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.

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

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 <u>competitive</u> allocation consists of:

Note the shorthand notation for a collection

- A collection of **utility-maximising** bundles (one for each of the n_h households)

$$[\mathbf{x}] := [\mathbf{x}^1, \mathbf{x}^2, \mathbf{x}^3, \ldots]$$

- A collection of **profit-maximising** 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

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

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

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...

A key role for the price system.

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

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?

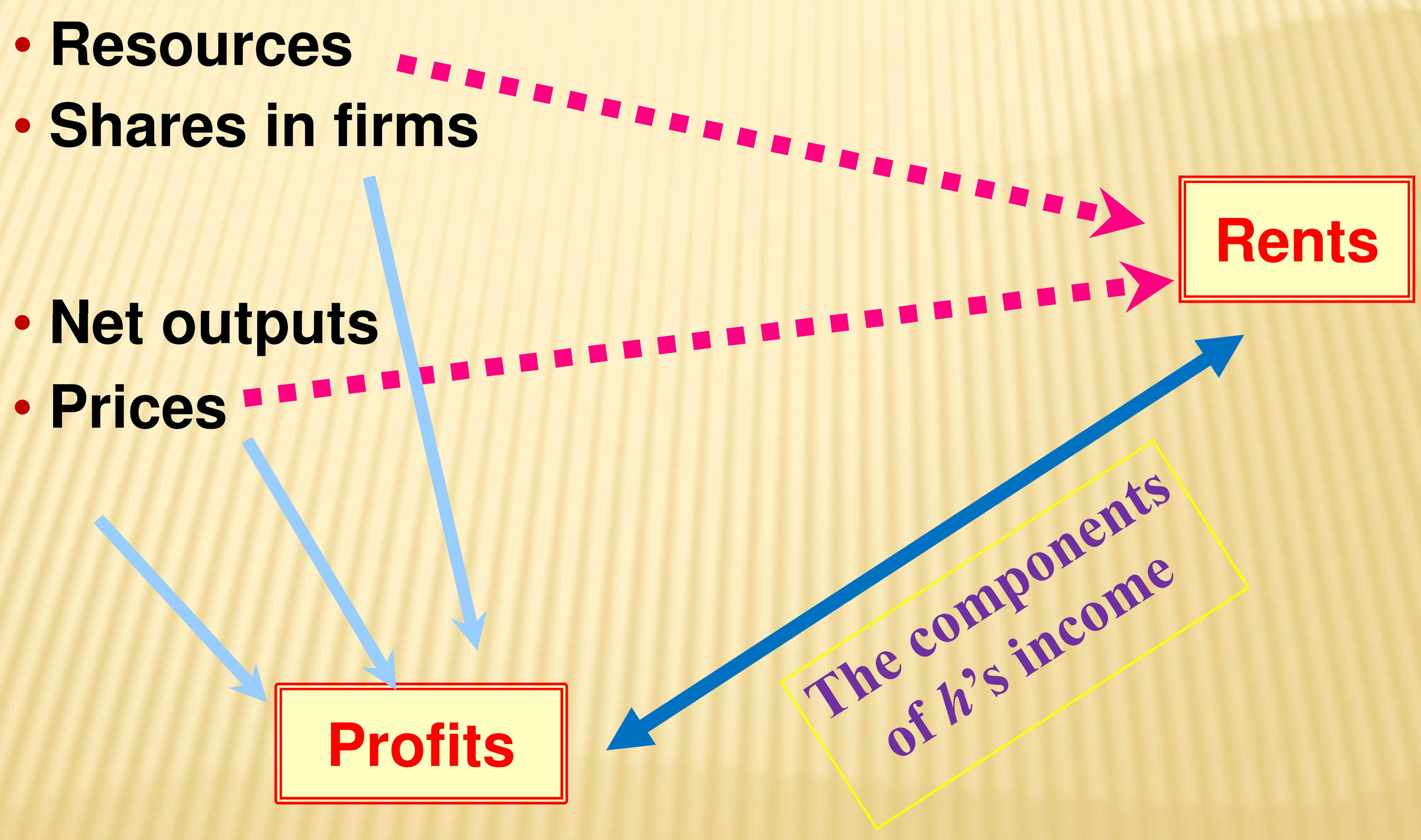
- Resources $R_1^h, R_2^h, \ldots$

  $R_i^h \geq 0,$
  $i = 1, \ldots, n.$

- 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

firm f, good i.

n-vector of prices

- Net ... t... ...d on prices:

  $q_i^f = q_i^f(\mathbf{p})$

  - Supply of net outputs

- Thus profits depend on prices:

  directly

  indirectly

  $$\Pi^f(\mathbf{p}) := \sum_{i=1}^{n} p_i \, q_i^f(\mathbf{p})$$

  - Again writing profits as price-weighted sum of net outputs

- So ... n be writter

  Holding by h of resource i

  Holding by h of shares in f

  $$y^h = \sum_{i=1} p_i R_i^h + \sum_{f=1}^{n_f} \varsigma_f^h \Pi^f(\mathbf{p})$$

  - ...ncomes = resource rents + ...ofits

- 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

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

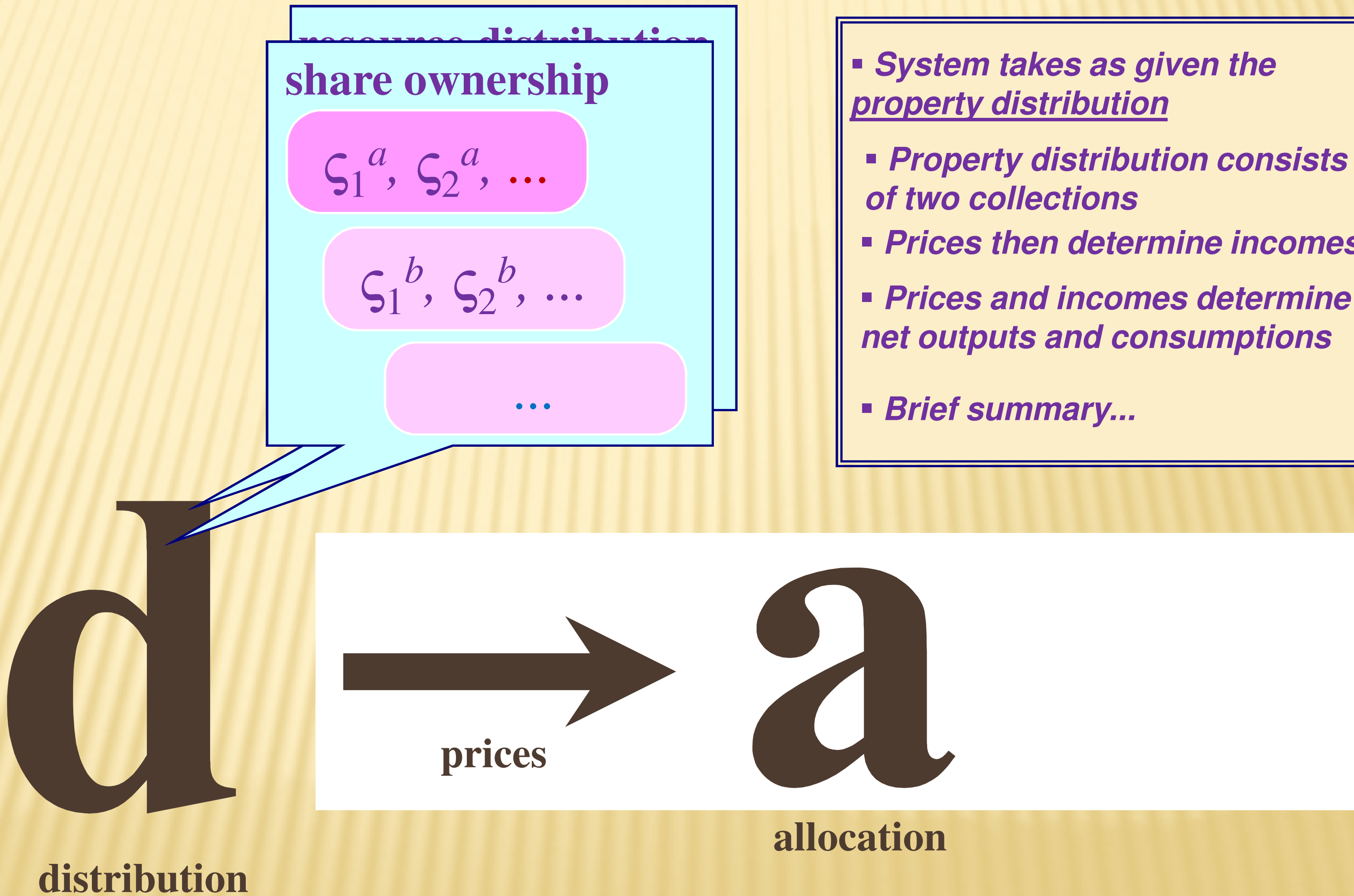
$$\mathbf{p} \rightarrow \{\mathbf{x}^h(\mathbf{p}) \ , \ h=1,2,\ldots,n_h \}$$

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

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

- *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



- 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...

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 stock of good i.

aggregate consumption 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

Sum over households

$$x_i = \sum_{h=1}^{n_h} x_i^h$$

- 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...

- Aggreg output:

By definition

$$q_i := \sum_{f=1}^{n_f} q_i^f$$

- 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 **p**
  - Everyone maximises at those prices **p**
- The materials balance condition must hold
  - Demand cannot exceed supply:

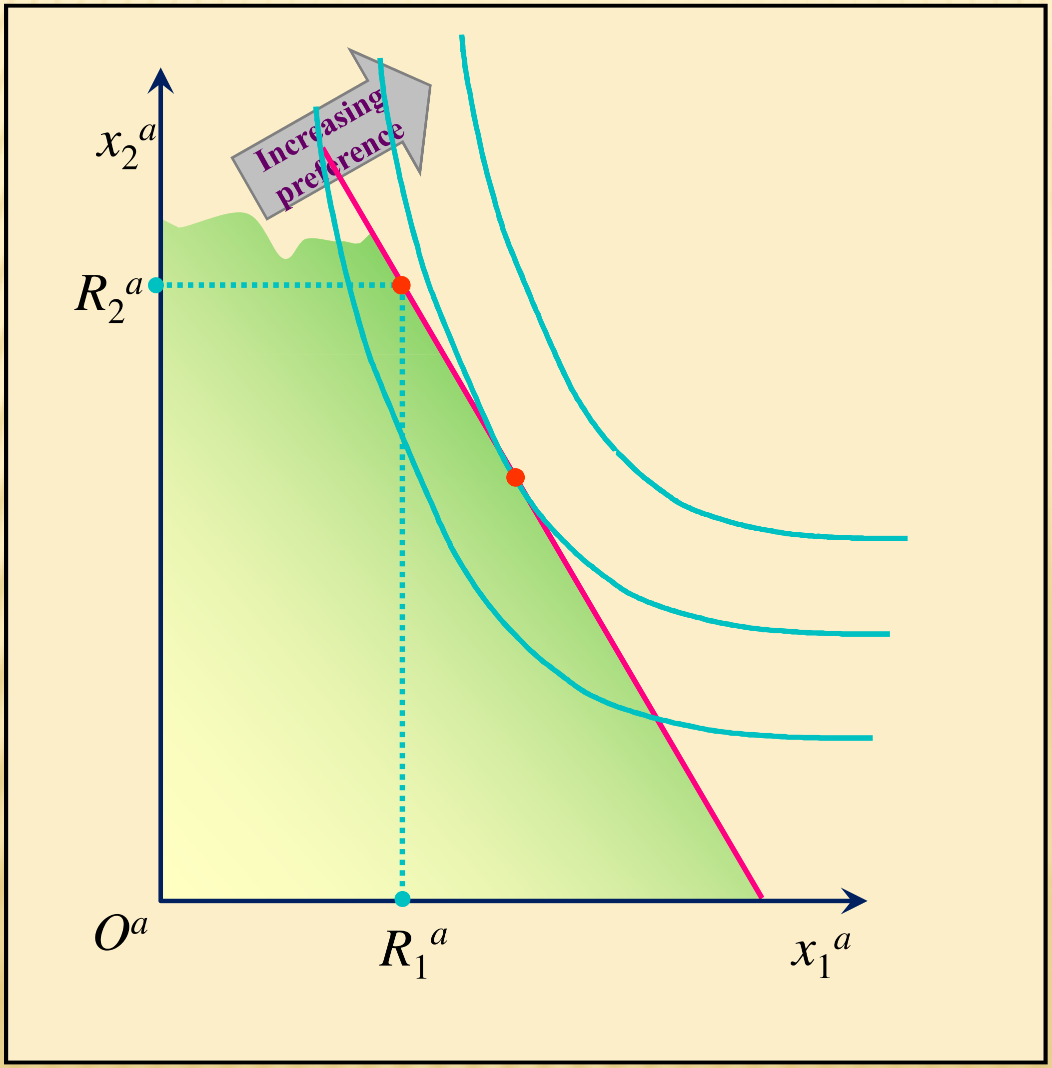
$$\mathbf{x} \leq \mathbf{q} + \mathbf{R}$$

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



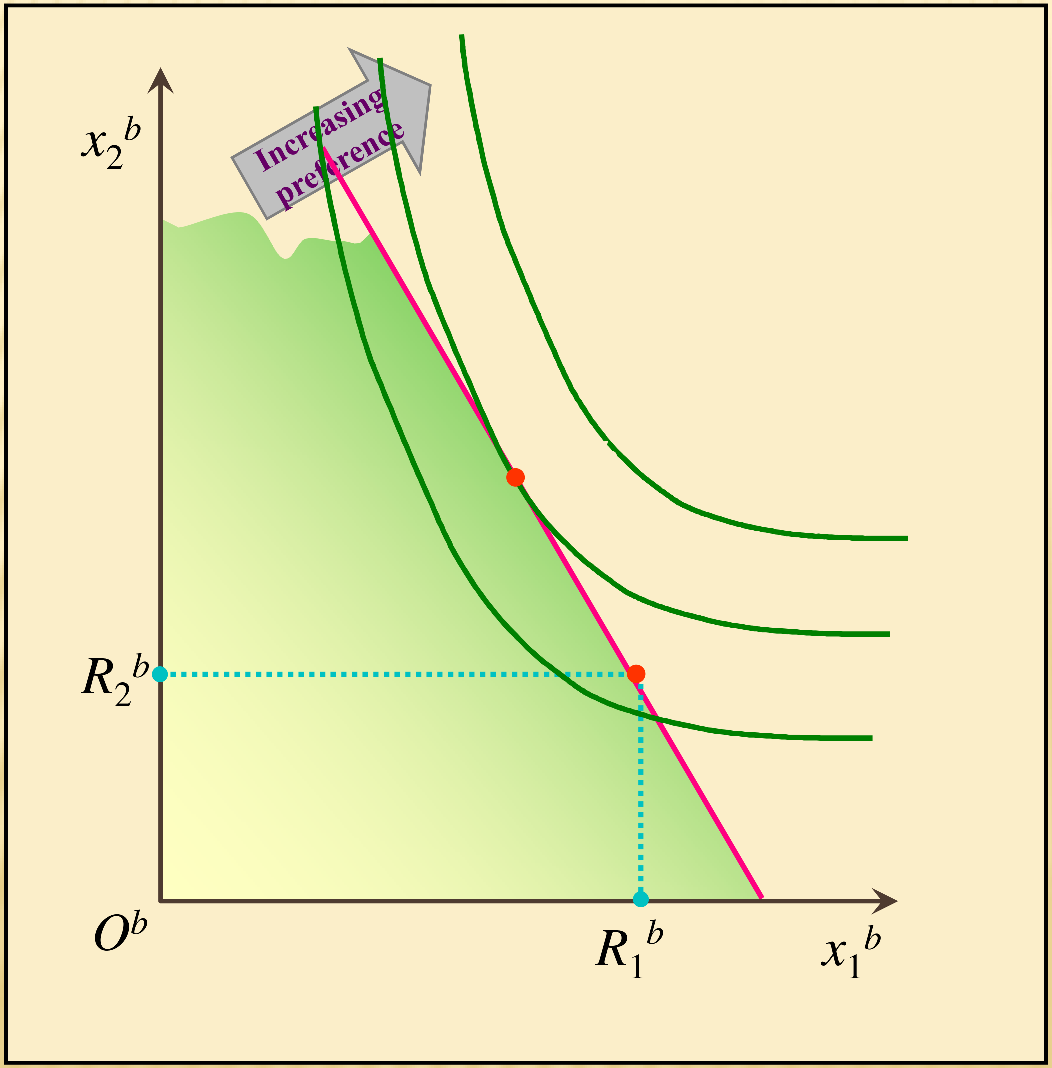
- *Resource endowment*
- *Prices and budget constraint*
- *Preferences*
- *Equilibrium*

- *Budget constraint is*

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

- *Alf sells some endowment of 2 for good 1 by trading with Bill*

BILL'S OPTIMISATION PROBLEM



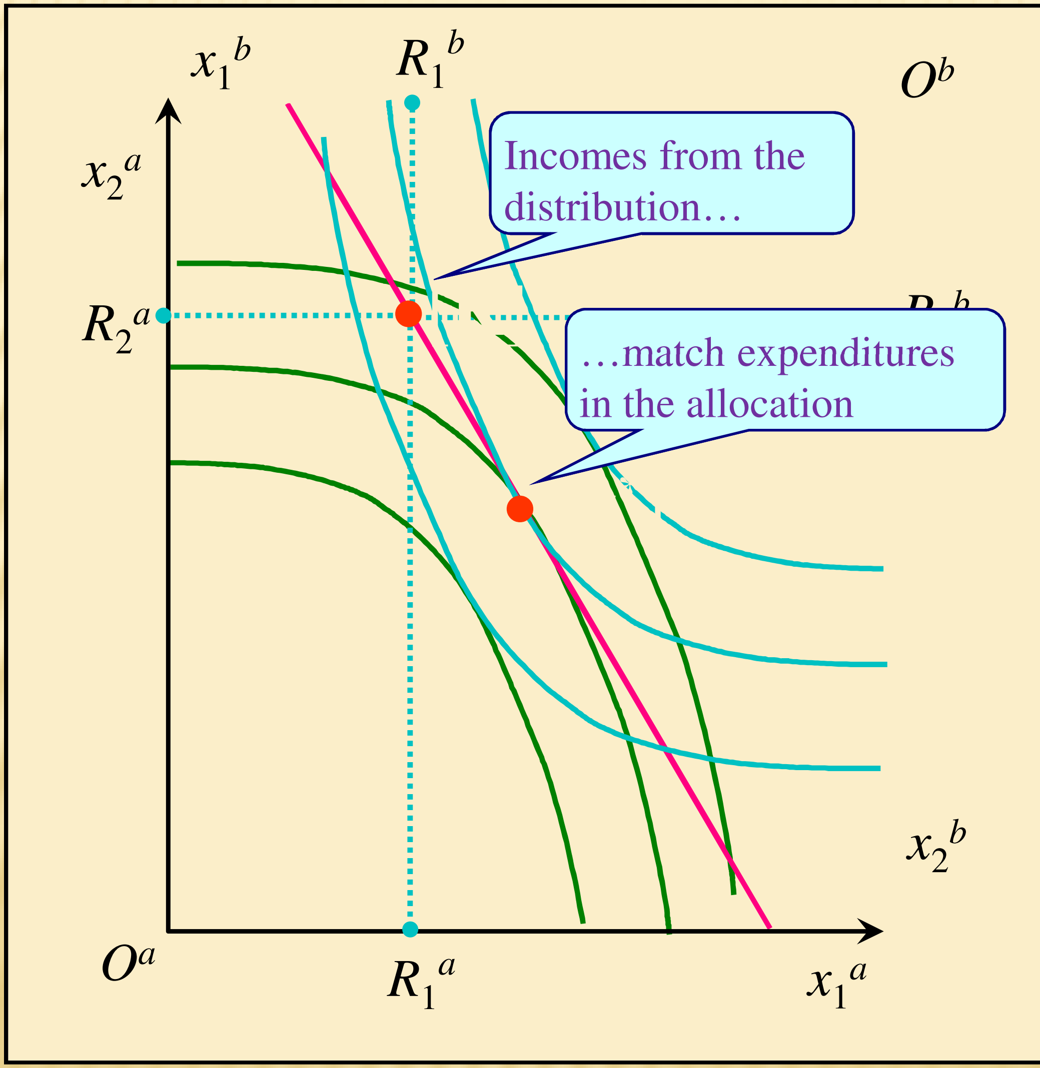
- *Resource endowment*
- *Prices and budget constraint*
- *Preferences*
- *Equilibrium*

- *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*.