UNIVERSITY OF CAMBRIDGE

bridge PROJETO

Future Technology Transformation in Agriculture

FTT:AGRI

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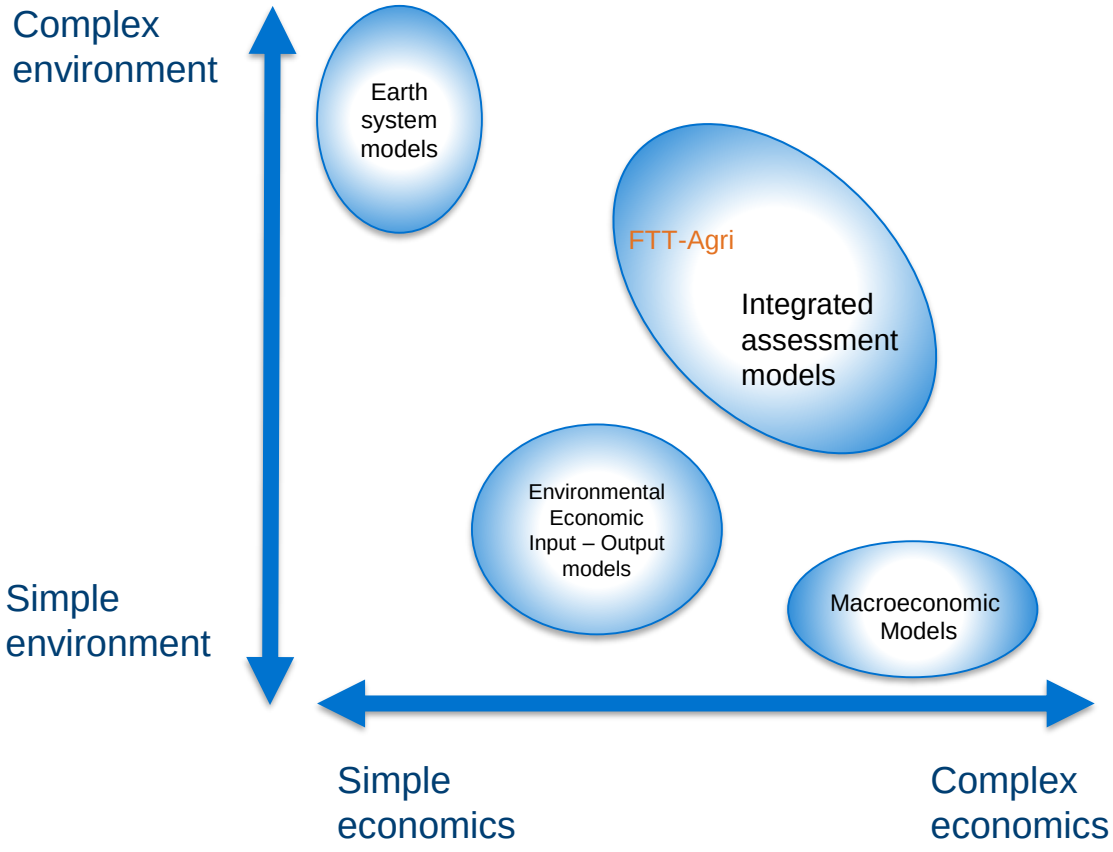
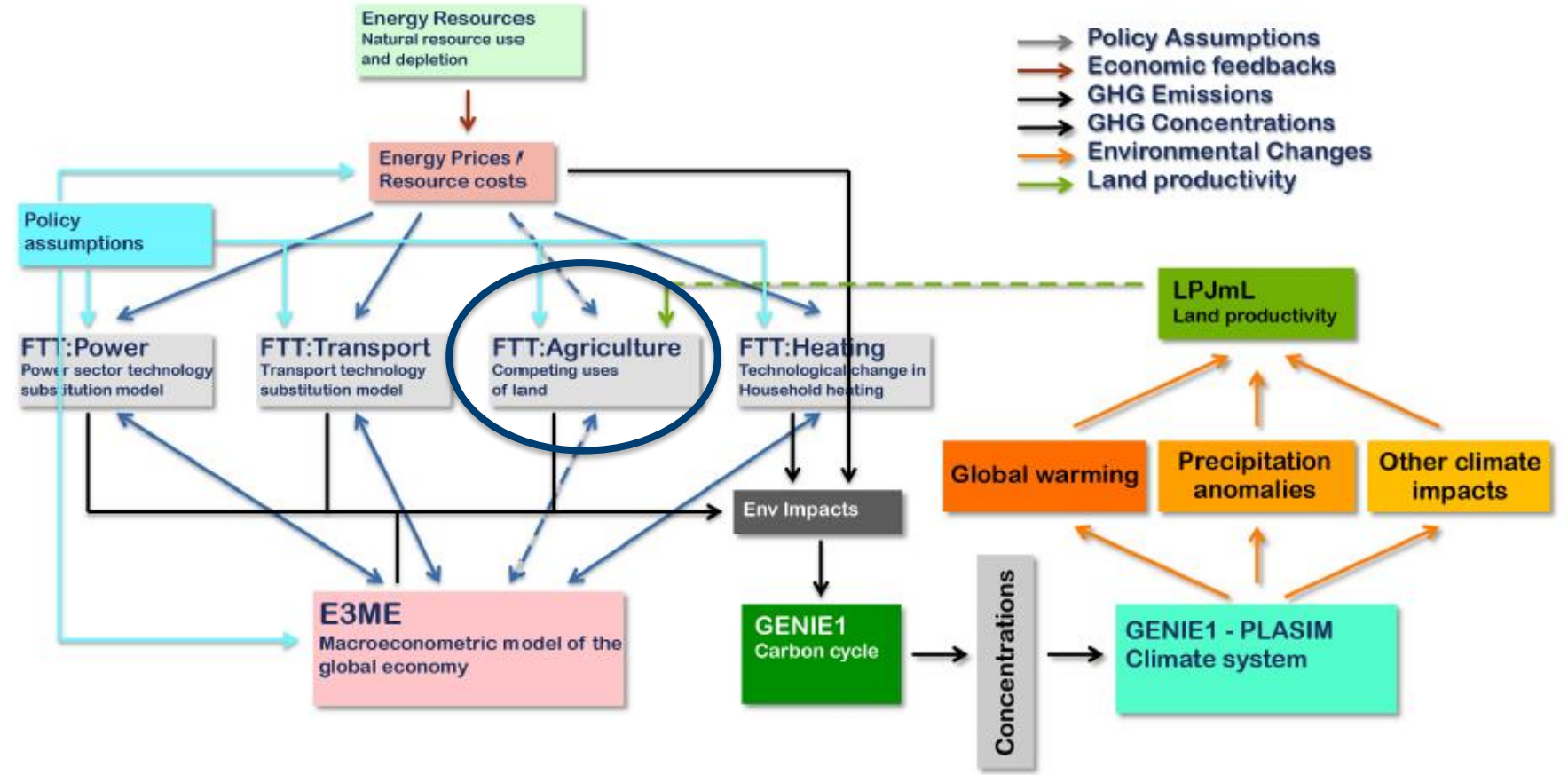
Outline

- Environment-Economic models
- FTT:Agri Model description and applications
- Land use and Land use change modelling with FTT: Agri

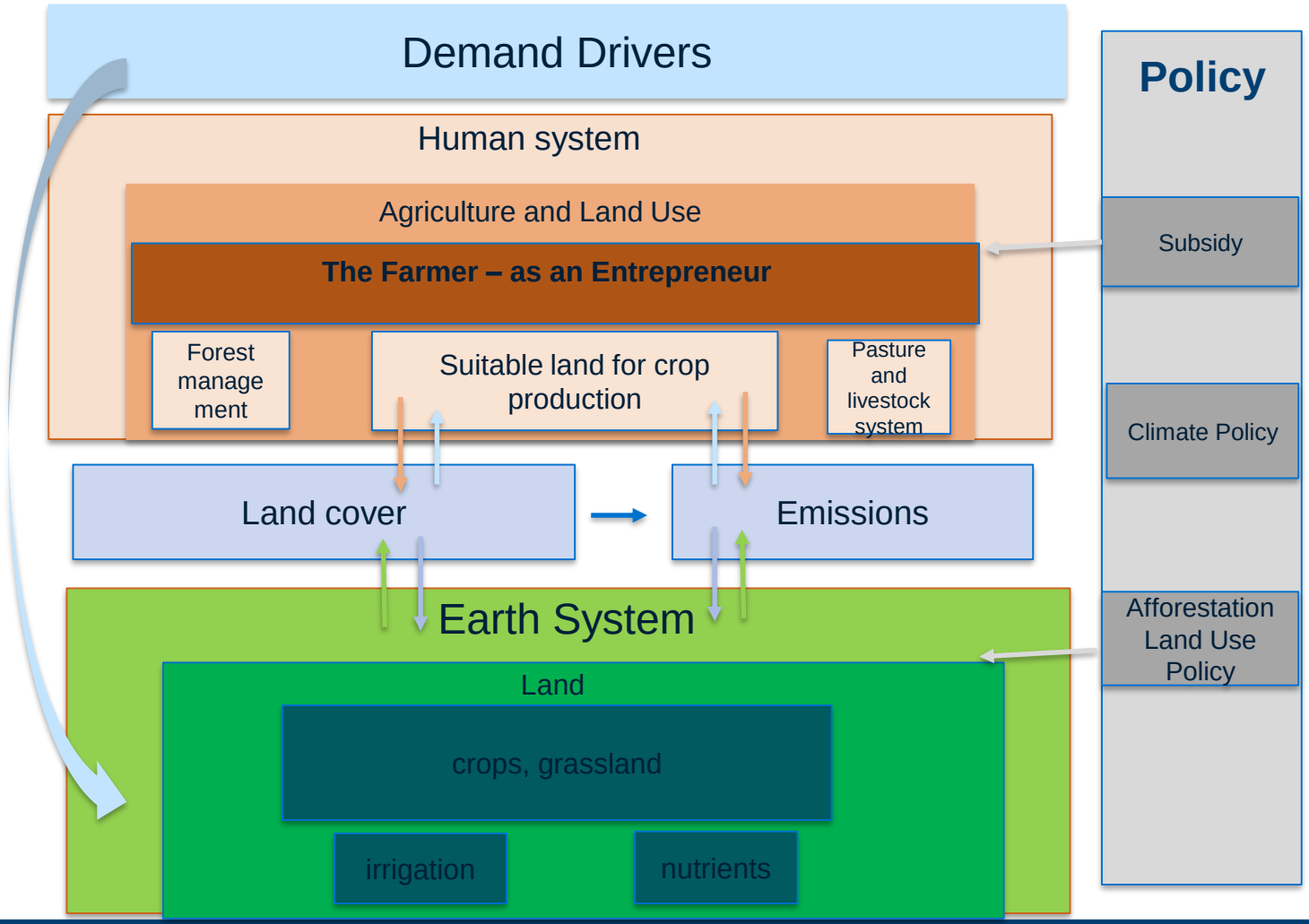
Different types of global models



The E3ME-FTT-GENIE Integrated Assessment Model
FTT:Agri



Human – Earth System interaction



FTT:Agri
Basic classes / structure



Land types	Land use types	Final commodities
		Cereals
		Rice
Agriculture	Cropland rainfed	Potatoes
	Cropland irrigated	Other roots
		Maize
Grasslands	Pasture	Soy
		Sunflower
		Rapeseed
		Other oil crops
		Sugar crops
		poultry
		pork
		beef
		other meats/animal products
Natural Forests		
	Managed Forests	fish
		fruit
		vegetables
		other

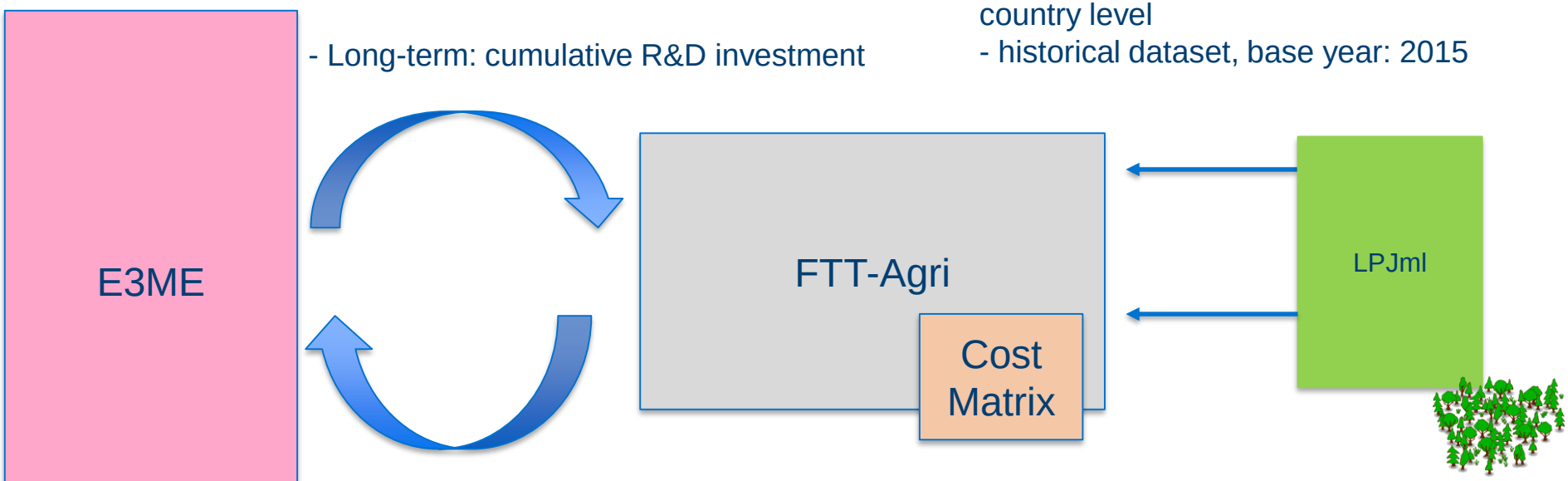
Crops			
		Explanation	made up of:
1	Temperate cereals		Wheat Rye Barley
2	Rice	is always irrigated, but may have values for rainfed	
3	Maize		
4	Tropical cereals		Millett Sorghum
5	Pulses		field peas
6	Temperate roots		Sugar Beet
7	Tropical roots		Cassava
8	Sunflower		
9	Soybean		
10	Groundnut		
11	Rapeseed		
12	Sugarcane		
13	Others		citrus, vine coffee
14	Pastures	modelled as crops	
15	grass		bioenergy crops type 1
16	trees		bioenergy crops type 2

E3ME – FTT:Agri – LPJml interaction

- Annual Demand for 19 Food Commodities
- Supply (tonnes) for base year (2005,FAO)

- Long-term: cumulative R&D investment

- Potential land area suitable for crop type level: grid cell, means, stdev. taken as country level
- historical dataset, base year: 2015



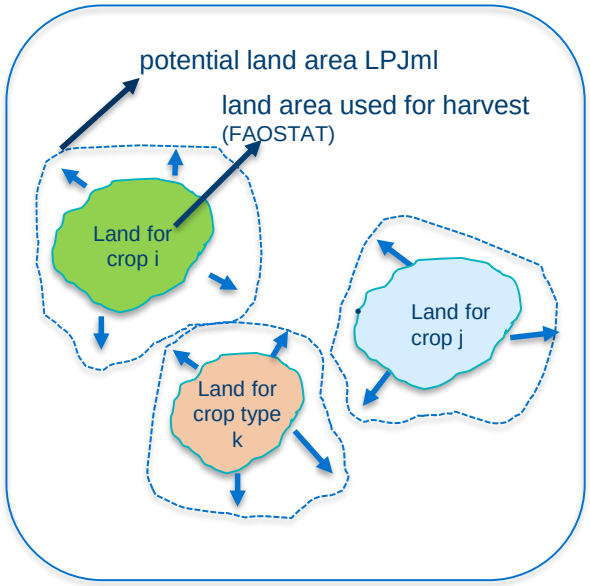
- Potential supply for subsequent years
- Emissions (tons CO2eq) as result of land use changes
- Commodity prices
- Demand for other inputs

- Theoretical biophysical productivity Simulations from 2000 – 2100 under two climate change scenarios level: grid cell: means, stdev taken at country level

FTT:Agri Basic concept

Land Supply - short term demand change

Short-term demand changes for commodities...



..met by use of spare/rest land to produce commodities

Potential supply is higher than actual supply

Land use (capacity) factor:

$LUF = G/G_p$

LUF remains constant

FTT:Agri Basic Concept

Land supply - long-term demand change

country level

commodity supply to meet demand at time t

suitable area for crop $_j$

crop k

Management factor, Technology by country

mean productivity, j

mean productivity, k

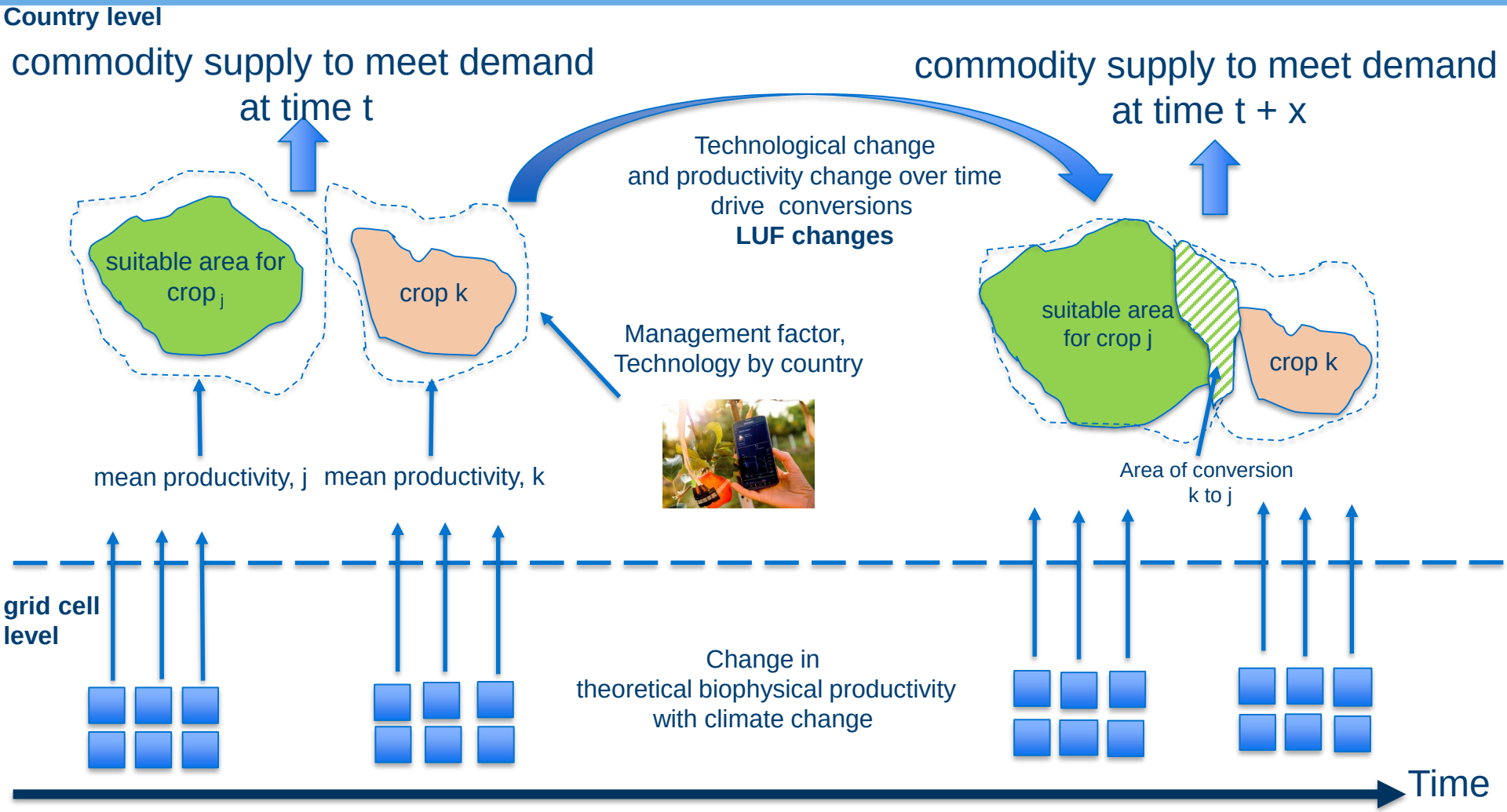
grid cell level

theoretical biophysical productivity at grid cell level

Time

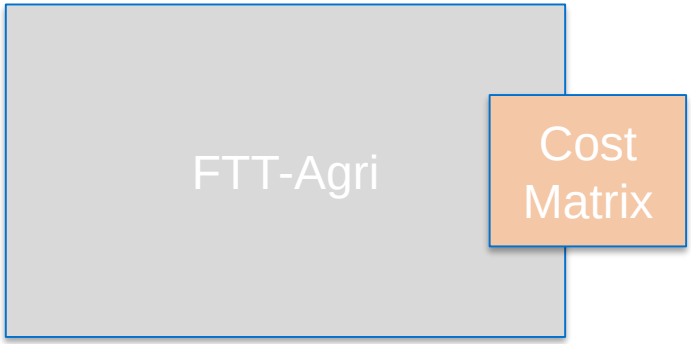
FTT:Agri Basic Concept

Land supply - long-term demand change



Costs of Production

Farmers Business Plan
(at country level)

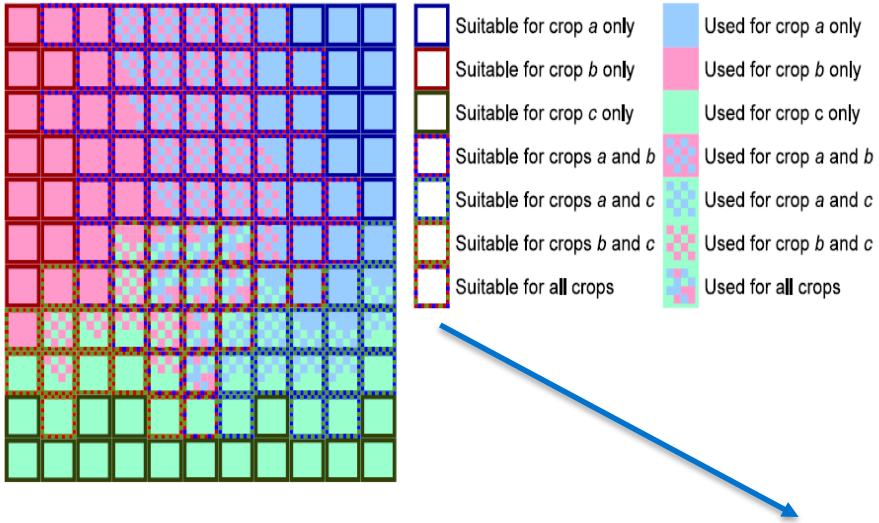


-fixed costs
-variable costs
-land rental
-discount rates
-project lifetimes

Levelised costs Agriculture

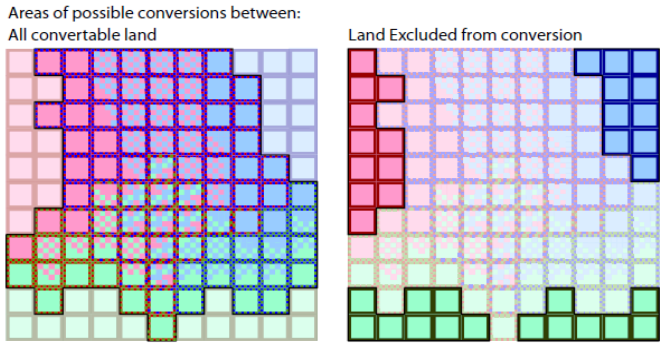
Model of decision making by groups of farmers

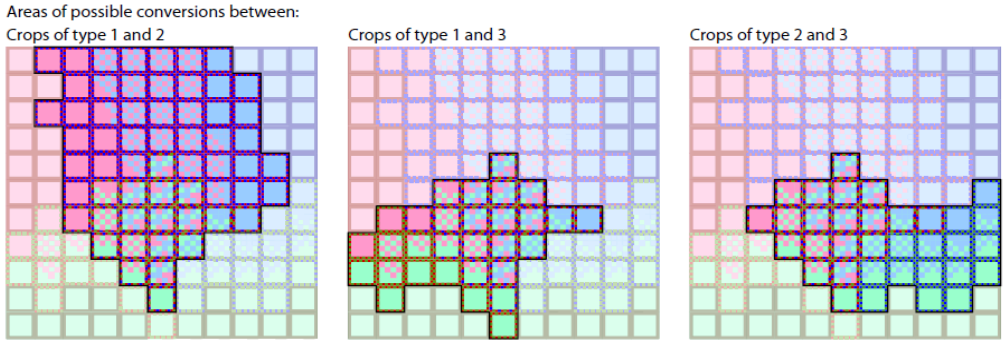
Cropland conversion Example



Conversions take place over a longer time horizon

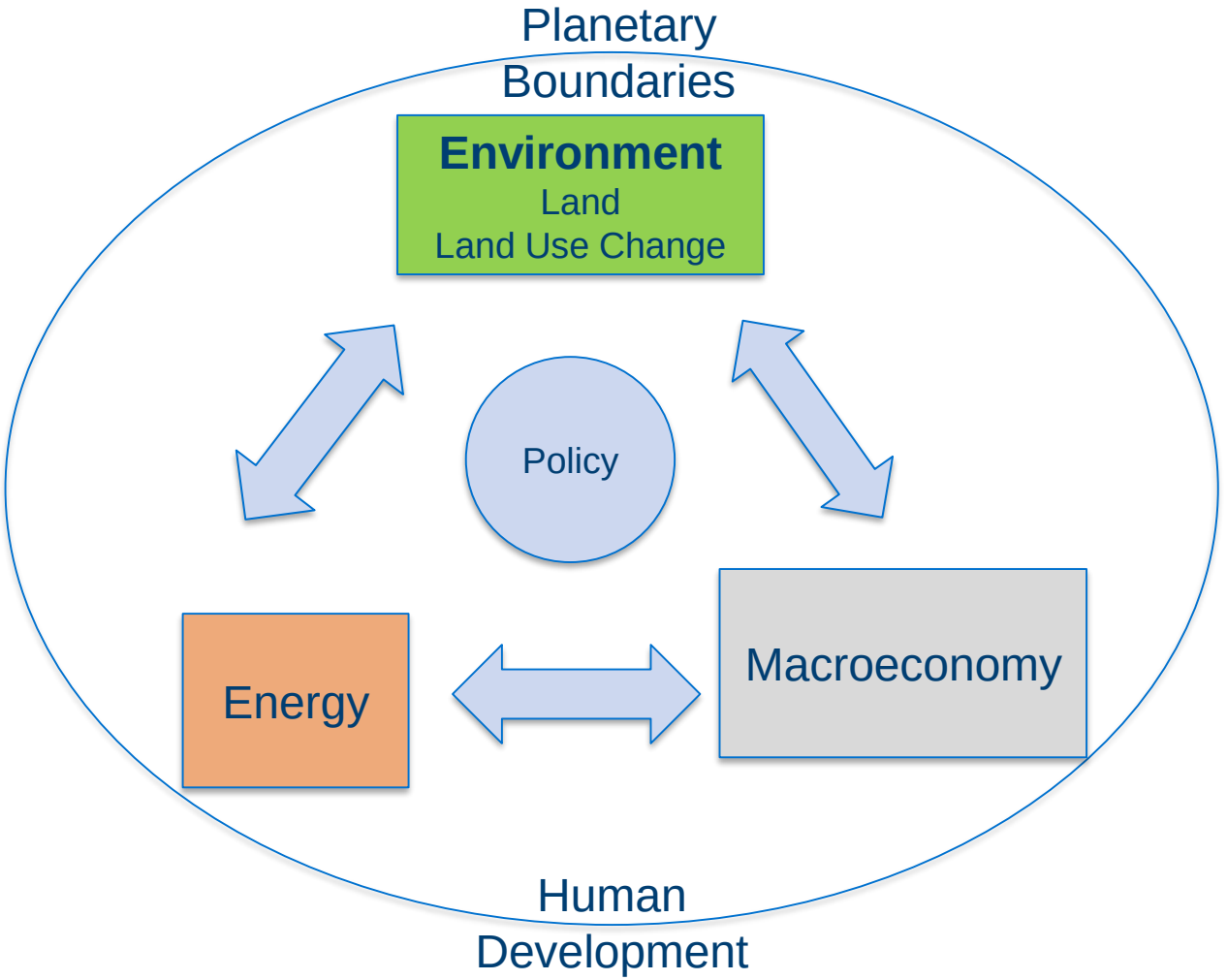
driven by:
- changes in productivity (climate)
- Investments (technology, management factor)





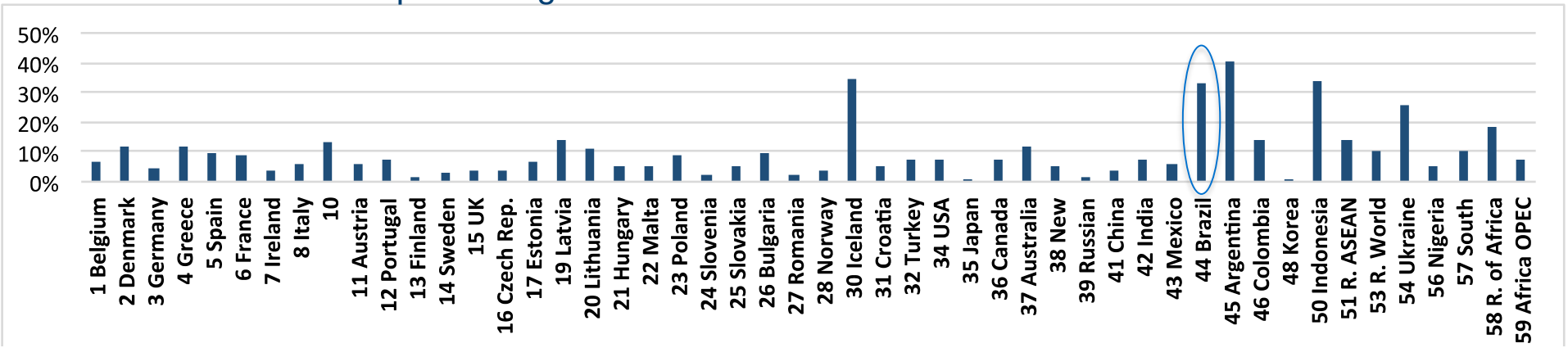
Thank You!

Global Energy-Economy-Environment system

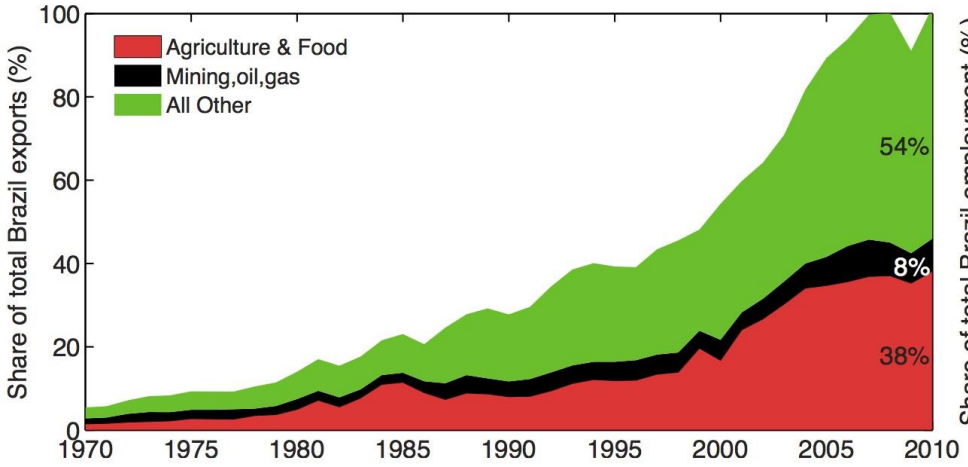


Example:Agriculture and food in the Brazilian economy

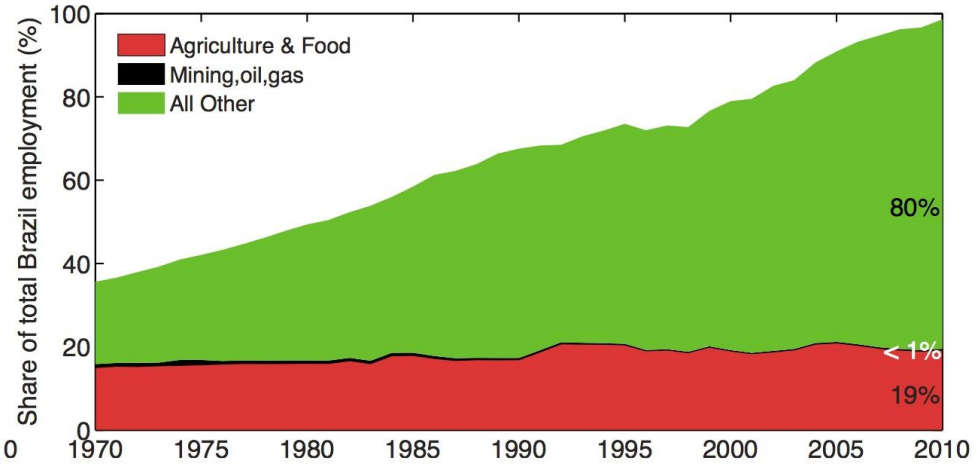
Shares of national export for agriculture and food



Agriculture-food exports for Brazil



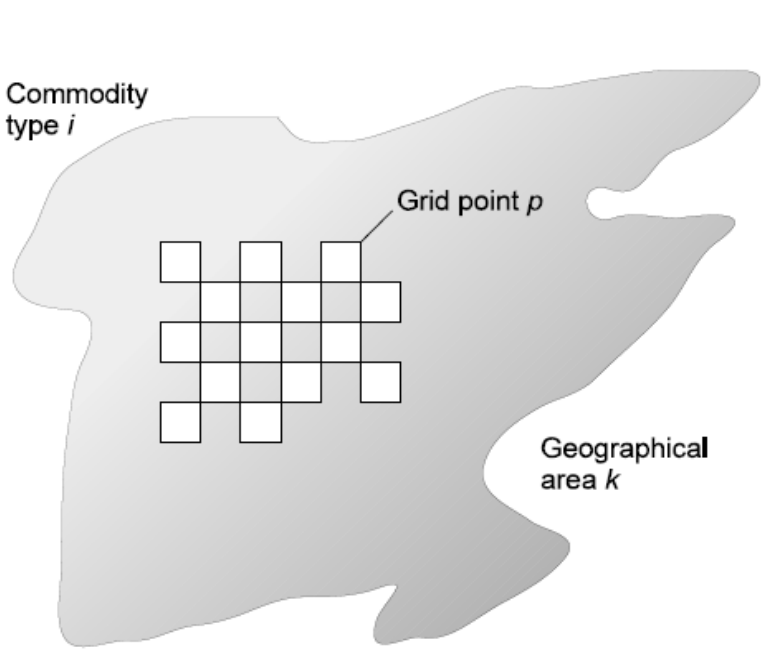
Agriculture-food employment for Brazil

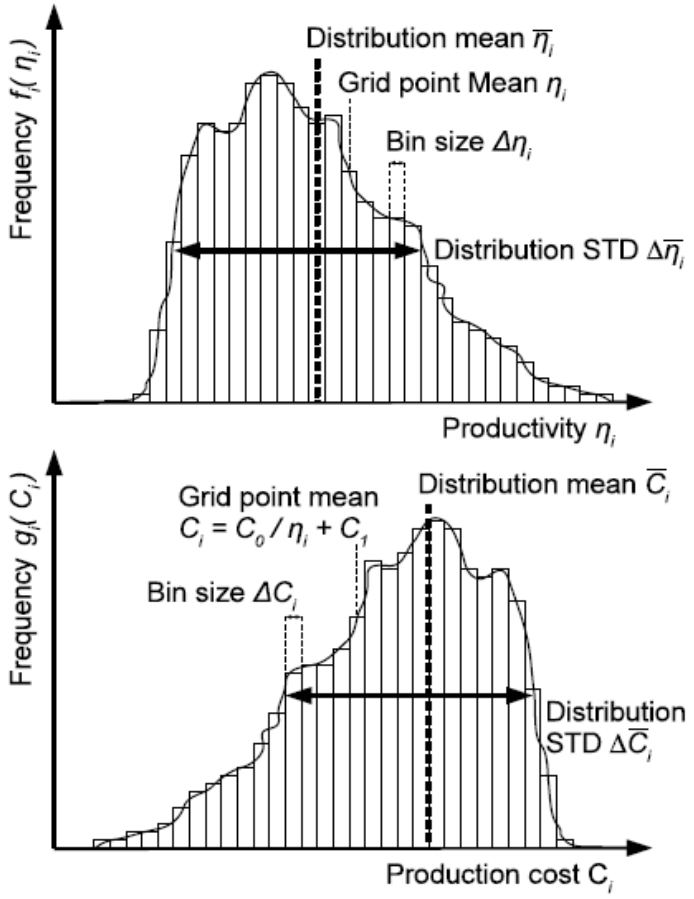


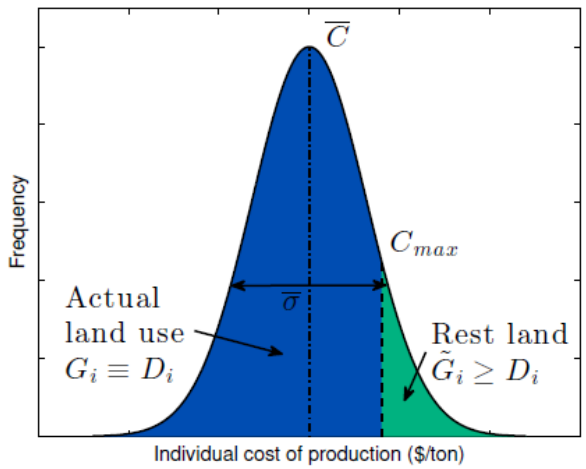
Source: Eurostat, OECD, national statistics, Asian Development Bank, UN prodcom

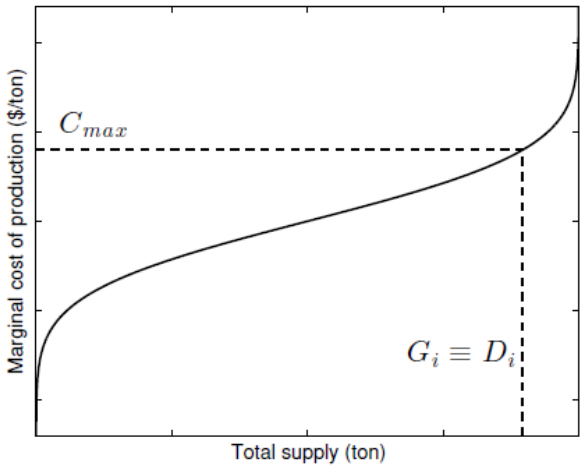
Additional slides

Aggregating productivity to distributions






$\overline{C}$
C_{max}
$\overline{\sigma}$
Actual
land use
$G_i \equiv D_i$
Rest land
$\tilde{G}_i \geq D_i$
Frequency
Individual cost of production ($/ton)


C_{max}
$G_i \equiv D_i$
Marginal cost of production ($/ton)
Total supply (ton)