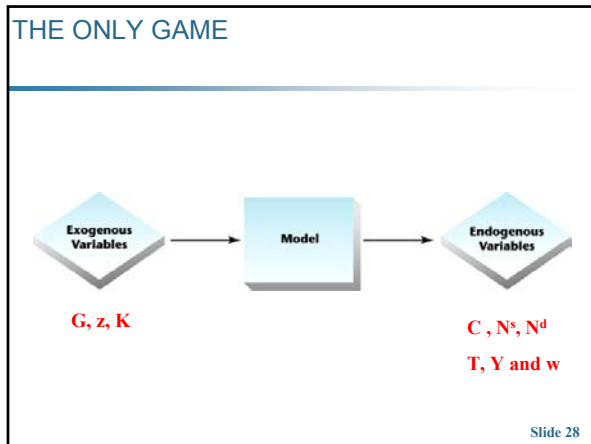
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## THE ONLY GAME




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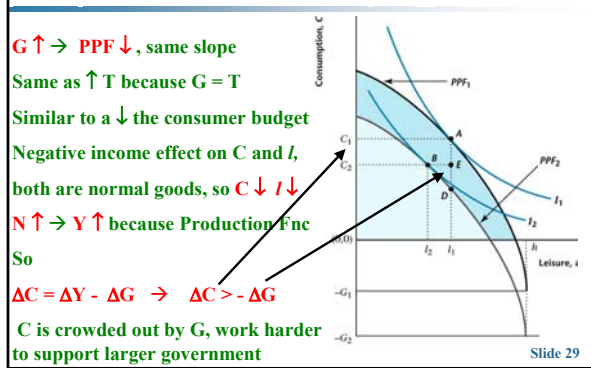
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Figure 5-6 Equilibrium Effects of an Increase in Government Spending




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## Effects of an increase in G

$C \downarrow$   $l \downarrow$   $N \uparrow$   $Y \uparrow$   
 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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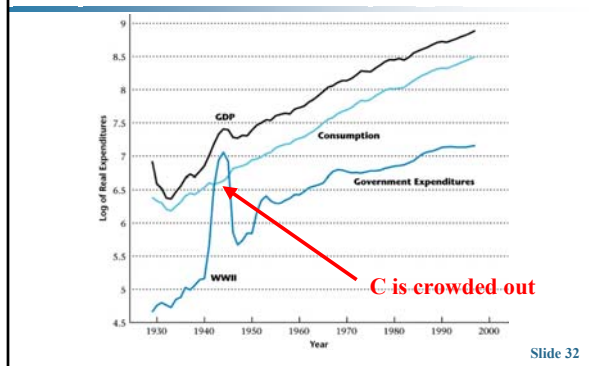
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Figure 5-7 GDP, Consumption, and Government Expenditures, 1929-1997



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## GAME II

Do the same for Total Factor Productivity.

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

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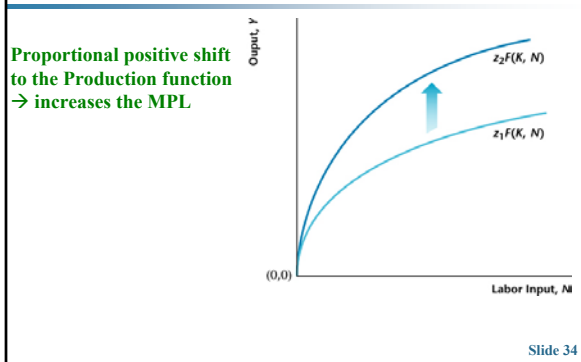
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Figure 5-8 Increase in Total Factor Productivity




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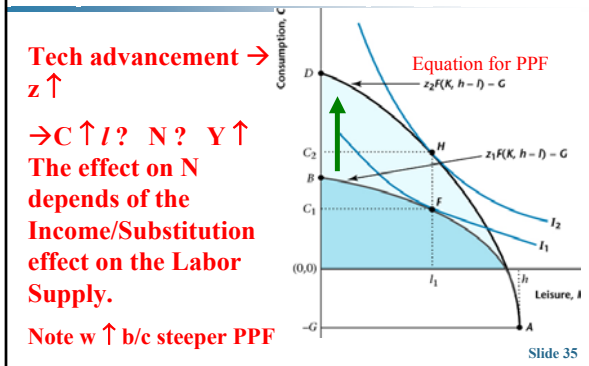
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Figure 5-9 Competitive Equilibrium Effects of an Increase in Total Factor Productivity




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Income / Substitution Effects of a Change in  $z$

The twist in the production function → Change in MPL  
 → 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** → more Labor Supply, i.e.,  $l \downarrow$

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

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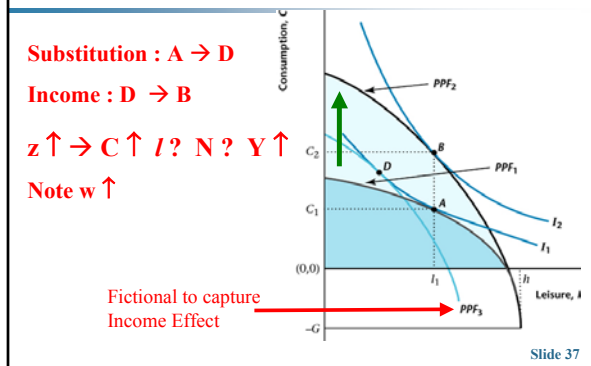
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Figure 5-10 Income and Substitution Effects of an Increase in Total Factor Productivity




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Model vs. Data

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

**REAL BUSINESS CYCLE THEORY**

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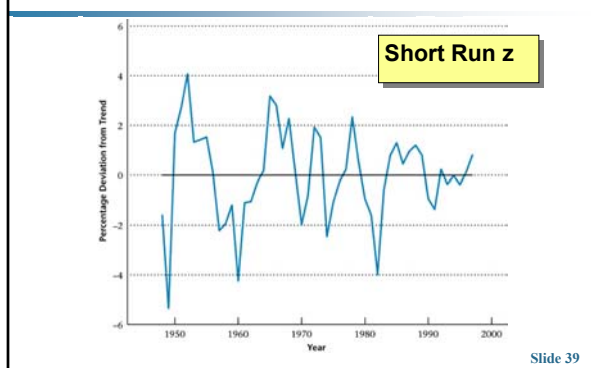
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Figure 5-11 Deviations from Trend in the Solow Residual




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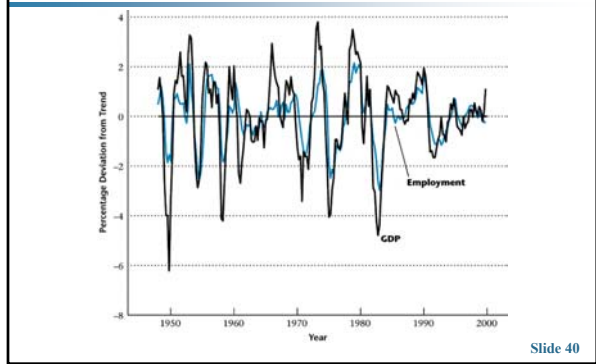
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Figure 5-12 Employment and GDP



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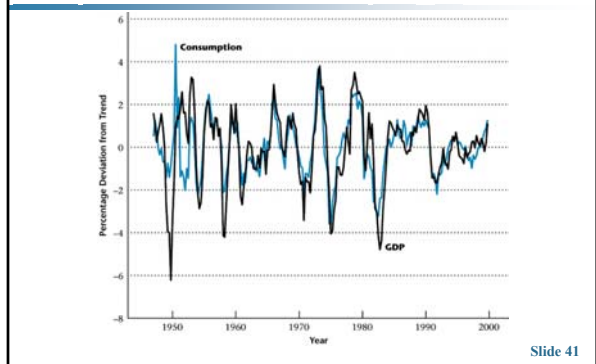
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Figure 5-13 Consumption and GDP



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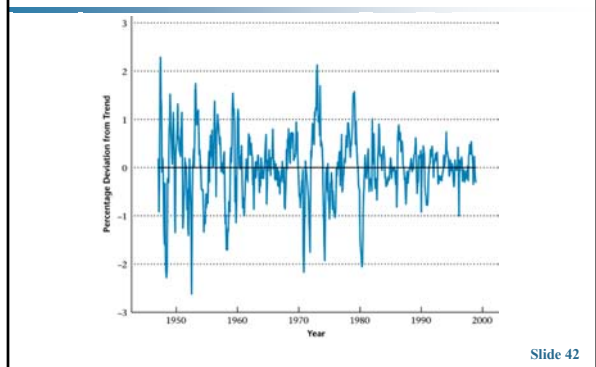
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Figure 5-14 Deviations from Trend in the Real Wage



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