The impact of improved agricultural technology on tropical deforestation

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Content

- Some facts:
  - ca. 20% of global anthropogenic carbon emissions are due to deforestation
  - ca. 17 million hectares of forestland is cleared per year.
  - The bulk of deforestation takes place in developing countries.

- There are numerous economic studies on the causes of deforestation.

- Impact of improved agricultural technology has been discussed controversially.

2. Technological progress

- Technological progress is an increase in total factor productivity, i.e.
  - farmers produce more output with the same amount of input, or
  - farmers produce the same output with fewer inputs.

- The impact of new technologies is often described in terms of how intensively they use various inputs (e.g. labor-intensive, capital-saving, etc.)

3. Micro-level analysis – The perfect market case (1)

- Farmers are integrated into perfect markets ➔ von Thünen approach

- Assumptions:
  - There is a farm household that produces a single agricultural commodity
  - Land is abundant (i.e. its price equals zero)
  - Agricultural expansion takes place in “empty” forest
  - Farmers incur transport costs by moving inputs and outputs between village and field

- **Land rent:**

$$r = py - wl - qk - vd$$

p: output price

y: agricultural yield

w: wage rate

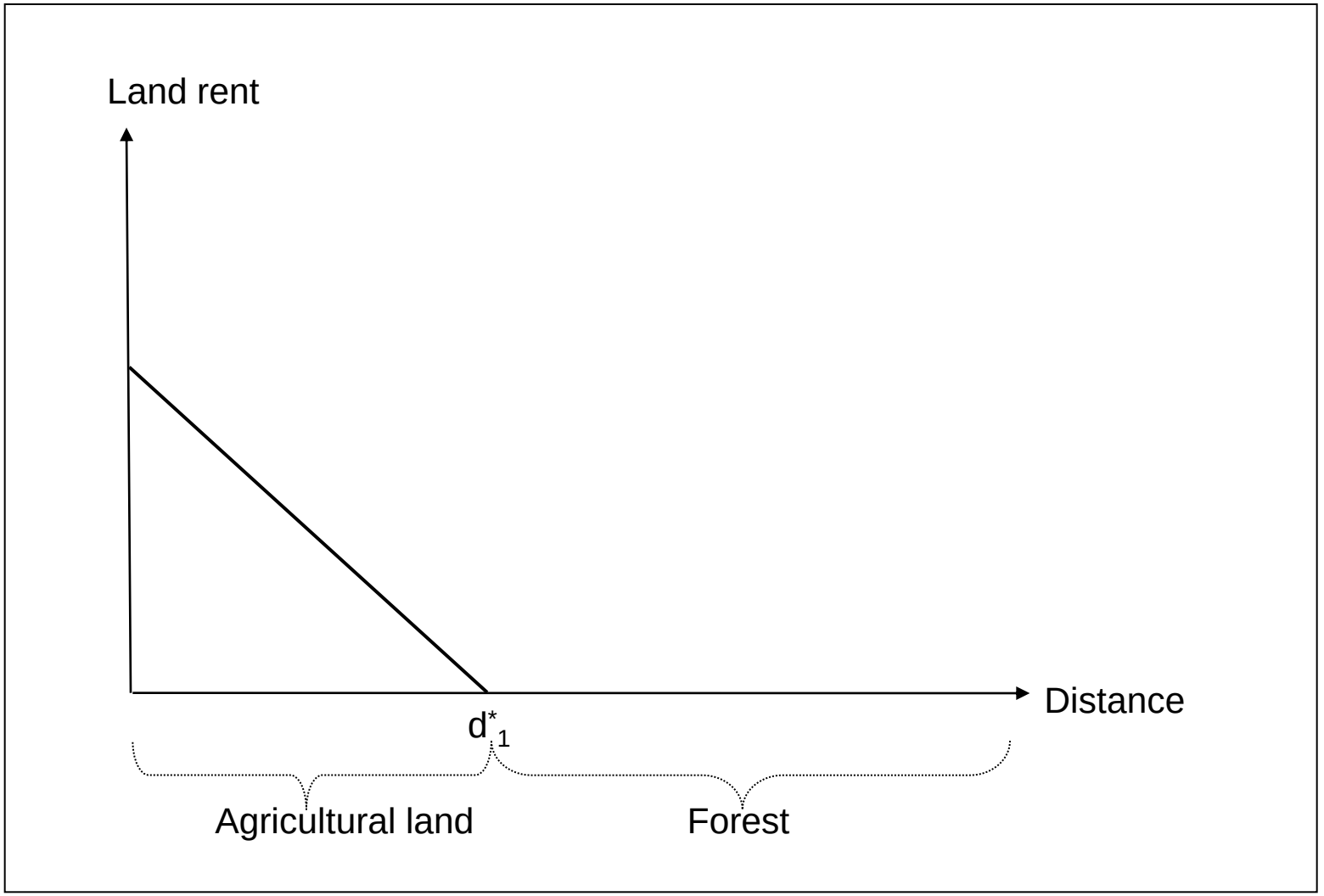
q: price of capital

l, k: labor and capital requirements per hectare

v: transport costs per km

d: distance in km

3. Micro-level analysis – The perfect market case (3)



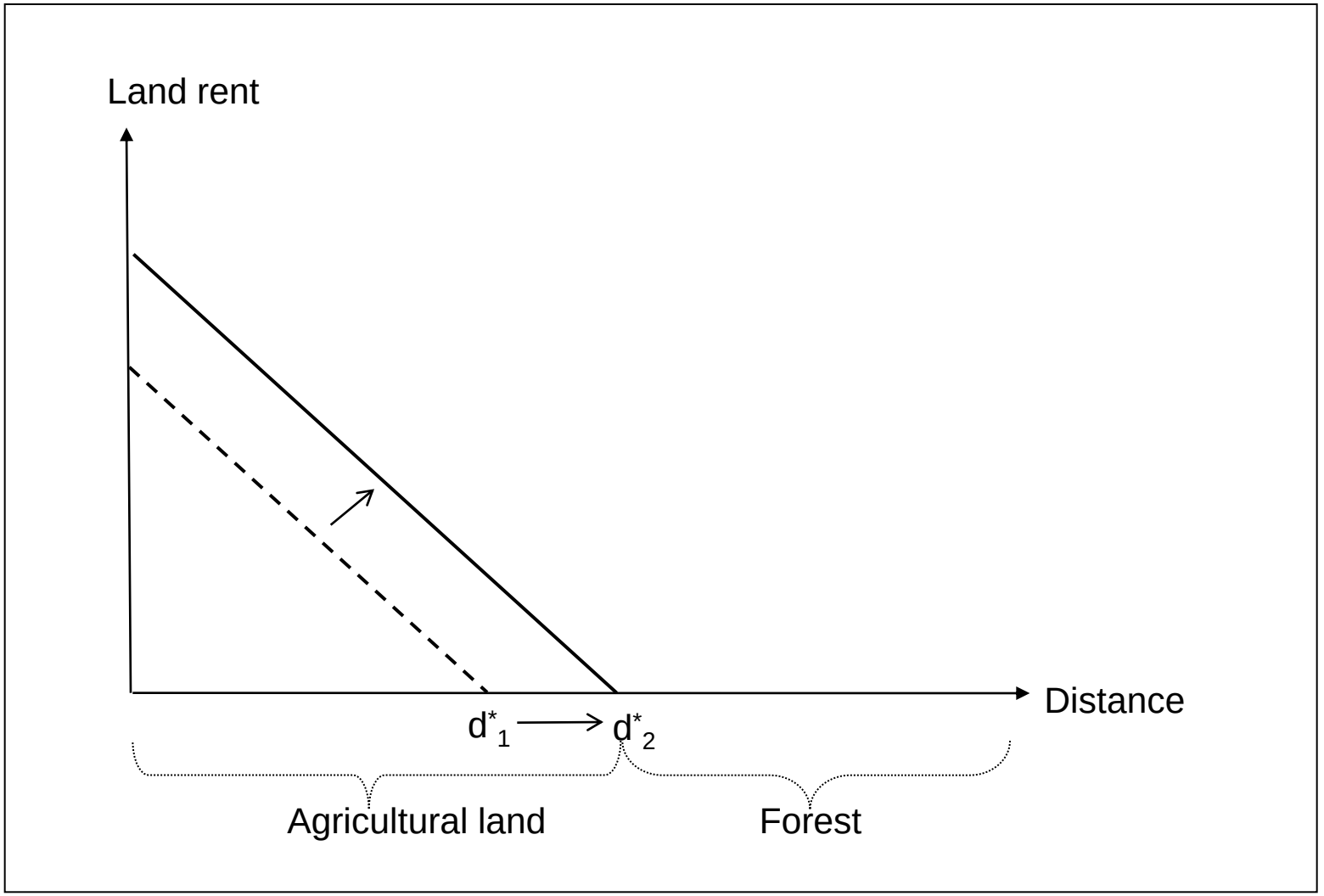
- **Agricultural frontier:**

$$d^* = (py - wl - qk) / v$$

- **The impact of technological progress:**

$$y\uparrow \rightarrow d^*\uparrow \triangleq \text{forest area}\downarrow$$

3. Micro-level analysis – The perfect market case (5)



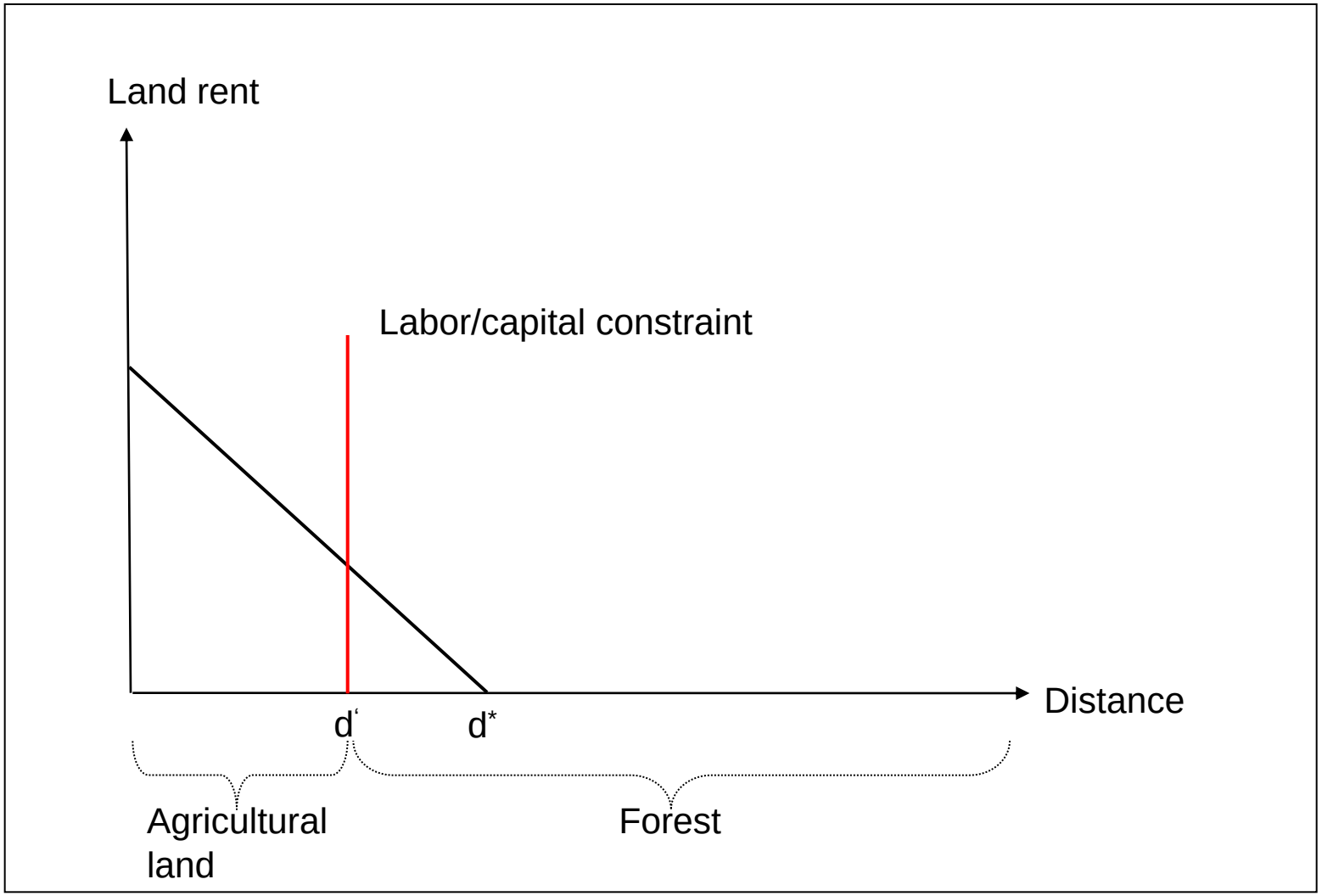
- **Limited access to labor:**

$$L^D \leq L^S$$

- **Limited access to capital:**

$$K^D \leq K^S$$

3. Micro-level analysis – The imperfect market case (2)



- **The impact of technological progress:**
  - Changes that allow farmers to use *less* of the scarce factor

    ➔ forest area↓

  - Changes that use *more* of the scarce factor

    ➔ forest area↓

- Assumptions:
  - Farmers seek a predefined level of material well-being.
  - They have little interest in going beyond that level.
  - Once the level is reached, the household will turn to leisure.

- **The impact of technological progress:**

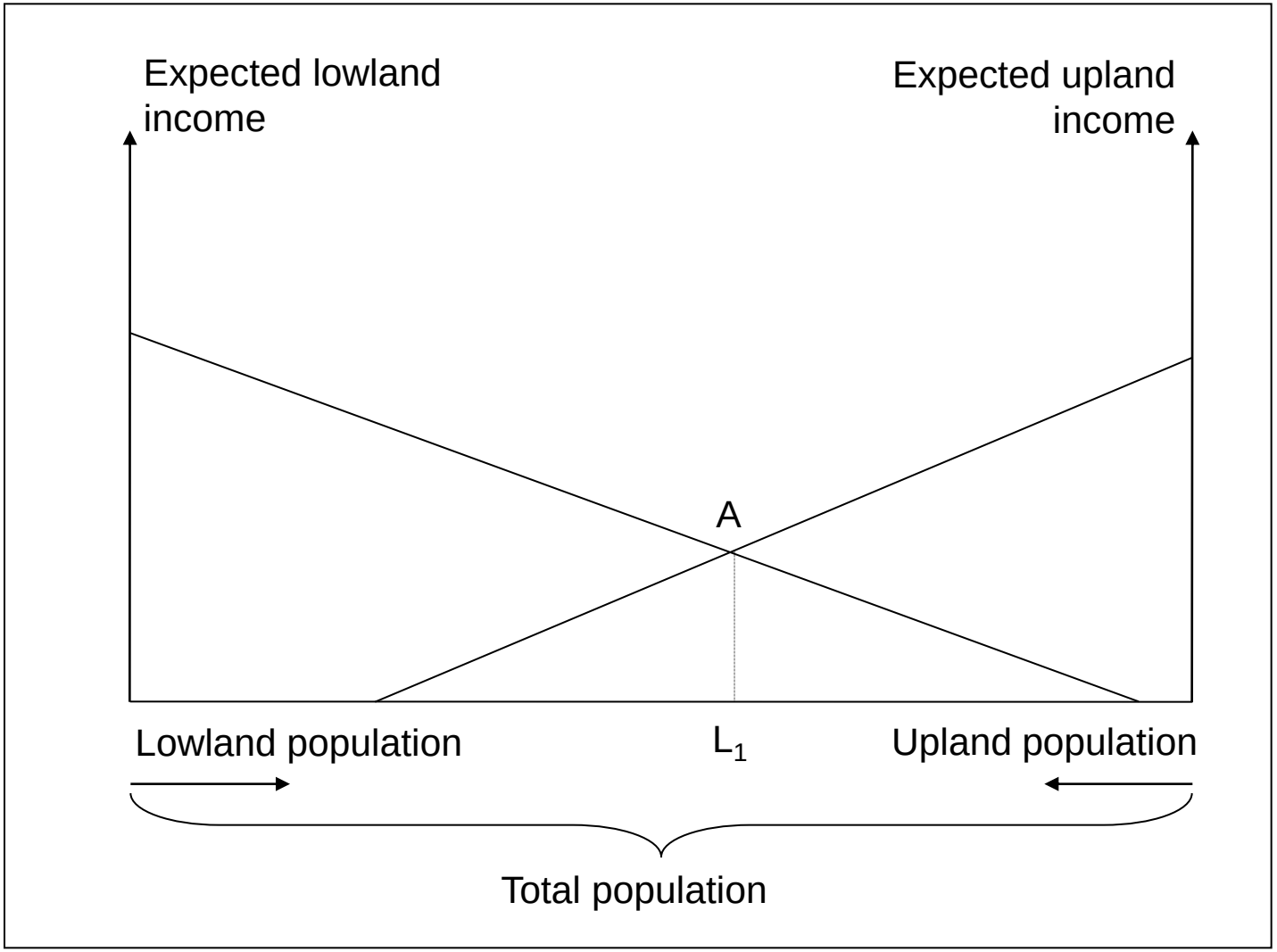
  Any yield-increasing technological progress will unambiguously benefit forest conservation, because the household will be able to achieve the same income using less inputs.

- Technological progress is unlikely to involve only one household.
- If a large number of farmers adopt the new technologies, this will have economic repercussions.
- These macroeconomic effects can either diminish or enlarge the microeconomic effects just discussed.
- Two types of effects:
  - Migration
  - Changes in prices

4. Macro-level analysis – Migration (1)

- Simplified version of the Harris-Todaro migration model

- Assumptions:
  - There are two regions, uplands and lowlands
  - The expected per capita income in each region declines as the number of people rises.
  - People will migrate until each region has the same level of per capita income.


Expected lowland income
Expected upland income
A
Lowland population
L_1
Upland population
Total population

- **The impact of technological progress:**

  - Technological progress only in the lowlands:

    ➔ Higher expected lowland income ➔ migration to the lowlands

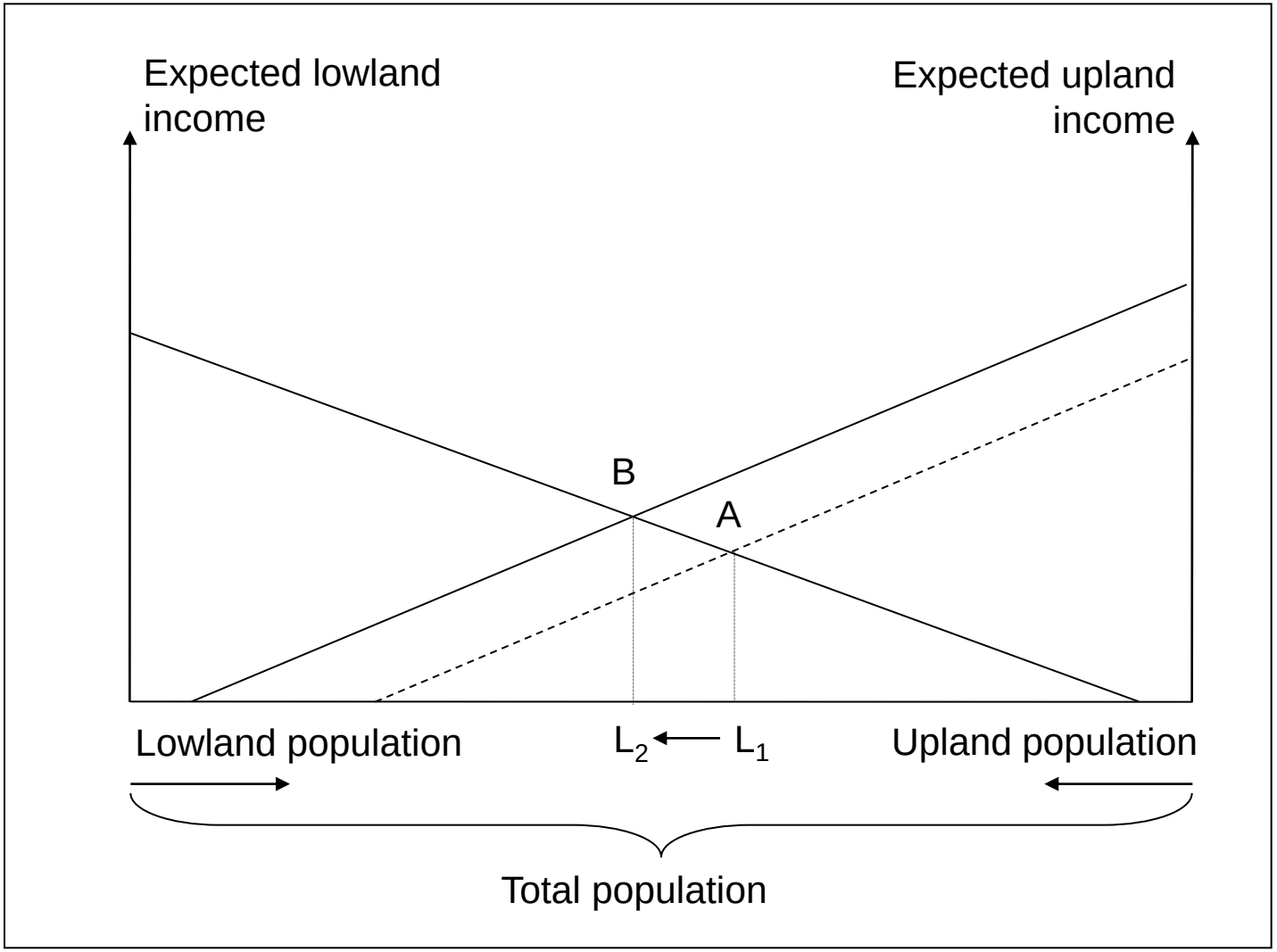
    ➔ no decrease in forest area

  - Technological progress only in the uplands:

    ➔Higher expected upland income ➔ migration to the uplands

    ➔ decrease in forest area

4. Macro-level analysis – Migration (4)



- **The impact of technological progress:**
  - Products sold mostly in *domestic* markets:

    Productivity increase ➔ rise in aggregate supply ➔ price declines ➔ revenues go down ➔ no decrease in forest area

  - Products sold mostly in *international* markets:

    Productivity increase ➔ rise in aggregate supply ➔ price fixed ➔ revenues go up ➔ decrease in forest area

5. Conclusion

- The impact of technological progress in agriculture on deforestation depends (among others) on the following:
  - the type of technological change
  - the presence of market imperfections
  - how much people migrate in response to regional income differentials

Contact

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