MICROECONOMICS
Principles and Analysis

GENERAL EQUILIBRIUM: BASICS

LIMITATIONS OF CRUSOE MODEL

- The Crusoe story takes us only part way to a treatment of general equilibrium:
  - There's only one economic actor.
  - So there can be no interaction.
- Prices are either exogenous (from the mainland? the world? Mars?) or hypothetical.
- But there are important lessons we can learn:
  - Integration of consumption and production sectors.
  - Decentralising role of prices.

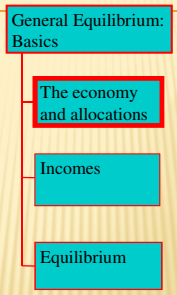
When we use something straight from Crusoe we will mark it with this logo

ONWARD FROM CRUSOE...

- This is where we generalise the Crusoe model.
- We need a model that will incorporate:
  - Many actors in the economy...
  - ...and the possibility of their interaction.
  - The endogenisation of prices in the economy.
- But what do we mean by an "economy"...?
- We need this in order to give meaning to "equilibrium"

OVERVIEW...

The components of the general equilibrium problem.



THE COMPONENTS

- At a guess we can model the economy in terms of:
  - Resources
  - People
  - Firms
- Specifically the model is based on assumptions about:
  - Resource stocks
  - Preferences
  - Technology
- (In addition –for later – we will need a description of the rules of the game)

WHAT IS AN ECONOMY?

- Resources (stocks) $R_1, R_2, \ldots$ — n of these
- Households (preferences) $U^1, U^2, \ldots$ — n_h of these
- Firms (technologies) $\Phi^1, \Phi^2, \ldots$ — n_f of these

AN ALLOCATION

A competitive allocation consists of:

Note the shorthand notation for a collection

utility-maximising

- A collection of bundles (one for each of the n_h households) $[\mathbf{x}] := [\mathbf{x}^1, \mathbf{x}^2, \mathbf{x}^3, \ldots]$

profit-maximising

- A collection of net-output vectors (one for each of the n_f firms) $[\mathbf{q}] := [\mathbf{q}^1, \mathbf{q}^2, \mathbf{q}^3, \ldots]$

- A set of prices (used by households and firms) $\mathbf{p} := (p_1, p_2, \ldots, p_n)$

HOW A COMPETITIVE ALLOCATION WORKS

$\mathbf{p} \rightarrow \{\mathbf{q}^f(\mathbf{p}),\ f=1,2,\ldots,n_f\}$

$\mathbf{p}, \{y^h\} \rightarrow \{\mathbf{x}^h(\mathbf{p}),\ h=1,2,\ldots,n_h\}$

just a minute! Where do these incomes come from??

- *Implication of firm f's profit maximisation*
- *Firms' behavioural responses map prices into net outputs*
- *Implication of household's utility maximisation*
- *Households' behavioural responses map prices and incomes into demands*
- *The competitive allocation*

AN IMPORTANT MISSING ITEM

- For a consumer in isolation it may be reasonable to assume an exogenous income.
  - Derived elsewhere in the economy.
- Here the model involves all consumers in a closed economy.
  - There is no "elsewhere."
- Incomes have to be modelled explicitly.
- We can learn from the "simple economy" presentation.

OVERVIEW...

General Equilibrium: Basics

The economy and allocations

Incomes

Equilibrium

A key role for the price system.

MODELLING INCOME

- What can Crusoe teach us?
- Consider where his "income" came from
  - Ownership rights of everything on the island
- But here we have many persons and many firms.
  - So we need to proceed carefully.
  - We need to assume a system of ownership rights.

WHAT DOES HOUSEHOLD *H* POSSESS?

- Resources $R_1^h, R_2^h, \ldots$ $R_i^h \geq 0,\ i=1,\ldots,n.$

- Shares in firms' profits $\varsigma_1^h, \varsigma_2^h, \ldots$ $0 \leq \varsigma_f^h \leq 1,\ f=1,\ldots,n_f.$

INCOMES

- Resources
- Shares in firms
- Net outputs
- Prices

Rents

Profits

The components of *h*'s income

THE FUNDAMENTAL ROLE OF PRICES

- Net supply of good *i* by firm *f* depends on prices: $q_i^f = q_i^f(\mathbf{p})$ (**p** is an *n*-vector of prices)
  - Supply of net outputs
- Thus profits depend directly and indirectly on prices: $\Pi^f(\mathbf{p}) := \sum_{i=1}^{n} p_i\, q_i^f(\mathbf{p})$
  - Again writing profits as price-weighted sum of net outputs
- So *h*'s income can be written (holding by *h* of resource *i*; holding by *h* of shares in *f*): $y^h = \sum_{i=1} p_i \bar{R}_i^h + \sum_{f=1}^{n_f} \varsigma_f^h \Pi^f(\mathbf{p})$
  - Incomes = resource rents + profits
- Incomes depend on prices: $y^h = y^h(\mathbf{p})$
  - Note that the function $y^h(\bullet)$ depends on the ownership rights that *h* possesses

PRICES IN A COMPETITIVE ALLOCATION

$\mathbf{p} \rightarrow \{\mathbf{q}^f(\mathbf{p}),\ f=1,2,...,n_f\}$

$\mathbf{p} \rightarrow \{\mathbf{x}^h(\mathbf{p}),\ h=1,2,...,n_h\}$

$y^h = y^h(\mathbf{p})$

$\mathbf{p} \rightarrow [\mathbf{q}(\mathbf{p})]\ [\mathbf{x}(\mathbf{p})]$

- *The allocation as a collection of responses*
- *Put the price-income relation into household responses*
- *Gives a simplified relationship for households*
- *Summarise the relationship*

THE PRICE MECHANISM

share ownership

$\varsigma_1^a, \varsigma_2^a, \ldots$

$\varsigma_1^b, \varsigma_2^b, \ldots$

$\ldots$

- *System takes as given the property distribution*
  - *Property distribution consists of two collections*
  - *Prices then determine incomes*
  - *Prices and incomes determine net outputs and consumptions*
  - *Brief summary...*

d → **a**

distribution — prices — allocation

OVERVIEW...

Specification and examples

- General Equilibrium: Basics
  - The economy and allocations
  - Incomes
  - Equilibrium

WHAT IS AN EQUILIBRIUM?

- What kind of allocation is an equilibrium?
- Again we can learn from previous presentations:
  - Must be utility-maximising (consumption)...
  - ...profit-maximising (production)...
  - ....and satisfy materials balance (the facts of life)
- We can do this for the many-person, many-firm case.

COMPETITIVE EQUILIBRIUM: BASICS

- For each h, maximise $U^h(\mathbf{x}^h)$, subject to $\sum_{i=1}^{n} p_i x_i^h \le y^h$
- For each f, maximise $\sum_{i=1}^{n} p_i q_i^f$, subject to $\Phi^f(\mathbf{q}^f) \le 0$
- For each i: $x_i \le q_i + R_i$

aggregate consumption of good i.

aggregate stock of good i.

aggregate net output of good i.

- *Households maximise utility, given prices and incomes*
- *Firms maximise profits, given prices*
- *For all goods the materials balance must hold*

CONSUMPTION AND NET OUTPUT

- "Obvious" way to aggregate consumption of i: $x_i = \sum_{h=1}^{n_h} x_i^h$ (Sum over households)
  - Appropriate if i is a *rival* good
  - Full additional resources are needed for each additional person consuming a unit of good i.
- An alternative way to aggregate: $x_i = \max_h \{x_i^h\}$
  - Opposite case: a nonrival good
  - Examples: TV, national defence...
- Aggregate output: $q_i := \sum_{f=1}^{n_f} q_i^f$ (By definition)
  - if all the $\mathbf{q}^f$ are feasible will $\mathbf{q}$ be feasible?
  - Yes if there are no externalities
  - Counterexample: production with congestion...

TO MAKE LIFE SIMPLE:

- Assume incomes are determined privately.
- All goods are "rival" commodities.
- There are no externalities.

COMPETITIVE EQUILIBRIUM: SUMMARY

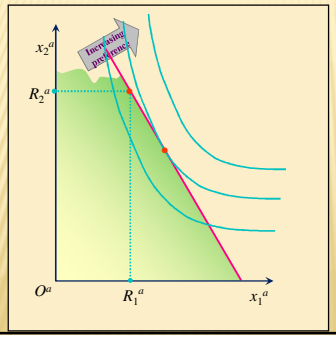
- It must be a competitive allocation
  - A set of prices $\mathbf{p}$
  - Everyone maximises at those prices $\mathbf{p}$
- The materials balance condition must hold
  - Demand cannot exceed supply: $\mathbf{x} \le \mathbf{q} + \mathbf{R}$

AN EXAMPLE

- Exchange economy (no production)
- Simple, standard structure
- 2 traders (Alf, Bill)
- 2 Goods:

	Alf	*Bill*
• resource endowment	(R_1^a, R_2^a)	(R_1^b, R_2^b)
• consumption	(x_1^a, x_2^a)	(x_1^b, x_2^b)
• utility	$U^a(x_1^a, x_2^a)$	$U^b(x_1^b, x_2^b)$

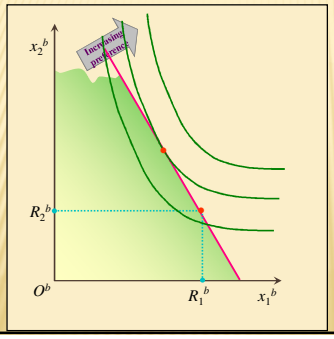
ALF'S OPTIMISATION PROBLEM



- *Resource endowment*
- *Prices and budget constraint*
- *Preferences*
- *Equilibrium*

- *Budget constraint is* $\sum_{i=1}^{2} p_i x_i^a \le \sum_{i=1}^{2} p_i R_i^a$
- *Alf sells some endowment of 2 for good 1 by trading with Bill*

BILL'S OPTIMISATION PROBLEM



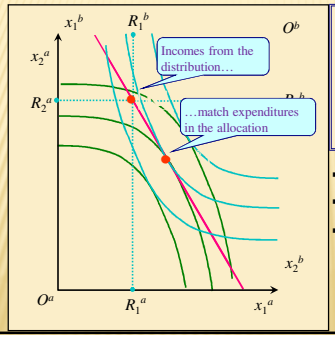
- *Resource endowment*
- *Prices and budget constraint*
- *Preferences*
- *Equilibrium*

- *Budget constraint is*

$$\sum_{i=1}^{2} p_i x_i^b \leq \sum_{i=1}^{2} p_i R_i^b$$

- *Bill, of course, sells good 1 in exchange for 2*

COMBINE THE TWO PROBLEMS



- *Bill's problem (flipped)*
- *Superimpose Alf's problem.*
- *Price-taking trade moves agents from endowment point…*
- *…to the competitive equilibrium allocation*
- *The role of prices*

- *This is the Edgeworth box.*
- *Width:* $R_1^a + R_1^b$
- *Height:* $R_2^a + R_2^b$.

ALF AND BILL AS A MICROCOSM

- The Crusoe equilibrium story translates to a many-person economy.
- Role of prices in allocations and equilibrium is crucial.
- Equilibrium depends on distribution of endowments.
- Main features are in the model of Alf and Bill.
- But, why do these guys just accept the going prices…?
- See *General Equilibrium: Price-Taking*.