

Lecture Notes for Chapter 2 of
MACROECONOMICS:
An Introduction

National Income

Copyright © 2000, 2003, 2008 by Charles R. Nelson
01/10/08

In this chapter we will discuss-

- *What is our National Income?*
- *Its relation to Gross National Product and Gross Domestic Product*
- *Why Savings equals Investment*
- *Role of Rest-of-the-World*
- *Composition of NI and GDP in US.*

What is Robinson Crusoe's National Income?

- His income is what he produces:
 - *coconuts he gathers,*
 - *fish he catches,*
 - *objects he makes, furniture & tools.*
 - *a stockade.*

He allocates production between:

- Consumption goods & services
- Capital goods (tools, fishing raft)
- Government (stockade).

Moral of the story -

Crusoe's opportunities to consume, invest, and defend are limited by his ability to produce!

How much does Crusoe save?

- Income not consumed or used for government is savings (like yours).
- That is his investment in capital goods.
- His savings is equal to his investment.
- Motive for savings and investment?

Crusoe economics:

- 1. Society's income is what it produces.
- 2. Income is allocated between
 - *consumption,*
 - *investment, and*
 - *government.*
- 3. To increase any of these, we must give up some of another, or produce more.

And ...

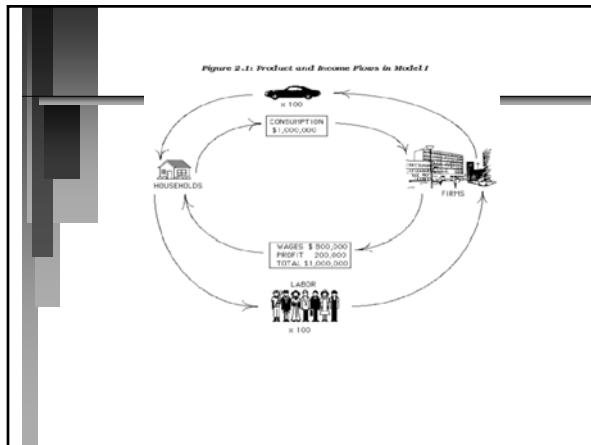
- 4. Savings is equal to the investment in new capital goods.
- 5. If our income is to grow we must invest in capital goods that raise productivity.

Model I: An Economy Producing Only Consumption Goods

- Produces cars.
- Two sectors: business and households.
- There are 100 workers.
- One worker produces one car per year, economy produces 100 cars per year.

Consumption spending:

- Households purchase the cars for \$10,000 each.
- Household consumption spending is:
 $100 \text{ cars} \cdot \$10,000 = \$1,000,000$



Household spending is income to auto firms

- Firms distribute revenue to factors of production.
- To labor:
wage is \$8,000, total \$800,000.
- To capital:
firms' profit is \$200,000.
- Total of factor incomes is called National Income.

National Product and National Income

- Value of goods produced is called National Product.
- Since all of that value paid to factors, National Income = National Product
- Let's see how this works in Model I:

National Product and Income in Model I

- Value of Goods Produced is \$1,000,000
- So National Product is \$1,000,000
- Factor Incomes are:
 - Wages: \$800,000
 - Profits: \$200,000
- So National Income is \$1,000,000
- *National Product = National Income!*

Model II: An Economy That Also Produces Capital Goods (Trucks)

- A worker makes cars or trucks, so car workers + truck workers = 100
- One worker makes one car per year but it takes two to make a truck, so cars •1 + trucks •2 = 100
- Production possibilities frontier.

Society must give up something to get more of something else.

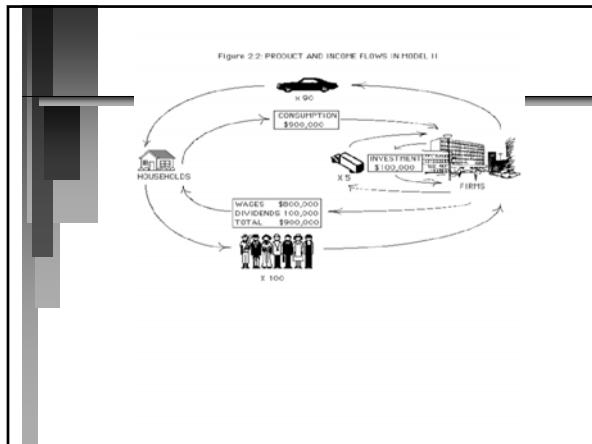
- The opportunity cost of a truck is 2 cars.
- Important concept in economics!
- Economist's mantra: "There is no such thing as a free lunch!"
- Dismal science??

Let's assume:

- A car still sells for \$10,000, a truck for \$20,000.
- Firms find they maximize profits when they produce 90 cars and 5 trucks.
- So 90 workers employed by car firms
- and the remaining 10 by truck firms.

Auto Firms' Product in Model II

- Sales: 90 cars @ \$10,000 = \$900,000
- Value of Product = \$900,000



Auto Firms' Factor Payments in Model II

- Wages: 90 @ \$8,000 = \$720,000
- Profit of \$180,000 allocated to-
 - Capital investment
5 trucks @ \$20,000 = \$100,000
 - Dividend to shareholders \$80,000
- Total Factor Income = \$900,000

Why isn't the cost of new trucks subtracted from profit?

- The trucks are a capital investment.
- New trucks add to assets of firm.
- Become a cost when they wear out, or "depreciate."

Truck Firms' Product in Model II

- Sales: 5 trucks @ \$20,000 = \$100,000
- Value of Product = \$100,000

Truck Firms' Factor Payments in Model II

- Wages: 10 @ \$8,000 = \$80,000
- Profit of \$20,000 to-
 - Dividend to shareholders \$20,000
- Total Factor Income = \$100,000
- Summing up for the whole economy:

National Product in Model II

- Value of goods produced:
 - Consumption goods: \$900,000
 - + Investment goods: \$100,000
 - = National Product : \$1,000,000

National Income in Model II

- Add up factor incomes:

Wages: \$800,000
+ Profits: \$200,000
=National Income: \$1,000,000

- National Product = National Income!

Savings is what society has left after paying for consumption:

- National Income: \$1,000,000
- Consumption: -900,000
= Savings: \$100,000
- Coincidental that Savings=Investment?
- Not at all!

Savings Must Equal Investment!

- Consumption + Investment = National Product, but also:
- National Product = National Income, so
- Consumption + Investment = National Income
- Now subtract Consumption:
on left you get Investment
on right you get Savings.
- Savings = Investment! Always!

The Message:

- Investment in new capital goods, requires reduced consumption.

Model III: Gross National Product

“Gross” is the opposite of “Net.”
Gross means before you subtract costs, in this case depreciation.

Depreciation -

- Two trucks wear out during the year
- Truck fleet at beginning of year: 20
Trucks produced during year: +5
Trucks scrapped during year: -2
Truck fleet at end of year: 23
- Cost of worn-out trucks is depreciation.

Subtract depreciation to get Net National Product:

- Gross National Product: \$1,000,000
- less Depreciation : -40,000
- = Net National Product: \$ 960,000

- Net National Product is net of depreciation.

Net Investment is only 3 trucks:

- Gross Investment (5 trucks) :\$100,000
- less Depreciation (-2 trucks) : 40,000
- = Net Investment (3 trucks) \$ 60,000

Auto Firms' Profits in Model III

- Sales (90 cars @\$10k) : \$900,000
- Wages (90 workers@\$8k): 720,000
- Depreciation (2 trucks@\$20k): 40,000
- = Profit: \$140,000
- Depreciation
 - is a cost to society
 - reduces factor incomes.

Auto Firms' Product in Model III

■ Gross value of product:	\$900,000
- Depreciation, 2 trucks:	40,000
= Net Value of Product:	\$860,000

Auto Firms' Factor Payments in Model III

■ Wages 90 workers @ \$8k:	\$720,000
■ Profit of \$140,000 allocated to -	
Net investment 3 trucks:	60,000
Dividend to shareholders:	80,000
Total Factor Income:	\$860,000
Diminished by \$40,000 Depreciation.	

Net National Product in Model III:

■ Value of Goods Produced:	
Consumption goods	\$900,000
+ Gross Investment	\$100,000
= Gross National Product	\$1,000,000
less Depreciation	\$40,000
= Net National Product	\$960,000

National Income in Model III

- Add up Factor Incomes:
Wages \$800,000
+ Profits \$160,000
= National Income \$960,000
- Again,
National Income equals
Net National Product!

*Model IV: Government Spending
and Taxation*

- Congress decides to buy 6 trucks.
- cars•1 + business trucks•2 + gov't trucks•2 = 100 workers
- Produce fewer trucks for capital investment, or
- fewer cars for households, or both.
- Let's assume car production falls by 10
- and business trucks by 1.

How will government pay for trucks?

- Congress imposes 10% tax on
- profits of firms and
- household income.

Auto Firms' Profits in Model IV

- Sales 80 cars @ \$10,000: \$800,000
- -Wages 80 workers @ \$8k: 640,000
- - depreciation: 40,000
- = Profit Before Tax: \$120,000
- - Income Tax of 10%: -12,000
- = Profit After Tax: \$108,000

Auto Firms' Product in Model IV

- Sales 80 cars @ \$10k: \$800,000
- Gross value of product: \$800,000
- - Depreciation, 2 trucks: 40,000
- = Net Value of Product: \$760,000

Auto Firms' Factor Payments in Model IV

- Wages 80 workers @ \$8k: \$640,000
- Profit before tax \$120,000 to -
 - Net investment 2 trucks \$40,000
 - Dividend payment \$70,000
 - Income Tax \$12,000
 - amount borrowed: -\$2,000
- Total Factor Income \$760,000

But the truck fleet grows more slowly than in Model III:

- Truck fleet at beginning of year 20
- Trucks produced during year +4
- Trucks scrapped during year -2
- Truck fleet at end of year 22

Truck Firms' Profits in Model IV

- Sales, 10 trucks @ \$20,000: \$200,000
- - Wages, 20 workers @\$8k: -160,000
- = Profit Before Tax \$40,000
- - Tax of 10%: -4,000
- = Profit After Tax \$ 36,000

Truck Firms' Product in Model IV

- Value of Goods Produced:
Sales 10 trucks @ \$20,000: \$200,000

Truck Firms' Factor Payments in Model IV

- Wages 20 workers @ \$8k: \$160,000
- Profit of \$40,000 allocated to -
- Dividend to shareholders: \$36,000
- Income Tax paid \$4,000
- Total Factor Income \$200,000

How does the income tax affect the financial situation of the households?

It reduces the income left for consumption or savings.

Households' Income and Expenses in Model IV

- Wages: 100 @ \$8,000 \$800,000
- plus Dividends 106,000
- equals Personal Income 906,000
- less Income Tax of 10% 90,600
- equals Disposable Income 815,400
- - Consumption Spending 800,000
- equals Personal Savings \$15,400

Government's Income and Expenses in Model IV

- Income Tax Revenue from -
 - Business Sector \$16,000
 - Household Sector \$90,600
- equals Total Tax Revenue \$106,600
- less Government Spending -120,000
- = Government Surplus -\$13,400
- A touch of reality: government spends more than it collects in taxes!

Have Net National Product or National Income changed?

- Value of Goods Produced in Model IV:
 - Consumption Goods \$800,000
 - Gross Investment \$80,000
 - Gov't Purchases \$120,000
 - Gross National Product \$1,000,000
 - less Depreciation : -\$40,000
 - Net Nat'l Product : \$960,000

Factor Incomes in Model IV

- Wages \$800,000
- Profits \$160,000
- National Income \$960,000
- Has this changed?

National Income can be allocated to the three sectors in Model IV:

■ First, <u>Households</u>	
■ Wages	\$800,000
■ + Dividends	106,000
■ = Personal Income	\$906,000
■ - Income tax	-90,600
■ = Disposable Income	\$815,400

Next the Business Sector:

■ Profits	\$160,000
■ - Income Tax	-16,000
■ = Profits after tax	144,000
■ - Dividends paid	-106,000
■ = Undistributed Profit	\$38,000

And the Government Sector

■ Tax revenues	\$106,600
----------------	-----------

Finally, adding up the sectors:

- *National Income:* \$960,000

*Is it still true that
Savings = Investment?*

- *Net National Product = National Income.*
- *Consumption +
Net Investment +
Government purchases*
- *Equals*
- *Disposable Income +
Undistributed Profit +
Tax revenues*

In symbols:

- $C + I + G = DI + UP + T$
- *rearrange as:*
- $(DI - C) + UP + (T - G) = I,$
- *In words:*
*Personal Savings +
Undistributed Profits +
Government Savings
Equals
Net Investment*

*The Savings and Investment
Elements of Model IV are:*

- Savings of:
Household + Business + Gov't = Net Invest
- $(DI-C) + UP + (T-G) = I$
- $\$15,400 + \$38,000 + (-\$13,400) = \$40,000$
- Business uses its \$38,000 to buy trucks, but needs another \$2,000.
- Government is short \$13,400.
- Household savings is enough for both!

*How has the economy “made
room” for government trucks?*

- Lower household consumption, and
- Less investment in new capital goods
- Is society better off than before?

Issues for further discussion:

- Suppose the income tax is cut to 9%.
- How would this tax cut impact the economy if consumers:
 1. spent additional disposable income?
 2. saved additional disposable income?

The Role of International Trade

- The U.S. is a major exporter of grain, airplanes, software and computers.
- Exports are about 10% of U.S. GNP.
- The U.S. imports large amounts of petroleum, autos, and food products.
- Imports equal about 15% of GNP.
- Large trade deficit!

The Trade Deficit!!

- Excess of U.S. imports over exports
- About \$600 billion per year!
- A source of tension with Japan and Europe, and more recently China.

In Model V autos are traded internationally.

- Exports 10 cars & imports 11.
- Exports are \$100,000, Imports are \$110,000.
- Consumption higher by 1 car, \$10,000.
- Gross Investment and Government Purchases are the same as in Model IV.

Has GNP changed?

- GNP is still \$1,000,000.
- But total expenditures are:
- Consumption \$810,000
- + Gross Investment: \$80,000
- + Gov't Purchases: \$120,000
- + Exports: \$100,000
- = Total expenditures \$1,110,000!
- Why the difference?

Answer: Consumption includes imports.

- Let's subtract imports:
- Exports: \$100
- Less Imports 110
- = net Exports -10

National Product in Model V

- Value of Goods Produced:
- Consumption: \$810,000
- + Gross Investment: \$80,000
- + Gov't Purchases: \$120,000
- + Net Exports: -10,000
- + Gross Nat'l Product: \$1,000,000
- - Depreciation: -\$40,000
- = Net National Product: \$960,000

National Income in Model V

- Factor Incomes:
- Wages: \$800,000
- Profits: 160,000
- National Income: \$960,000

Households' Income and Expenses in Model V

- Wages 100 @ \$8,000: \$800,000
- plus Dividends: 106,000
- equals Personal Income: \$906,000
- less Income Tax of 10%: 90,600
- equals Disposable Income: \$815,400
- less Consumption: \$810,000
- equals Personal Savings: \$5,400
- Households buy 1 car more, save less.

Does "savings=investment"?
Set $NNP = NI$:

- **C**onsumption +
- **N**et **I**nvestment +
- **G**ov't purchases +
- (**E**xports - **I**mports)
- =
- **D**isposable **I**ncome +
- **U**ndistributed **P**rofit +
- **T**ax revenues

Using symbols:

- $C + I + G + (EX-IM) = DI + UP + T.$
- $(DI-C) + UP + (T-G) + (IM-EX) = I$
- *In words:*
Personal Savings +
Business Savings +
Gov't Savings +
Rest-Of-World Savings
=
Net Investment

The Trade Deficit is ROW Savings!

- Imports to US are \$\$\$ earned by ROW
- Exports are \$\$\$ spent by ROW
- Imports - exports are ROW savings.
- That is also our trade deficit
- And \$\$\$ the ROW has to lend in USA,

Savings = Investment equation:

- *Savings of:*
Household+Bus+Gov't+ROW=Net Invest
- $(D-C) + UP + (T-G) + (IM-EX) = I$
- $5,400 + 38,000 + (-13,400) + 10,000 = 40,000$

The U.S. has resembled Model V

- Both had a large government deficit and a large trade deficit.
- The trade deficit is a source of savings
- It made possible high consumption while we saved little.

What if the ROW were no longer interested in lending us its savings?

- Can we change *only* ROW savings?
- What adjustments would we be forced to make?

National Income of U.S. in "typical year" 2004

- Wages & Salaries \$5300b, 52 % of NI
- +Fringe benefits \$1270b, 12 % of NI
- = Employee Comp. \$6570b, 64% of NI
- Farm Income \$19b, <1 % of NI
- + Non-farm \$882b, 9 % of NI
- = Proprietors' Income \$901b, 9 % of NI
- Corporate Profits \$1167b, 11 % of NI

And -

- Rental Income \$173b, 2 % of NI
- Net Interest \$546b, 5 % of NI
- National Income \$10,243b, 100%
- + Statistical discrepancy \$59b
- Net National Product \$10,302 billion!
- about \$40 billion per working day!

What is Gross Domestic Product?

- U.S.-owned factors of production do not reside entirely within the U.S.
- The GNP is the output of U.S.-owned factors of production
- GDP is the output of all factors of production within the U.S.
- In practice, the difference is small.

GDP is announced each quarter

- Expressed at an annual rate
- Growth rate also at an annual rate
- Media announce “real ” GDP
- Adjusted for inflation.

Consumption in 2004:

- Durables: \$976b, 8% of GDP
- + Non-durables: \$2356b, 20 % of GDP
- + Services: \$4822 b, 41% of GDP
- = Consumption: \$8155b, 69 % of GDP

Capital Investment -

- Plant & Equipment \$1198b, 11% of GDP
- + Residential housing \$660b, 6%
- + Chg Inventories \$55b, <1%
- = Gross Investment \$1913b, 16%

Exports and Imports

- Exports \$1164b, 10% of GDP
- - Imports -\$1764b, -15% of GDP
- = Net Exports: -\$600b, -5% of GDP
- Negative Net Exports means we have a Trade Deficit.
- It is a negative number, but is it bad??

Government Purchases

- Federal \$803b, 7 % of GDP
- + State and Local \$1370b, 12%
- = Gov't Purchases \$2175b, 19%

Adding it all up:

- Gross Domestic Prod \$11,643 b, 100%
- + factor income from ROW: \$380b
- - factor income to the ROW: -\$347b
- =Gross National Product: \$11,677b
- - Depreciation: -\$1374b, -12%
- Net National Product: \$10,303b,88%

The savings of the four sectors add up to U.S. net investment.

- $(D-C) + UP + (T-G) + (IM-EX) = I$
- $\$104b + \$484b + (-\$367b) + \$600b = \$766b$
- In words: Savings by Households +Business+Gov't +ROW = Net Investment
- Notice the 'Twin Deficits!!'.

Why did the “twin deficits” emerge in the 1980s?

- Federal Gov had a large budget deficit.
- US Treasury had to offer higher rates
- ROW found our interest rates attractive, saved \$ and lent to US Treasury
- Saving by ROW is our trade “deficit”
- ROW saving financed our Gov’t deficit.

Where are the twin deficits today?

- Which sectors have negative savings?
- Which sectors are big savers?
- How are we financing capital investment?

The End!
