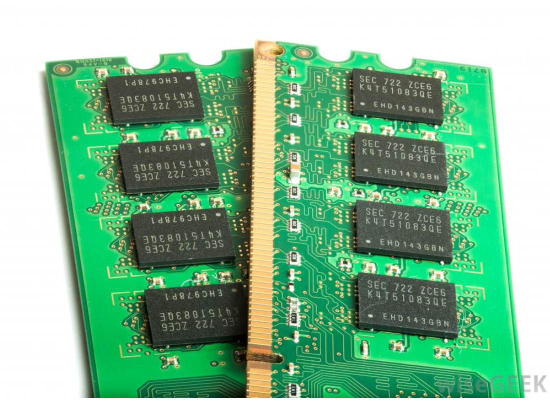
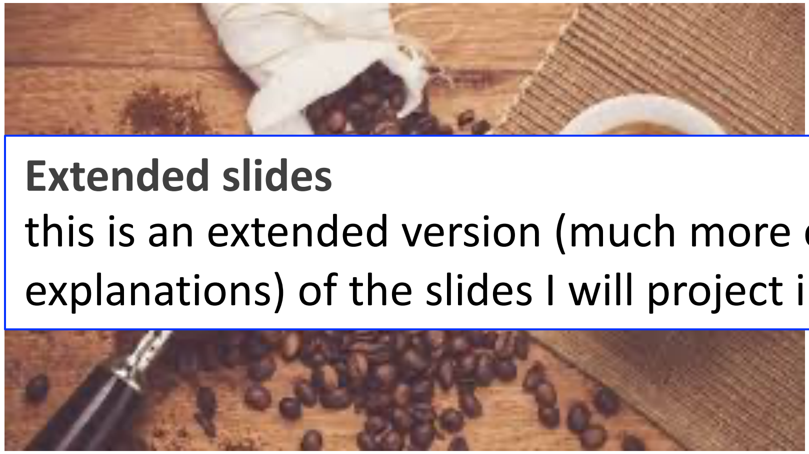
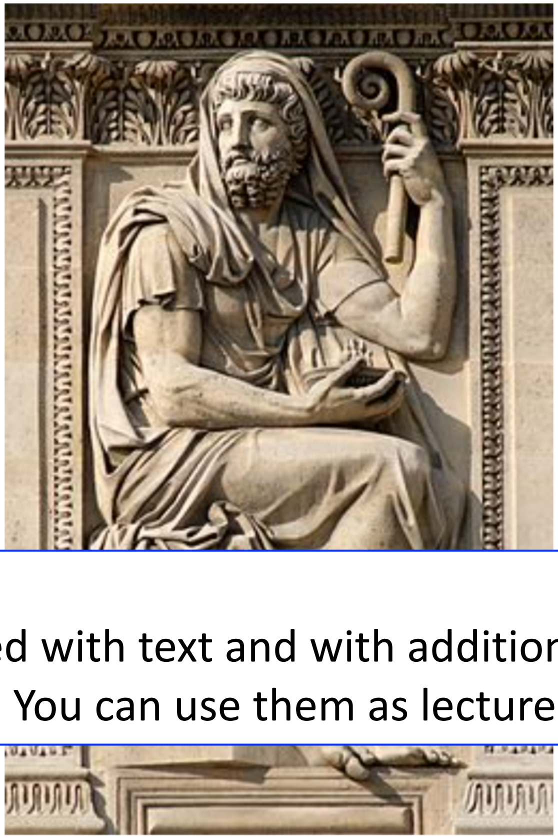
4 – Property & Exchange







Extended slides
this is an extended version (much more crowded with text and with additional explanations) of the slides I will project in class. You can use them as lecture notes.

4 – Property & Exchange

- How does trade generate economic gains?
- When trade generates economic gains, what determines the distributions of these gains among participants?
- Do social preferences influence trade among people?
- How does power influence voluntary exchange of goods?

Study Materials for this Section:

- Chapter 4 of the textbook
  "Property, Power & Exchange: Mutual Gains and Conflicts"

4 – Property & Exchange

Main takeaways:

- Exchange can create an economic surplus, that can be distributed in different ways among participants.
- Alternative institutions & norms that regulate the exchange result in different post-exchange allocations (different distributions of the economic surplus).
- Exchange creates mutual gains but also conflicts over the distribution of these gains.

4 – Property & Exchange

The Roadmap through Section 4

1. Trade: mutual gains & conflict
2. Edgeworth Box
3. Social optimum: the Impartial spectator
4. Property and Power
5. Personal exchange & social preferences

1 – Mutual Gains from Trade

- Suppose I have a ticket for a rock concert and you have a ticket for a soccer game.
- I: U(soccer game)>U(rock concert);
You: U(rock concert)>U(soccer game).
- Then we could both be better off if we exchanged the tickets: potential mutual gains from trade.
- But should we just exchange them 1:1, or should one of the two give also some money?
- An exchange 1:1 may seem most natural, but perhaps this would produce a much bigger increase in utility for one of the two.
- How the gains from trade are distributed depends on the rules (the institutions) that govern the exchange.

Important definitions (1/2)

- Mutual Gains from Exchange:
  - Each of two individuals has something that the other values more highly than the current owner.
- Barter Exchange:
  - Goods are directly transferred between two parties, without the intermediation of money.
  - While the role of money is a fundamental one, some basic microeconomic principles can be explained more simply by assuming barter exchange between economic agents.

Important definitions (2/2)

- Endowment: the goods that each agent has initially.
- Post-exchange allocation (or bundle): what each agent has after the exchange.
- Voluntary exchange: an exchange that leads to a *Pareto improvement*: at least one agent is better off & none is worse off (so all parties would voluntarily accept the exchange).
- Economic surplus (or rent): the improvement enjoyed by one or both parties thanks to the exchange.
- Distributional outcome of exchange: how the economic surplus is distributed between players.

We want to explore how different rules (institutions) governing exchange produce different distributional outcomes

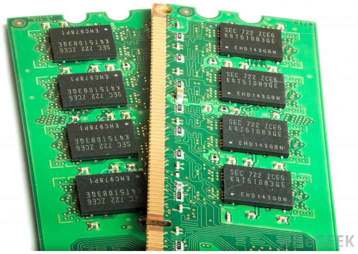
4 cases

1. Allocation imposed by a well-intentioned and well-informed impartial spectator (*social optimum*)
2. Take-it-or-leave-it power (*TIOLI power*)
3. Price setting power (*PSP*)
4. Exchange among friends (*social preferences*)

We will see that the outcome depends on who has what power and under which rules.

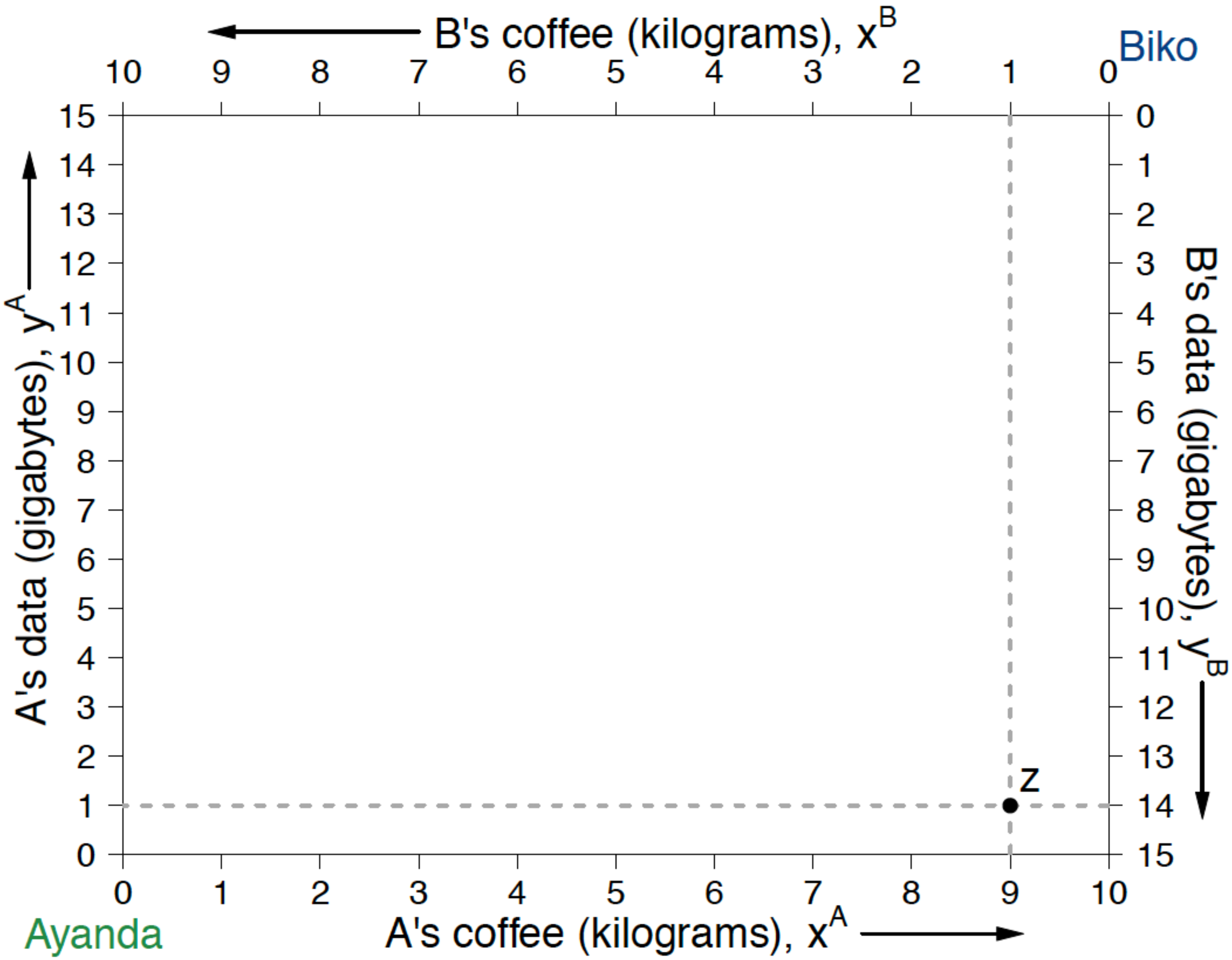
2 – Edgeworth box

- *2 agents*: Ayanda and Biko;
- *2 goods to be allocated*:
  - 10 kg. of coffee (x)
  - 15 gigabytes of data (y);



- x^A, y^A = quantities of the two goods that Ayanda gets;
- x^B, y^B = quantities that Biko gets;
- An allocation: (x^A, y^A , x^B, y^B)
- An allocation is *feasible* if $x^A + x^B \leq 10$ & $y^A + y^B \leq 15$
- 'No-goods-to-be-discarded' rule: all the available goods should be given to either Ayanda or Biko;
- an allocation satisfies the 'no-goods-to-be-discarded' rule if $x^A + x^B = 10$ & $y^A + y^B = 15$

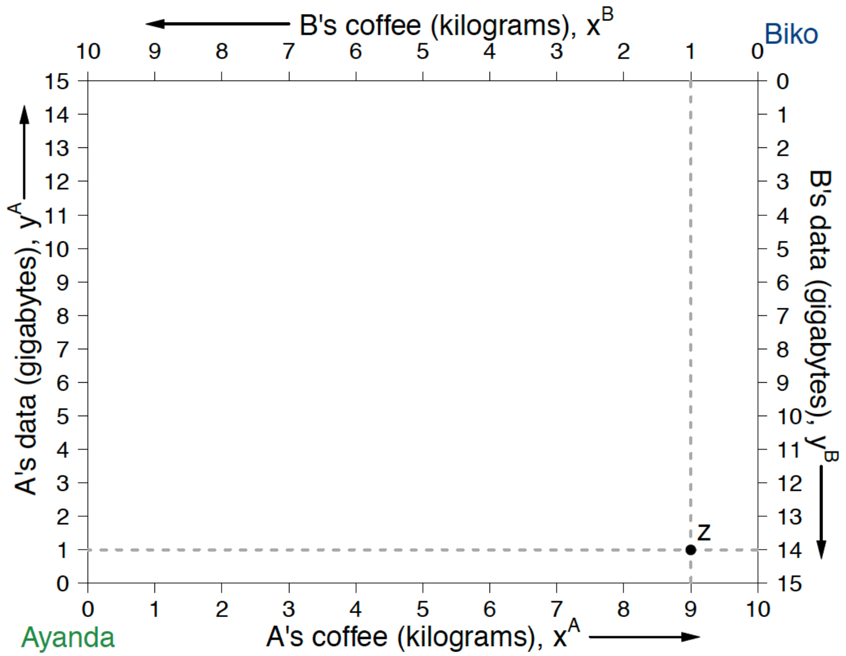
The Edgeworth Box (without indifference curves)



(a) An allocation, **z**

The Edgeworth Box (without indifference curves)

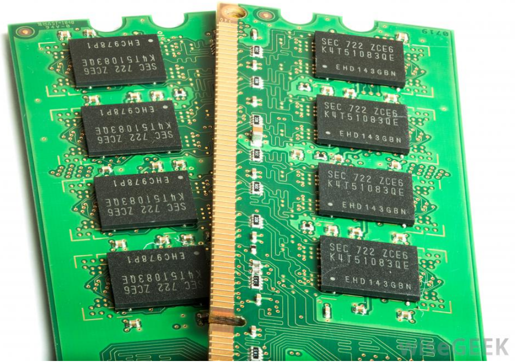
- The Edgeworth Box's width is the total available amount of good x (coffee);
- its height is the total available amount of good y (gigabytes);
- Each point in the Edgeworth box represents a feasible allocation;
- Only allocations that are feasible *and* satisfy the 'no-goods-to-be-discarded' rule are represented in the Edgeworth Box.



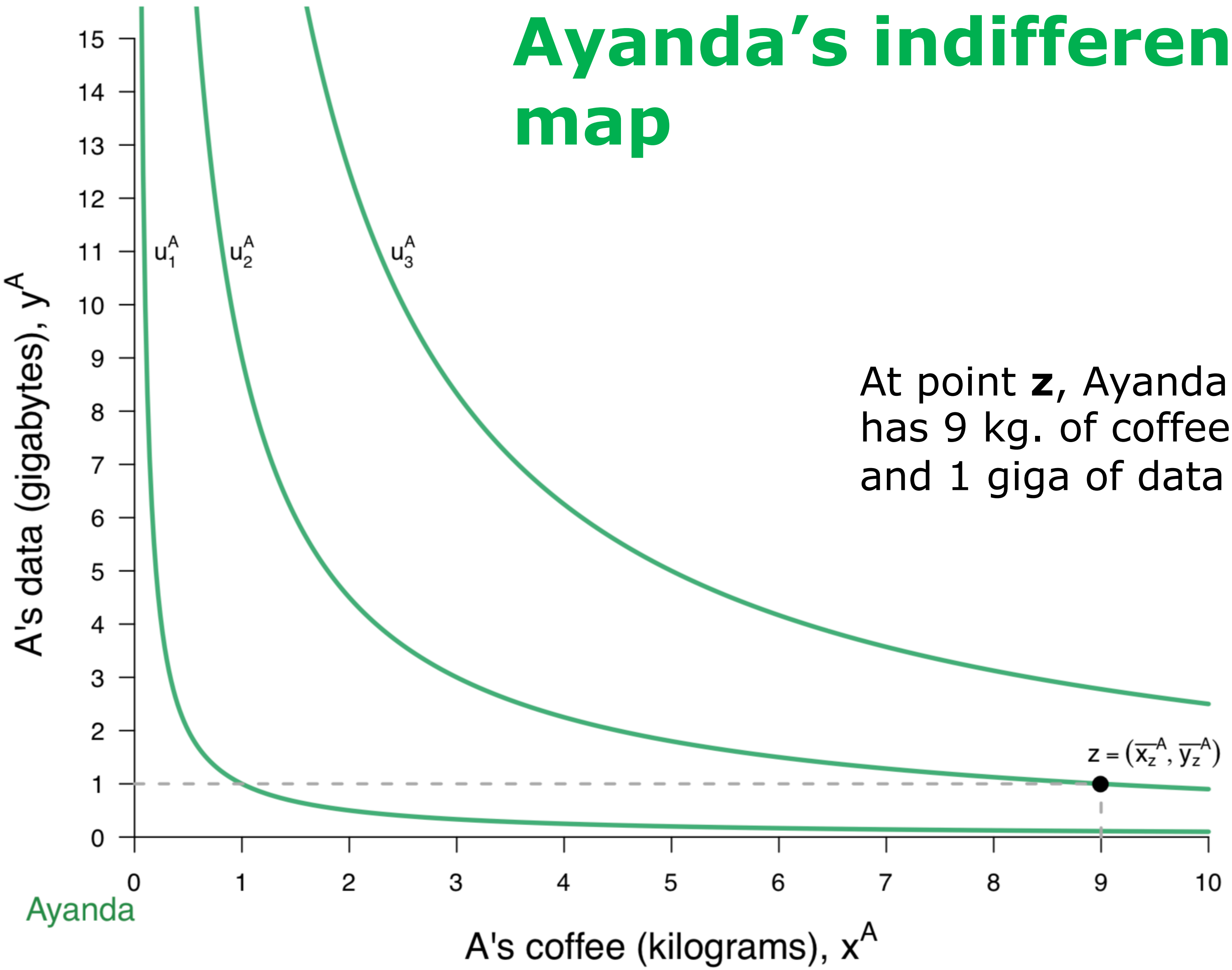
(a) An allocation, **z**

Now introduce preferences:

- **Ayanda's utility**: $u^A = u^A(x^A, y^A)$
- **Biko's utility**: $u^B = u^B(x^B, y^B)$
- For both agents, coffee and data provide positive but decreasing marginal utility: $u_x > 0$ and $u_{xx} < 0$;
- Their utility functions might be identical, or they might look different (provided they both feature $u_x > 0$ and $u_{xx} < 0$)

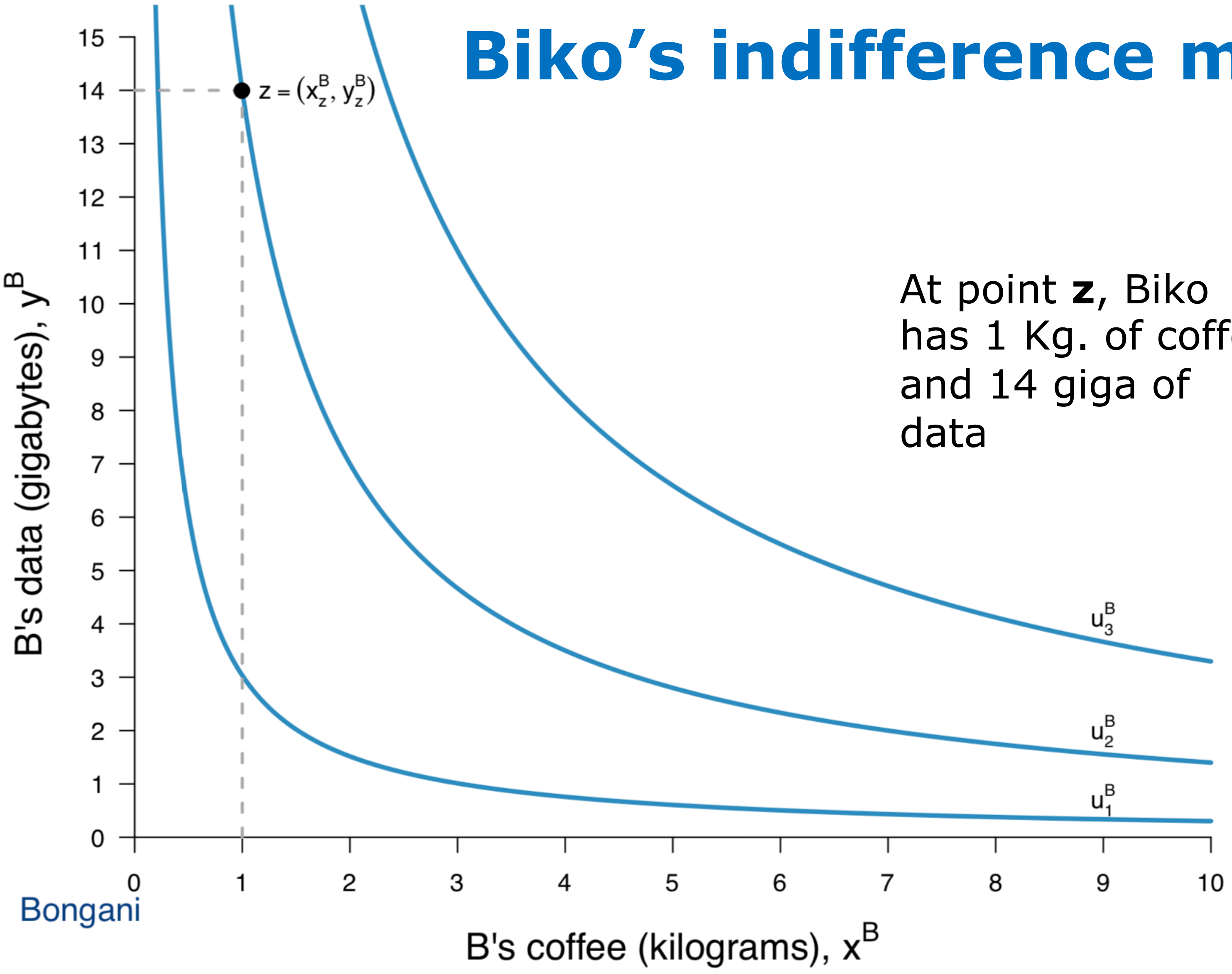


Ayanda's indifference map



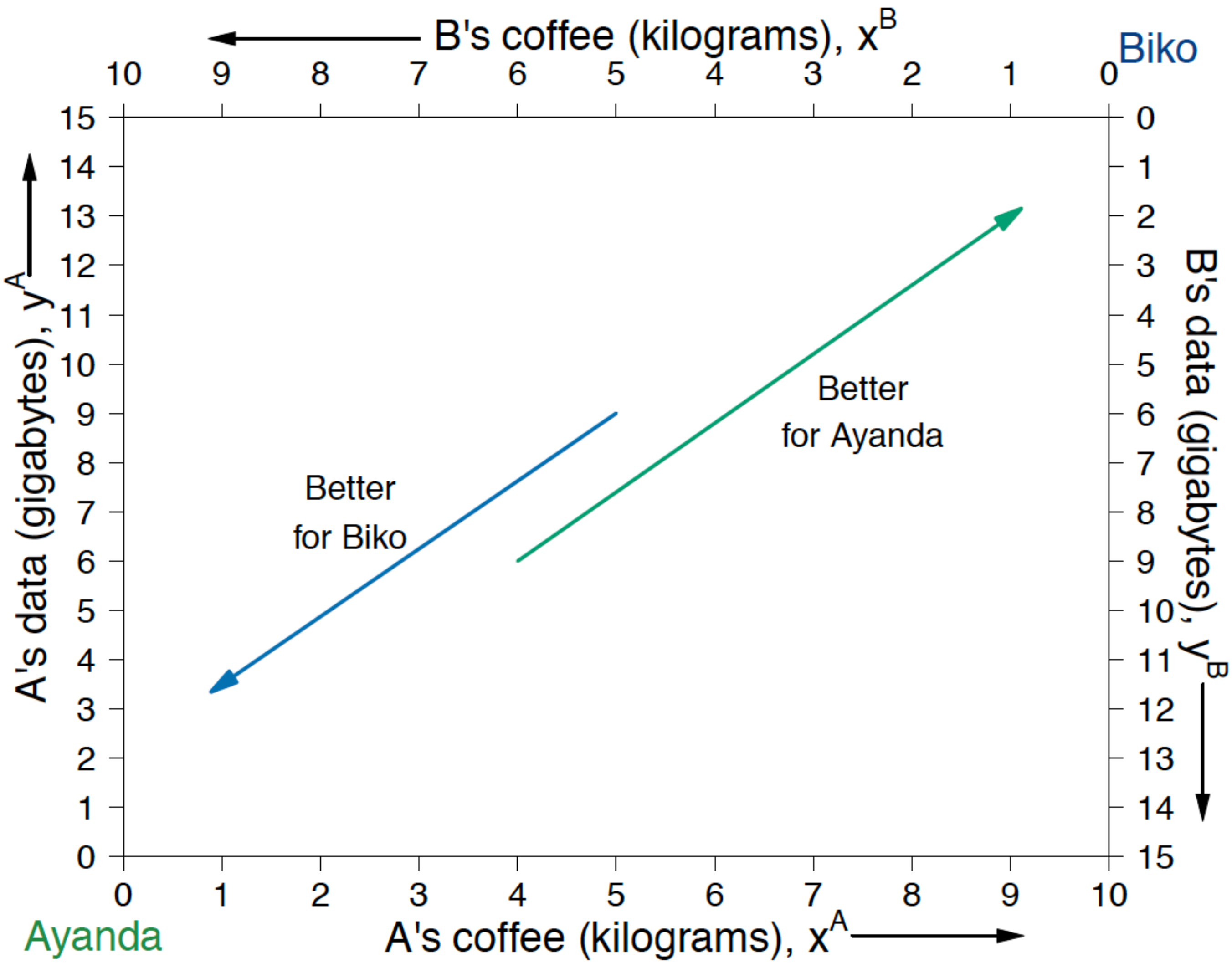
At point **z**, Ayanda has 9 kg. of coffee and 1 giga of data

Biko's indifference map



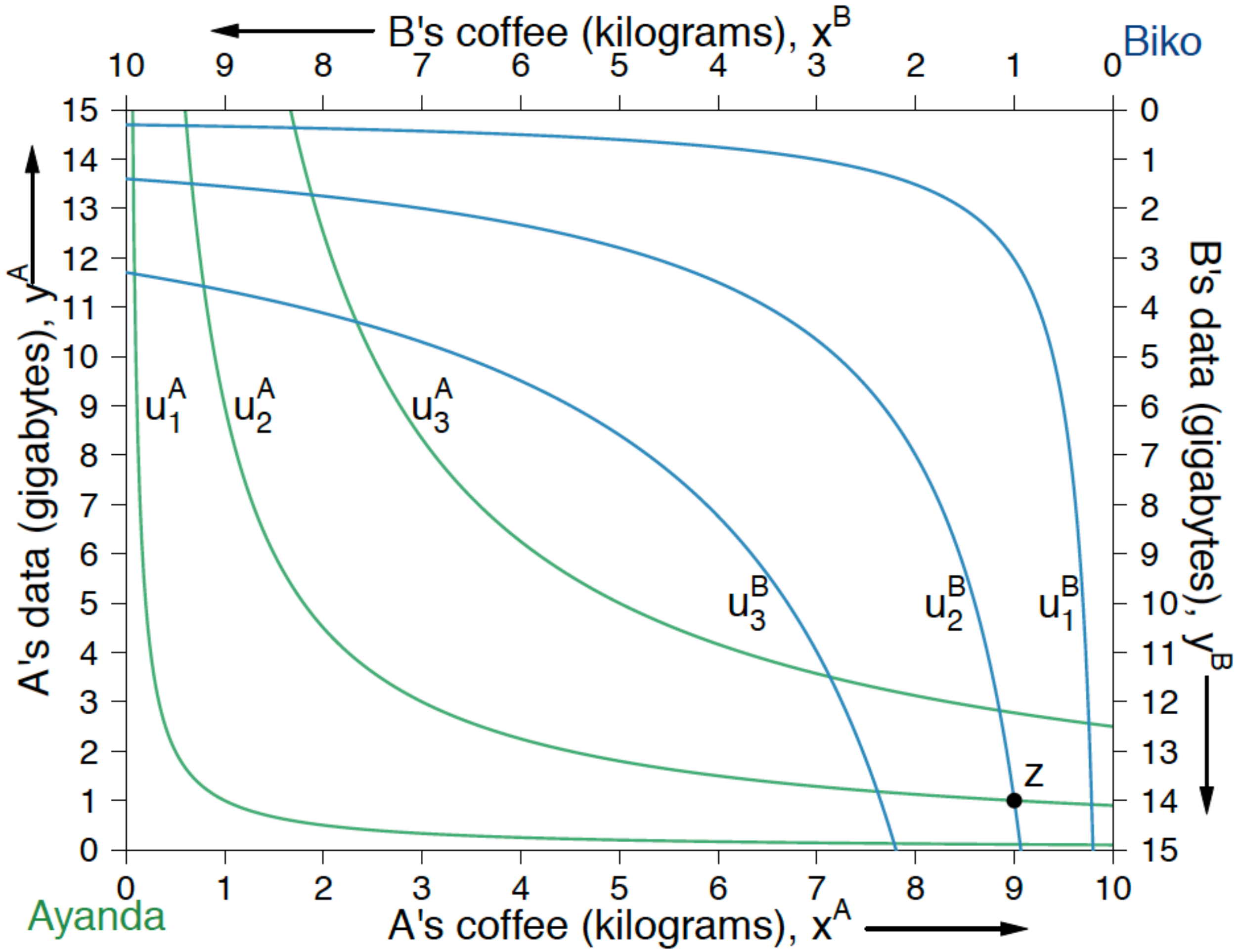
At point **z**, Biko has 1 Kg. of coffee and 14 giga of data

The Edgeworth Box (but without indifference curves)



(b) Indifference curves

The Edgeworth Box



(c) Indifference curves in an Edgeworth box

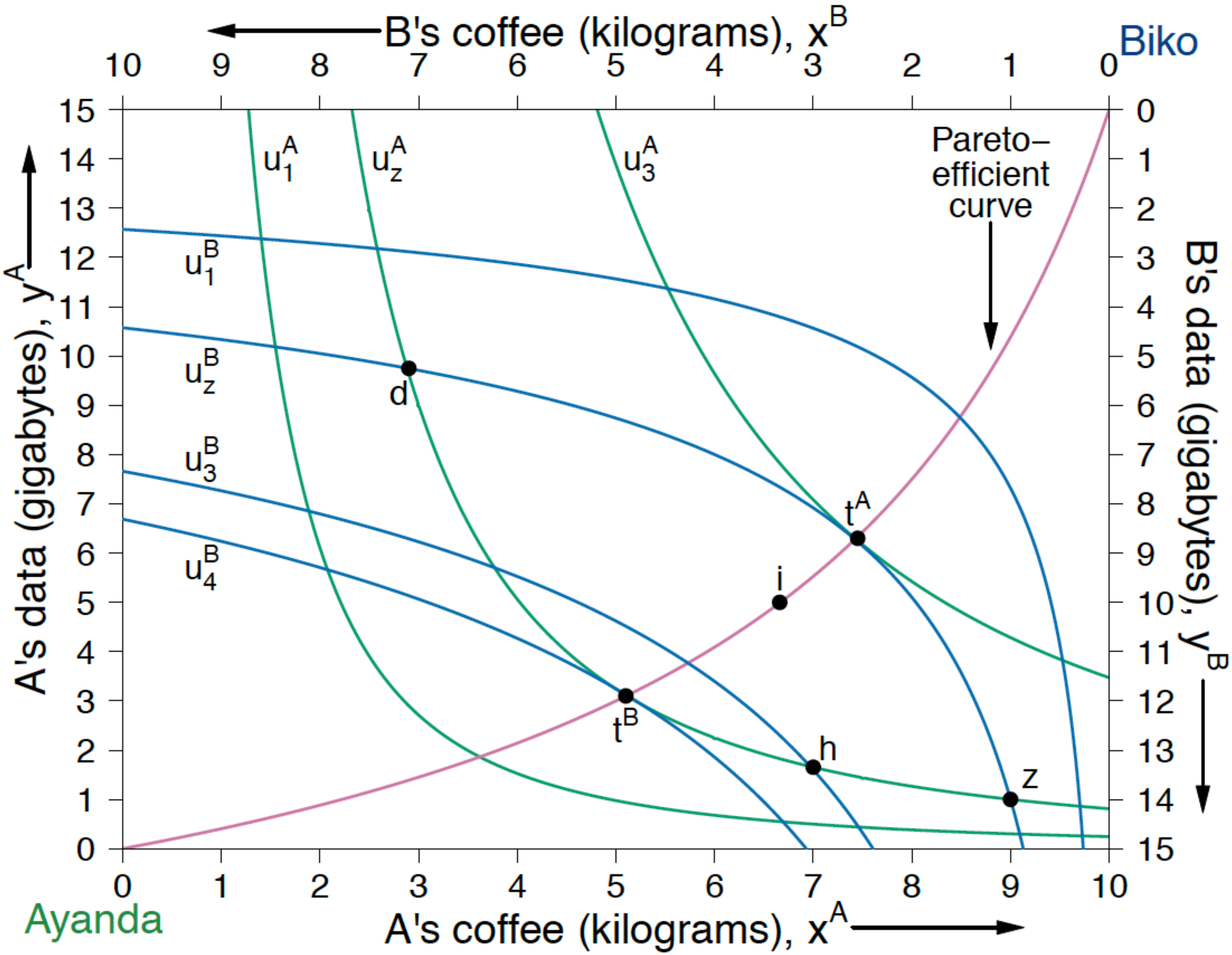
EFFICIENCY RULE:

In order for an allocation to be Pareto efficient, the MRS of coffee for gigabytes must be the same for Ayanda and Biko:

$$mrs^A(x^A,y^A)=mrs^B(x^B,y^B)$$

- $mrs^A(x^A,y^A)$: the max number of giga (y) that Ayanda is willing to pay to obtain one more Kg. of coffee (x);
- whenever their MRS(x,y) (or WTP) are different, they could both be made better through further exchange;
- if $mrs^A>mrs^B$, Ayanda values coffee more than Biko
- the utility of both could thus increase by transferring some coffee (x) to Ayanda in exchange for some giga (y).
- only when $mrs^A(x^A,y^A)=mrs^B(x^B,y^B)$ all opportunities for Pareto-improving exchanges have been exhausted.

Pareto-efficient curve = set of points of tangency of indifference curves.



Calculating the Pareto-efficient Curve

Example: Ayanda and Biko have the following (identical) Cobb-Douglas utility functions:

$$u^A = (x^A)^{0.5}(y^A)^{0.5}; \; u^B = (x^B)^{0.5}(y^B)^{0.5}$$

1. find mrs_A and mrs_B

$$mrs_A(x_A, y_A) = \frac{u_x^A}{u_y^A} = \frac{y^A}{x^A}; \; mrs_B(x_B, y_B) = \frac{u_x^B}{u_y^B} = \frac{y^B}{x^B}$$

2. equate them (as implied by Pareto efficiency) and use the 'no-goods to be discarded' condition to express everything in terms of goods held by A

$$mrs_A = mrs_B \rightarrow \frac{y^A}{x^A} = \frac{y^B}{x^B} \rightarrow \frac{y^A}{x^A} = \frac{\bar{y}-y^A}{\bar{x}-x^A} = \frac{15-y^A}{10-x^A}$$

Note:
$\bar{x} = total\ kg.of\ coffee$
$\bar{y} = total\ n.of\ gigabytes$

3. solve the equation for y_A

$$\frac{y^A}{x^A} = \frac{15 - y^A}{10 - x^A} \rightarrow \boldsymbol{y^A = \frac{3}{2}x^A}$$

Note: you can do the same for B and find the Pareto-efficient curve in terms of y^B.

3 – The Impartial Spectator

- Let us now introduce the *Impartial Spectator* (or: *Social Planner*)
- For the sake of fun and to put a face on the idea, we are going to call him Morgan and represent him as Morgan Freeman in the movie "Bruce Almighty", in which he performs the role of God.
- We assume that Morgan is basically a benevolent dictator seeking what is best for society.
- We introduce Morgan in order to identify the allocations that would be best for society (impartially taking into account the interest of everyone – just like he does in the movie).

3 – The Impartial Spectator

- Morgan's task is to select the best post-exchange allocation of coffee (x) & gigabytes (y) between Ayanda and Biko.
- The marginal utility of x and y is always positive for A and B (although diminishing): they prefer to have more than less of both goods.
- So an obvious criterion for the Social Planner is the 'no-goods to be discarded' rule: every available coffee and gigabyte must be allocated to A or B
  - no good should be 'left on the table' (discarded).
- All allocations on the Edgeworth box respect the 'no-goods to be discarded' rule
  - But there is a lot of them! (176 to be exact)

- Every allocation in the Edgeworth Box automatically satisfies the 'no-goods to be discarded' rule.
- But there is too many of them
- The Social Planner imposes a stricter criterion: Pareto Efficiency.

3 – The Impartial Spectator

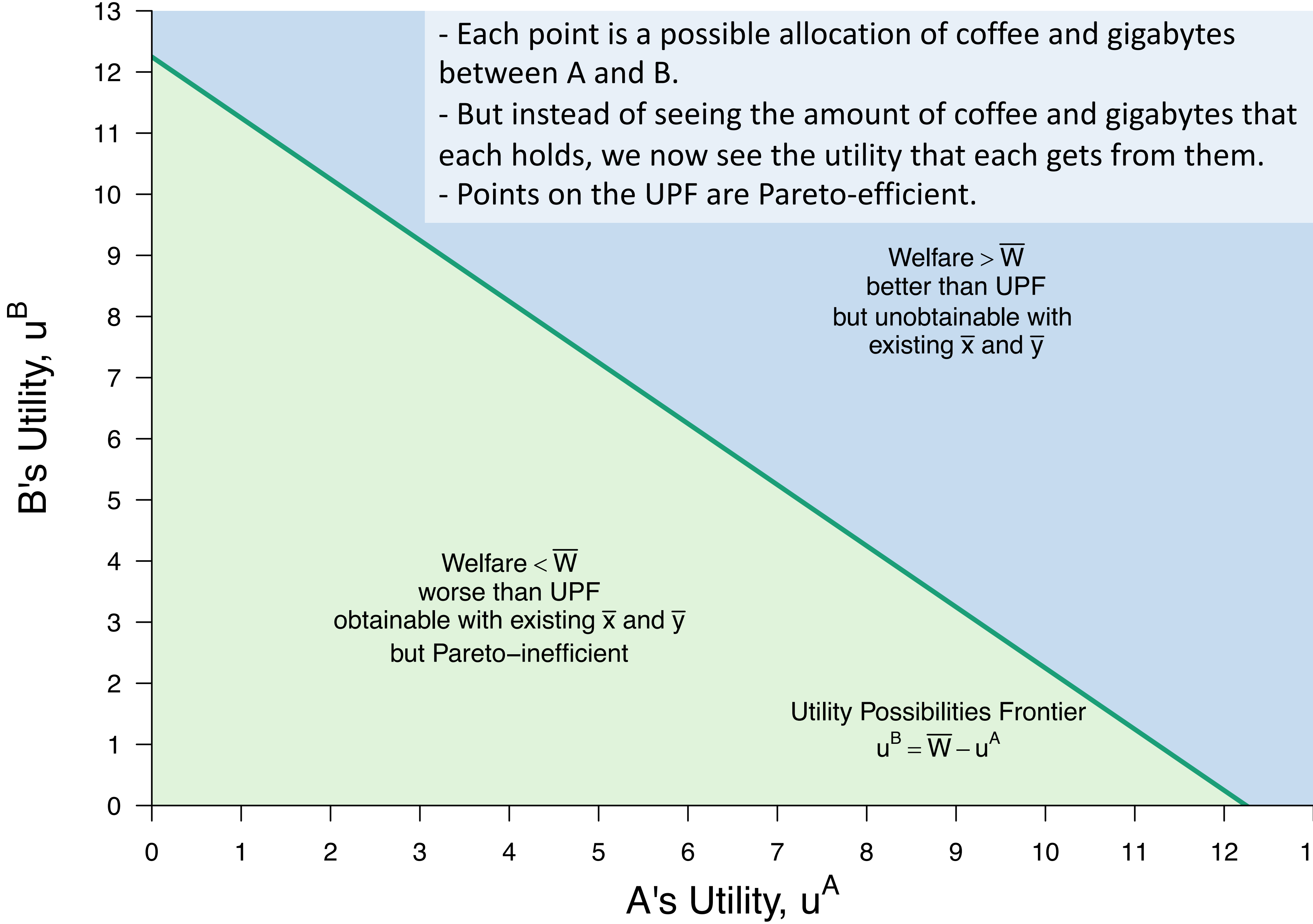
- Morgan has now eliminated Pareto-inefficient points.
- But still too many efficient allocations to choose from! (all allocations on the Pareto-efficient curve).
- Now the problem is one of pure conflict: on the Pareto-efficient curve, improving Ayanda's utility requires worsening Biko's utility (and vice-versa).

- How will Impartial Spectator Morgan deal with this conflict of interests?

3– The Impartial Spectator

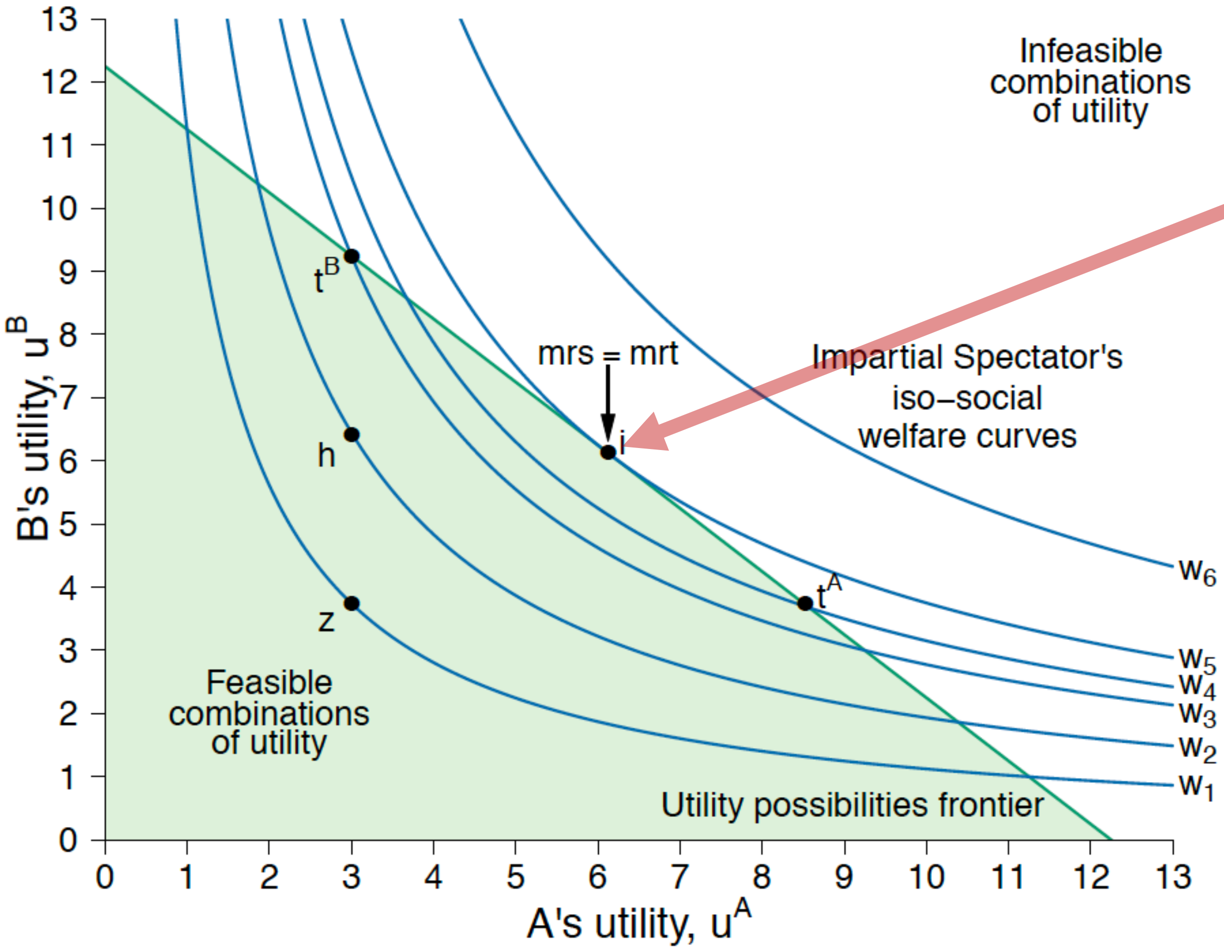
- At this point, Morgan needs to evaluate each allocation on the basis of the combination of u^A and u^B which that allocation implies.
- He needs some additional criterion in order to compare Pareto-efficient combinations of u^A and u^B and decide which one is best for society: a social welfare function.
- To do so, he uses the Utility Possibility Frontier (UPF)
  - the UPF is a curve that shows all Pareto-efficient outcomes in terms of the utility (or payoffs) obtained by each player.
  - the UPF defines all the combinations of u^A and u^B that are Pareto efficient.
- Morgan will only choose allocations on the frontier (others are not Pareto-efficient).
- He will then use his welfare function (by means of iso-welfare curves) to decide which specific allocation to pick.

- Each point is a possible allocation of coffee and gigabytes between A and B.
- But instead of seeing the amount of coffee and gigabytes that each holds, we now see the utility that each gets from them.
- Points on the UPF are Pareto-efficient.



- What criterion will Morgan (the Impartial Spectator) use in order to choose a particular allocation on the UPF?
- There are many criteria that could be used.
- A criterion can be defined as a Social Welfare Function (W) that Morgan aims to maximize.
- Let Morgan adopt a Cobb-Douglas Social Welfare Function:
  $$W(u^A, u^B) = W^M = (u^A)^{\lambda}(u^B)^{1-\lambda}$$
- Like a utility function for Morgan, with u^A and u^B as the two 'goods'.
- Morgan' indifference curves are called *iso-welfare curves* (sets of allocations that give the same value of W).
- Optimum: tangency of the highest feasible iso-welfare curve with the UPF: Morgan will select this allocation!

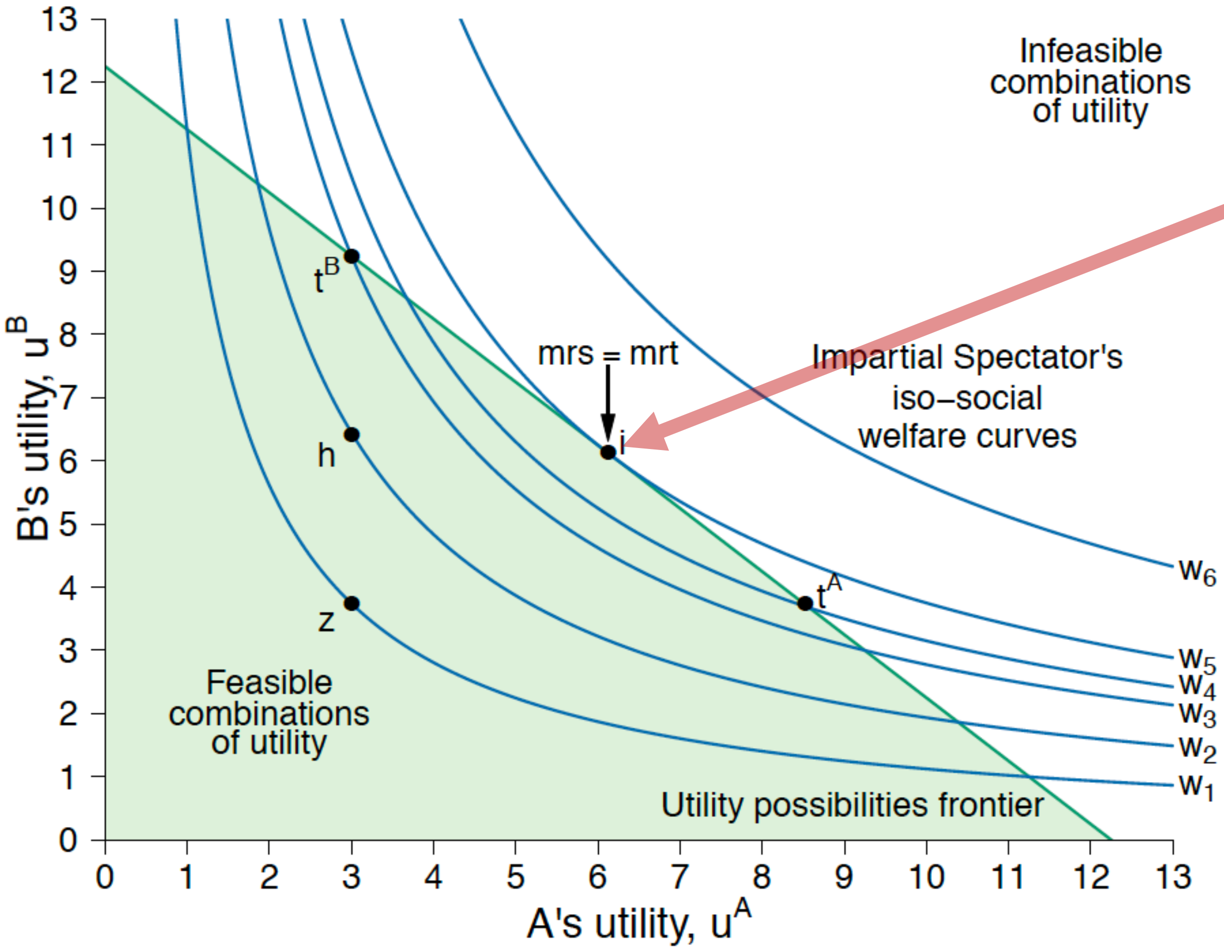
Morgan selects the point on the UPF (green curve) associated with the highest possible iso-welfare curve (blue line)



i = Impartial Spectator's preferred allocation.

(b) The utility possibilities frontier (UPF) and the Impartial Spectator's iso-social welfare curves (w)

Same logic as in Chapter 3:
UPF is the feasibility frontier for Morgan;
iso-welfare curve is the indifference curve



i = Impartial Spectator's preferred allocation.

(b) The utility possibilities frontier (UPF) and the Impartial Spectator's iso-social welfare curves (w)

3 – The Impartial Spectator

- In this example $\lambda=0.5$ in the social-welfare function
- So Morgan weights *equally* the utility of A. and B.
- This is why the preferred allocation gives the same utility to Ayanda and Biko (an egalitarian choice).
- λ = importance given to different interests in society (A's interest and B's interest, in this case).
- In the real world, we have no Impartial Spectator
  - (we do have a Morgan Freeman, though.)
- *Politics* determines the λ *'s* in policy-making.
- *Note the contrast:*
  - Making sure no good is discarded and respecting *Pareto-efficiency* is likely uncontroversial…
  - …but then choosing how to distribute the gains from trade through a social welfare function necessarily implies a *conflict of interests*.

4 – Property & Power

- Impartial spectator doesn't care about initial endowments.
- But in economies with *private ownership* (or *private property*), exchanges must be agreed on voluntarily by participants: *initial endowments* matter a big deal!

3 important features of private exchange:

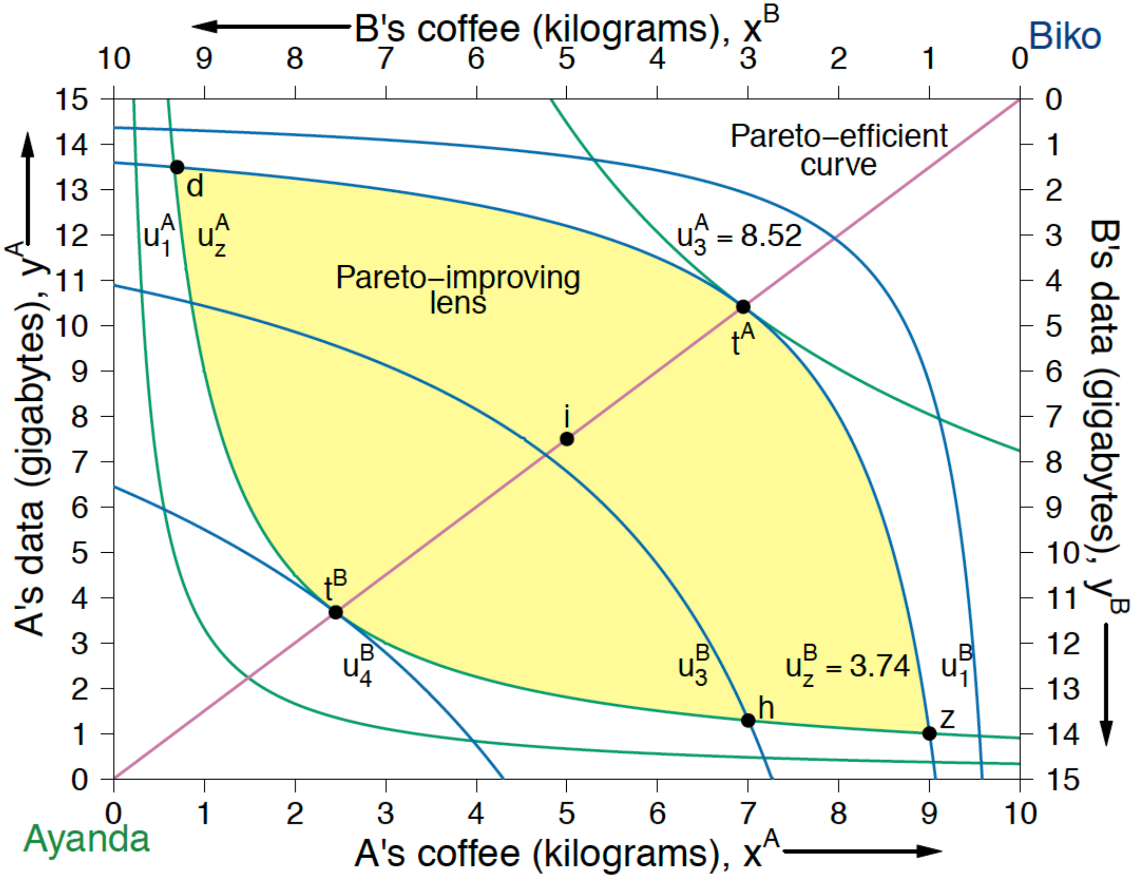
1. Property rights determine initial endowments;
2. Only *voluntary* exchanges can be realized;
3. Market institutions determine what exchanges are feasible and who has what power;

4 –Property & Power

- *A's endowment*: $(x_z^A, y_z^A) = (9{,}1)$
  (A. has 9 kg. of coffee and 1 giga)
- *B's endowment*: $(\bar{x}^B, \bar{y}^B) = (1{,}14)$
  (B. has 1 kg. of coffee and 14 giga)

- *Participation constraint*: the utility that a player receives from her initial endowment
  - $u_z^A = u^A(9{,}1)$ is Ayanda's participation constraint
  - $u_z^B = u^B(1{,}14)$ is Biko's participation constraint
  - Also called *fallback utility* or *reservation utility*: *A player will never agree to an exchange that results in a level of utility lower than the p.c.*

4 –Property & Power



(a) Edgeworth box for Ayanda and Biko

- The initial endowment *z* is *not Pareto efficient* (not on the Pareto-efficient curve);
- So there is room for *voluntary exchange* (Pareto-improvements): there is a Pareto-improving set (or *lens*);
- But which allocation in the *Pareto-improving lens*, exactly, will be reached through exchange?

Take-it-or-leave-it (TIOLI) power

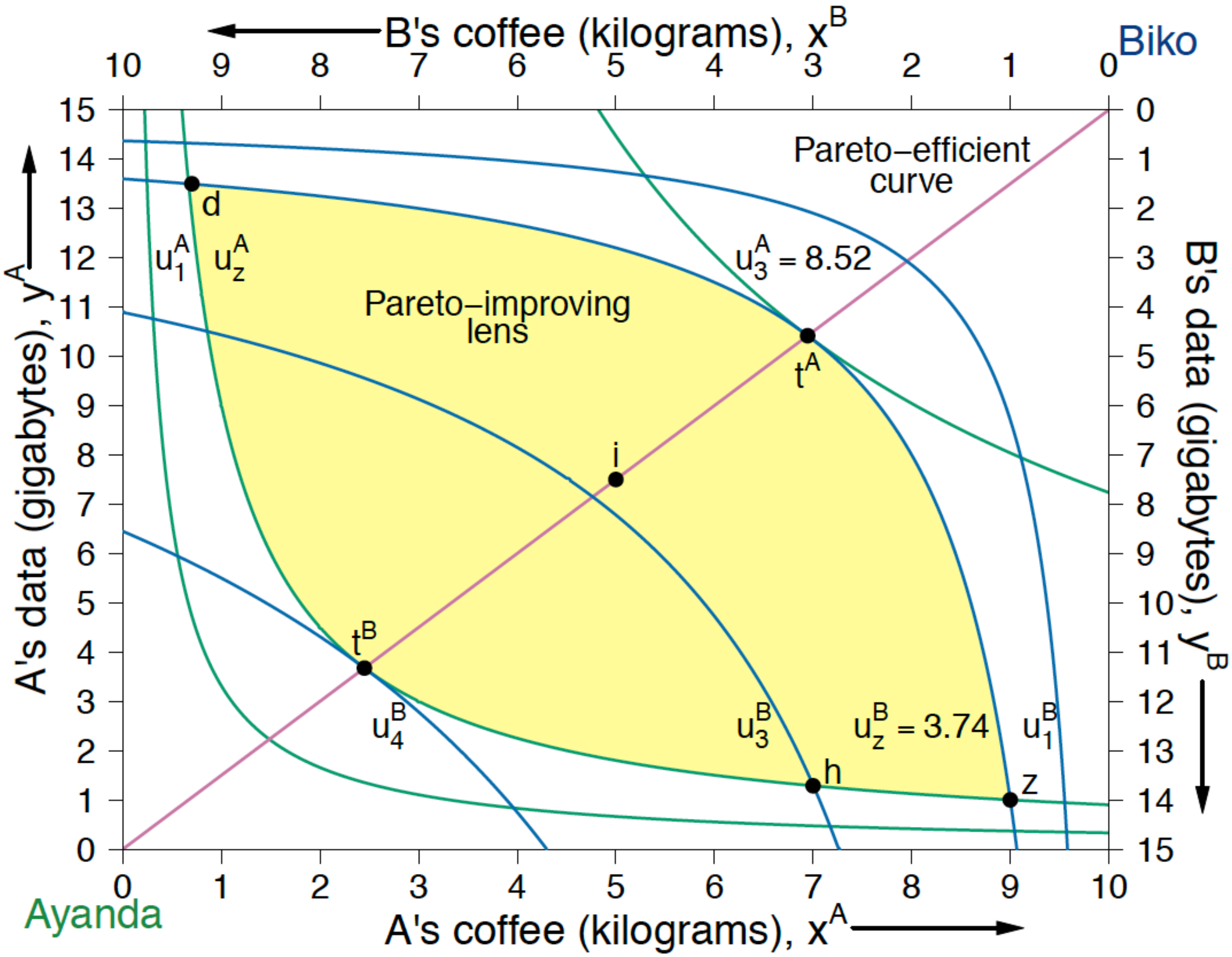
- Ayanda has the power to be the *first-mover* and make a *TIOLI* offer

- *Ayanda to Biko: "I'll give you n kgs. of coffee for m gigabytes. If you refuse, I will not agree to any other trade you might propose."*
  - That is, *"accept or we stay at z."*
  - (like in the Ultimatum Game)

An example of TIOLI power is when you apply for a job at McDonald's: either you take the McDonald's wage or leave the job.

Take-it-or-leave-it (TIOLI) power

- What post-exchange allocation will A offer to B?
- A's maximization problem: find the post-exchange allocation at which B is no worse off than at the endowment, and A is as well off as she can be.
  - in reality, A would offer to B *just a tiny bit more* (an 'epsilon' more) than his participation constraint, to make sure B will accept…
  - …but for simplicity, we ignore the 'epsilon', and say that she will offer B an allocation where $u^B = u_z^B$
- → A will offer the point on the Pareto-efficient curve that gives to B a utility equal to her participation constraint.
  This is at the same time:
  - *the intersection of the Pareto-efficient curve with B's participation constraint;*
  - *the point of tangency between B's participation constraint and A's indifference curve.*
- In this way she makes sure that B will accept and she obtains the highest possible utility for herself;
- all the benefits from exchange (the economic surplus) go to A;
- B remains at the starting point (or in reality just a tiny bit better) in terms of utility.



(a) Edgeworth box for Ayanda and Biko

A will offer t^A:

- gives B same u^B of initial endowment **z** (same indifference curve)
- gives A the maximum possible utility given the participation constraint.

B's participation constraints is A's feasible frontier: outcomes above that curve are not achievable for A;

A chooses the point that allows her to reach the highest possible indifference curve, given the constraint: *tangency between B's participation constraint and A's indifference curve*

Take-it-or-leave-it (TIOLI) power

- In the TIOLI outcome, the first-mover gets all of the economic surplus;
- The TIOLI outcome is Pareto-efficient
  - First-mover appropriates the whole economic surplus, so has an incentive to maximize it;
  - She chooses the point where the other players' initial indifference curve is tangent to her own (thus respecting the efficiency rule).

Calculating the TIOLI final allocation (1/2)

Example: Suppose Ayanda and Biko have the following (identical) Cobb-Douglas utility functions:

$u^A = (x^A)^{0.5}(y^A)^{0.5}$; $u^B = (x^B)^{0.5}(y^B)^{0.5}$

The total available quantities are $\bar{x} = 10$ and $\bar{y} = 15$

B's initial endowment is $(\bar{x}^B, \bar{y}^B) = (1{,}14)$ and A. has TIOLI power.

1. Compute the equation for the Pareto-efficient curve, expressed in terms of the goods that B has
   - $y^B = \frac{3}{2}x^B$ (see earlier slide on how to calculate this)

2. Calculate B's fallback utility
   - $u_z^B = (x^B)^{0.5}(y^B)^{0.5} = 1^{0.5}14^{0.5} = 3.74$

3. Substitute the Pareto-efficient curve into B's utility function
   - $(x^B)^{0.5}(y^B)^{0.5} = (x^B)^{0.5}(\frac{3}{2}x^B)^{0.5}$

Calculating the TIOLI final allocation (2/2)

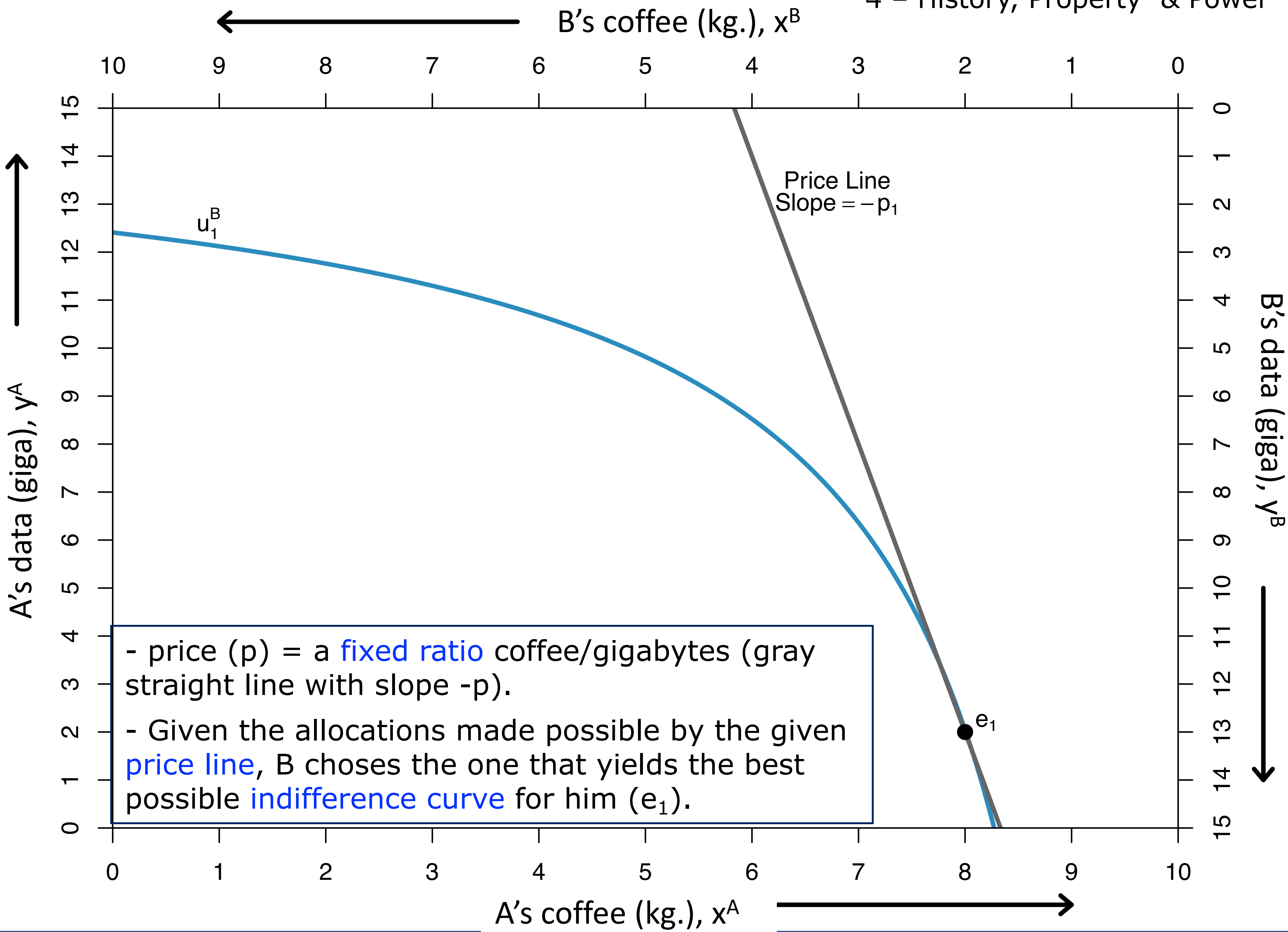
4. Set B's utility equal to his fallback and solve for x^B
   - $(x^B)^{0.5}(\frac{3}{2}x^B)^{0.5} = 3.74 \implies x^B = 3.05 \approx 3$
5. Then use again the Pareto-efficient curve to find y^B
   - $y^B = \frac{3}{2}(3) = 4.5$
6. Now, use the no-goods-to-be-discarded rule to find x^A and y^A
   - $x^A = \bar{x} - x_B = 10 - 3 = 7$
   - $y^A = \bar{y} - y_B = 15 - 4.5 = 10.5$
7. The TIOLI offer (and so the TIOLI post-exchange allocation) will thus be:
   - $x^A = 7;\ y^A = 10.5;\ x^B = 3; y^B = 4.5$

Price-setting power

- Ayanda fixes the *price* (ratio of exchange of y for x)…
- …but Biko gets to decide *quantities* - how many units to exchange.
  - *(Like when you go shopping.)*
- A must still satisfy B’s *participation constraint*
  - if B doesn’t get at least u_z^B, B will not do any trade.
- But now there is also an *incentive compatibility constraint*: Ayanda must predict how Biko will respond to each possible price she might offer;
- Like a sequential game solved by backward induction:
  - Ayanda predicts the *best responses* of Biko to each possible price.
  - Ayanda then sets the price that maximizes her payoff, *given Biko’s best responses*;

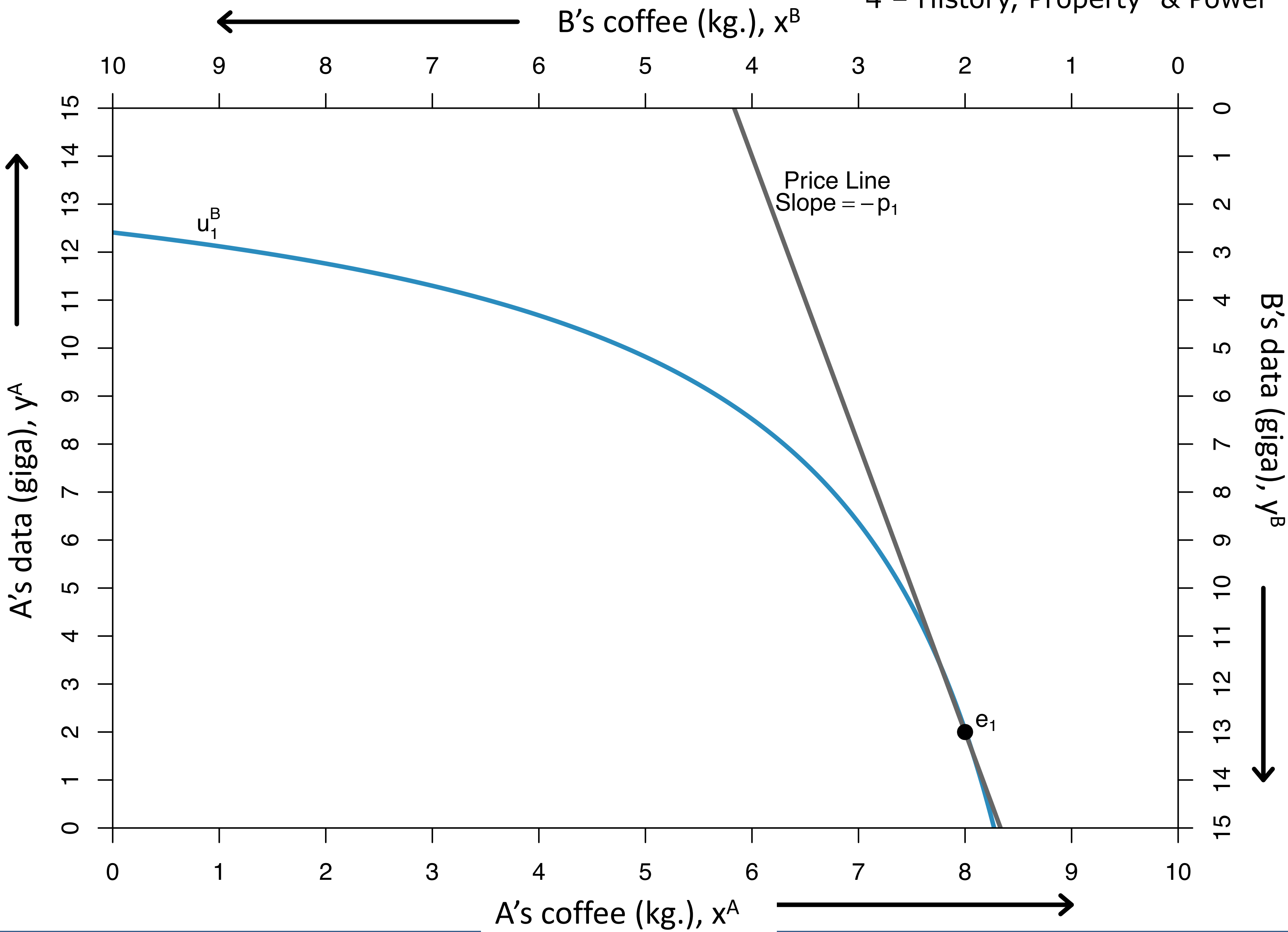
Price-setting power

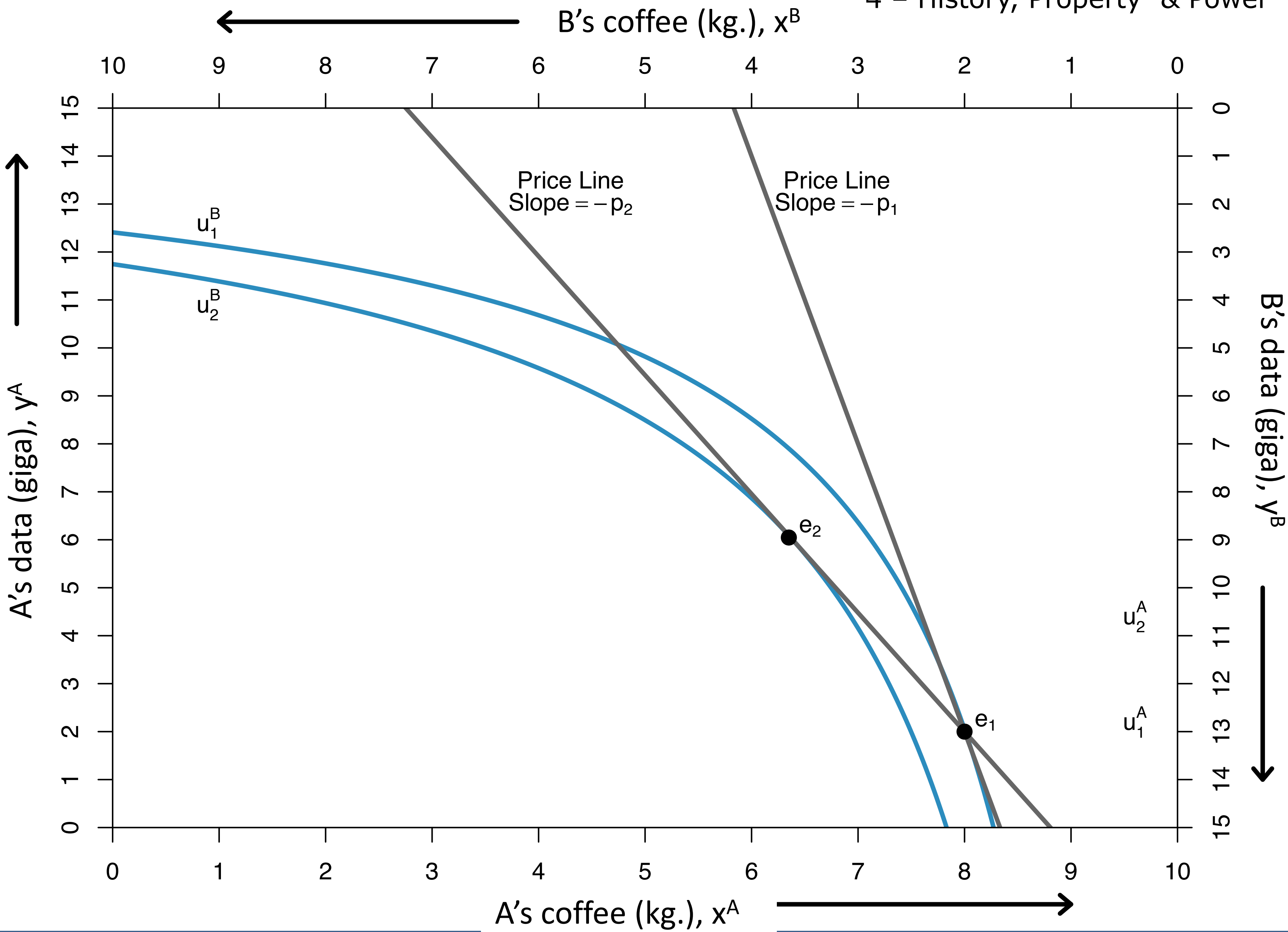
- Ayanda solves her maximization problem in two steps:
    1. Ayanda predicts the quantity that Biko will want to exchange at each possible price (that is, she computes B's *offer curve*);
    2. then A sets the price that will produce the best exchange from her point of view, given B's offer curve.



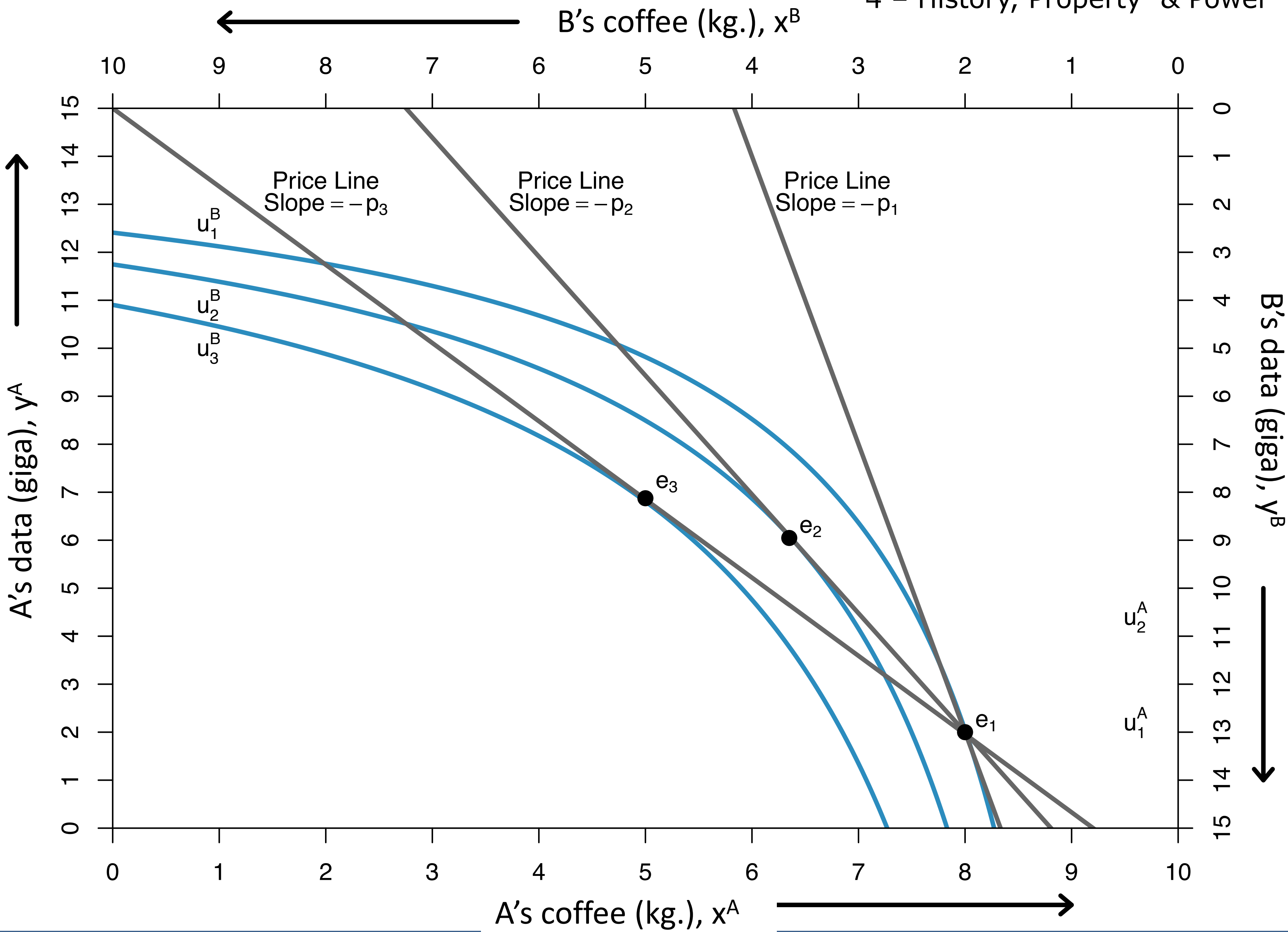
- price (p) = a fixed ratio coffee/gigabytes (gray straight line with slope -p).

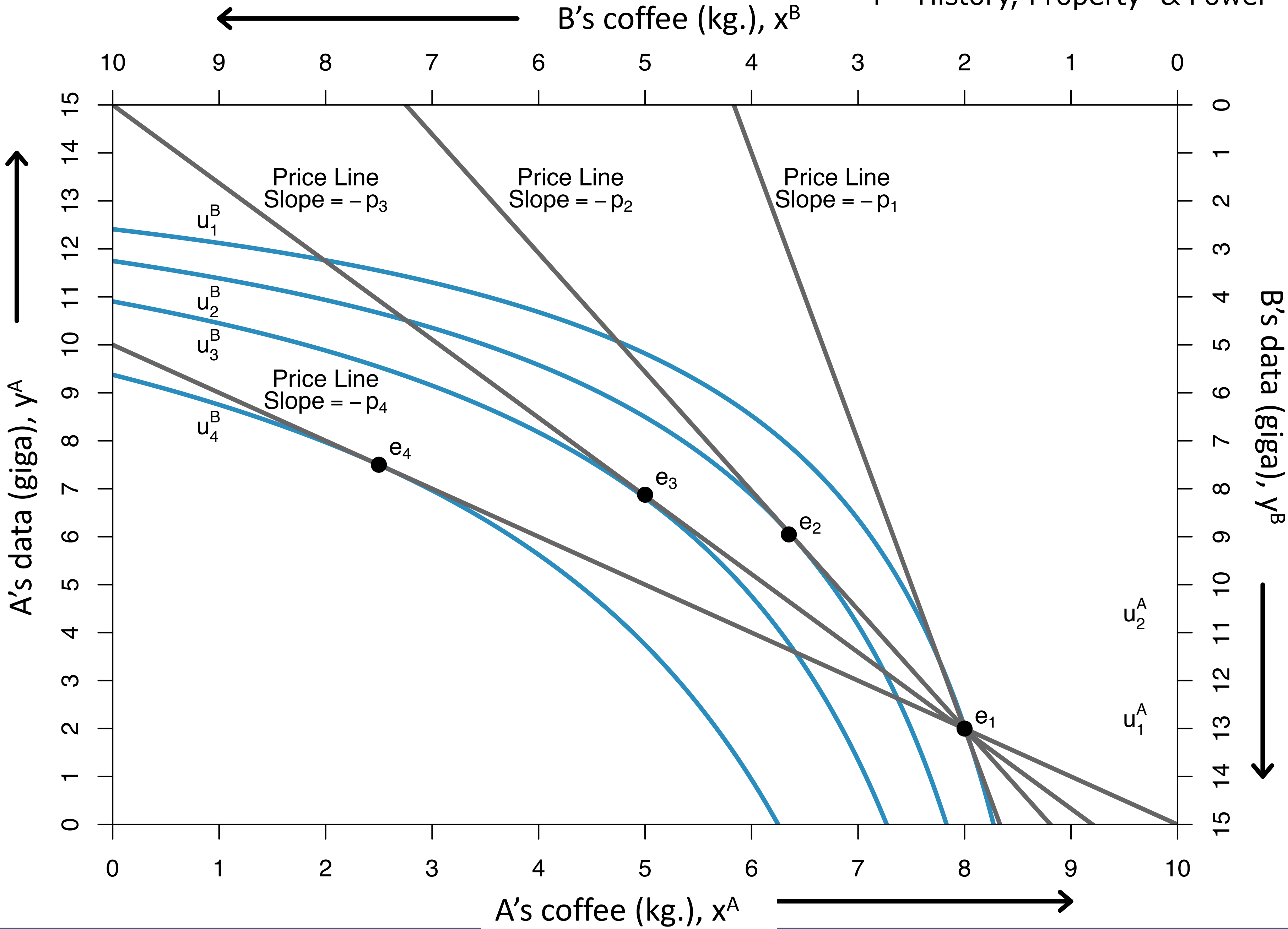
- Given the allocations made possible by the given price line, B choses the one that yields the best possible indifference curve for him (e_1).

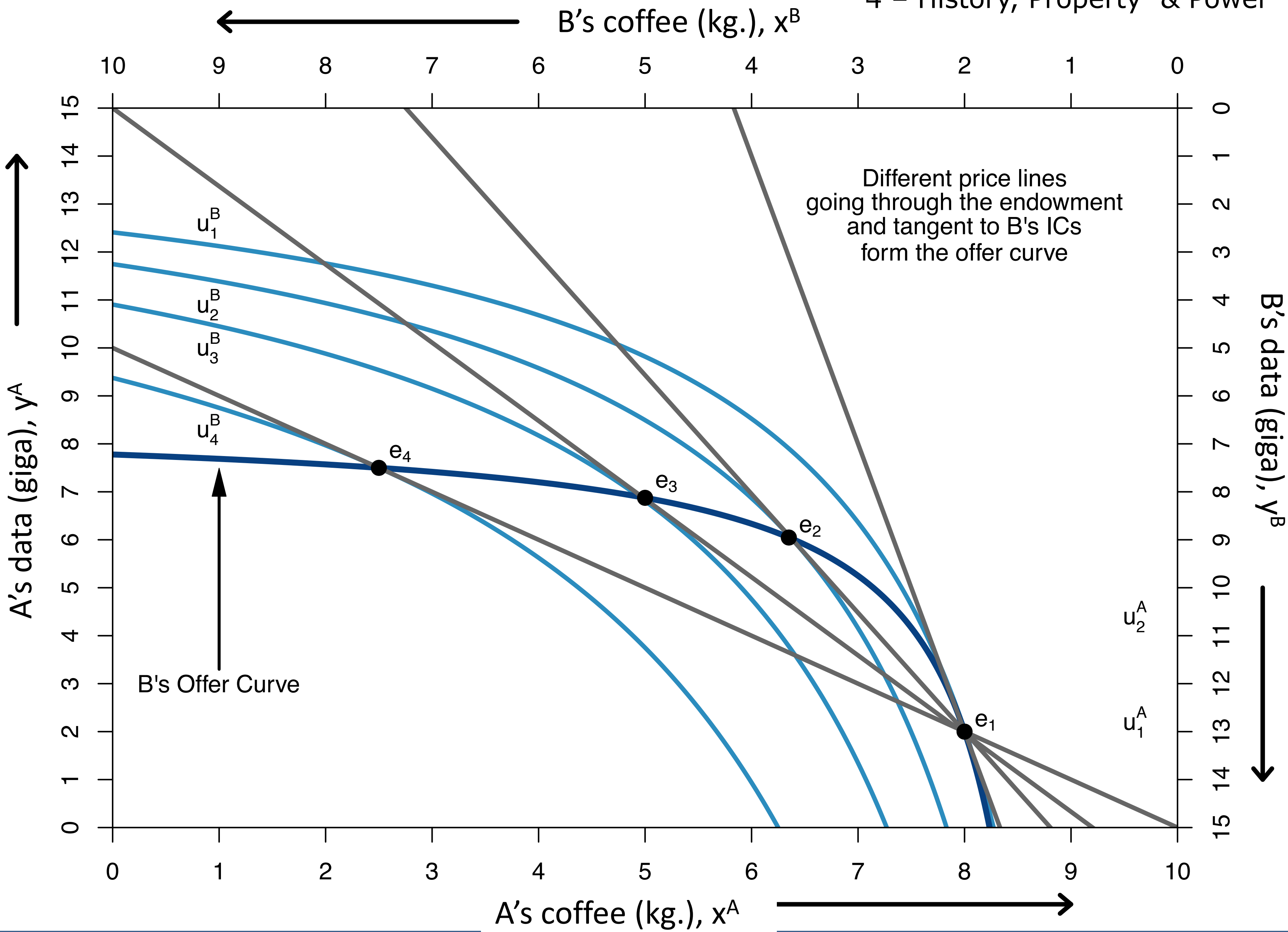

B's coffee (kg.), x^B
10
9
8
7
6
5
4
3
2
1
0
A's data (giga), y^A
B's data (giga), y^B
Price Line
Slope = $-p_1$
u_1^B
e_1
A's coffee (kg.), x^A



B's coffee (kg.), x^B
10
9
8
7
6
5
4
3
2
1
0
Price Line
Slope = − p_2
Price Line
Slope = − p_1
u_1^B
u_2^B
e_2
e_1
u_2^A
u_1^A
A's data (giga), y^A
B's data (giga), y^B
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
A's coffee (kg.), x^A


B's coffee (kg.), x^B
10 9 8 7 6 5 4 3 2 1 0
Price Line
Slope = − p_3
Price Line
Slope = − p_2
Price Line
Slope = − p_1
u_1^B
u_2^B
u_3^B
e_3
e_2
e_1
u_2^A
u_1^A
A's data (giga), y^A
B's data (giga), y^B
0 1 2 3 4 5 6 7 8 9 10
A's coffee (kg.), x^A


B's coffee (kg.), x^B
Price Line
Slope = $-p_3$
Price Line
Slope = $-p_2$
Price Line
Slope = $-p_1$
u_1^B
u_2^B
u_3^B
u_4^B
Price Line
Slope = $-p_4$
e_4
e_3
e_2
e_1
u_2^A
u_1^A
A's data (giga), y^A
B's data (giga), y^B
A's coffee (kg.), x^A

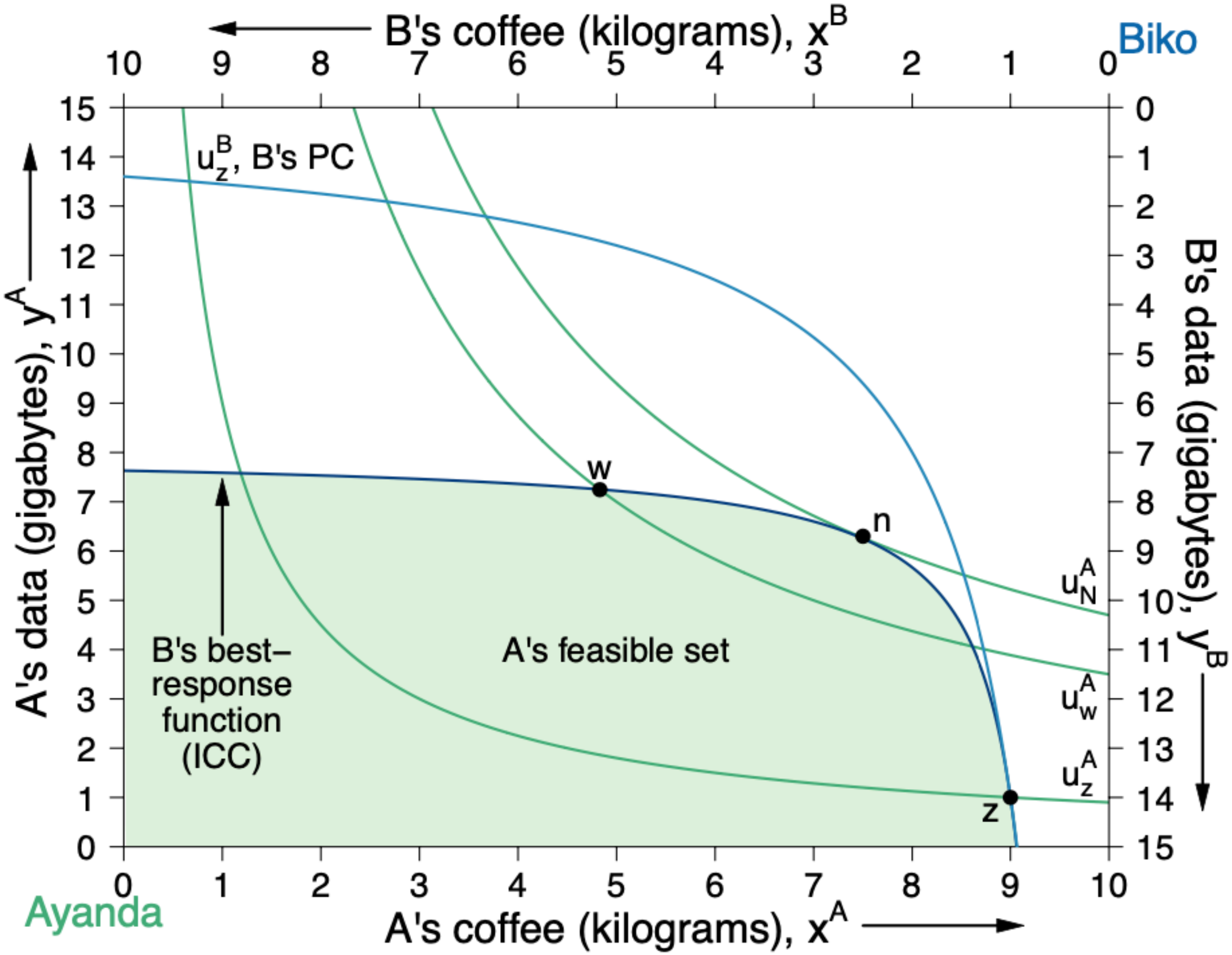


B's coffee (kg.), x^B
10 9 8 7 6 5 4 3 2 1 0
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A's data (giga), y^A
B's data (giga), y^B
Different price lines going through the endowment and tangent to B's ICs form the offer curve
u_1^B
u_2^B
u_3^B
u_4^B
e_4
e_3
e_2
e_1
u_2^A
u_1^A
B's Offer Curve
0 1 2 3 4 5 6 7 8 9 10
A's coffee (kg.), x^A

- Biko's offer curve tells Ayanda which allocation B will pick, for any possible price she (Ayanda) can set.
- So it displays all the possible allocations that Ayanda can induce Biko to pick.
- B's offer curve is analogous to a feasible frontier for A: it shows all the allocations that A can obtain.

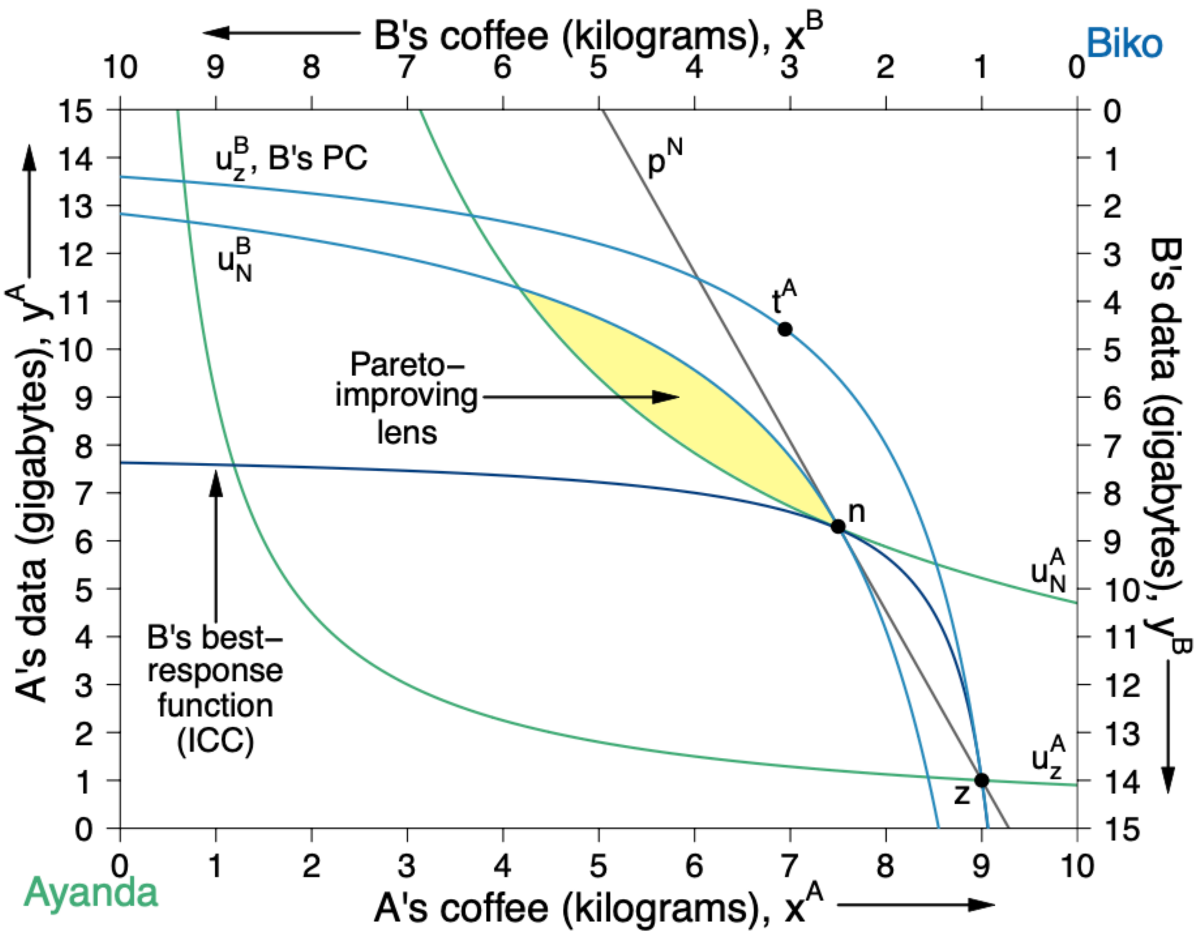
2nd step: A selects the allocation on B's offer curve that allows her to reach the highest possible utility.

- This is the point where A's indifference curve is tangent to her feasible frontier (which in this case is B's offer curve).
  - *So the solution is the point of tangency between B's offer curve and A's indifference curve*;
- A. will offer the price ratio that induces B. to pick that point of tangency.



(a) Maximizing utility subject to the incentive-compatibility constraint

- The post-exchange allocation when Ayanda has price-setting power is point **n**
- Point **n** is the point of tangency between B's offer curve and A's indifference curve.
- At point **n**, Ayanda reaches her highest feasible indifference curve, given the constraint she faces (represented by B's offer curve).
- Ayanda sets a price such as to reach point **n.**



(b) Pareto-superior alternatives to Ayanda's choice of **n**

- The price-setting post-exchange allocation **n** is not Pareto-efficient.
- Ayanda and Biko's indifference curves are *not* tangent at point n. Therefore, their MRS are *not* equal.
- The yellow Pareto-improving lens contains the set of allocations that are Pareto-superior to allocation n.

- A does worse with PSP than she would with TIOLI;
- B does better when A has only PSP and *not* TIOLI (with PSP he gets some *rent*);
- However, A is still better off than B (having PSP power is still better than not having it).

- Exchange with TIOLI was very unequal, but it produced a Pareto-efficient outcome.
- Exchange with PSP is less unequal but it produces a Pareto-inefficient outcome.
  – A now cannot extract all the surplus, and she cares only about the surplus she can appropriate, not the overall surplus.
  – Now A advances her interest in a way that produces inefficiency;

5 – Personal Exchange & Social Preferences

- Until now A & B both *homo economicus:* they had self-regarding preferences
- What happens with *social preferences*?
- Social preferences will reduce the extent of conflict and increase the scope of cooperation.

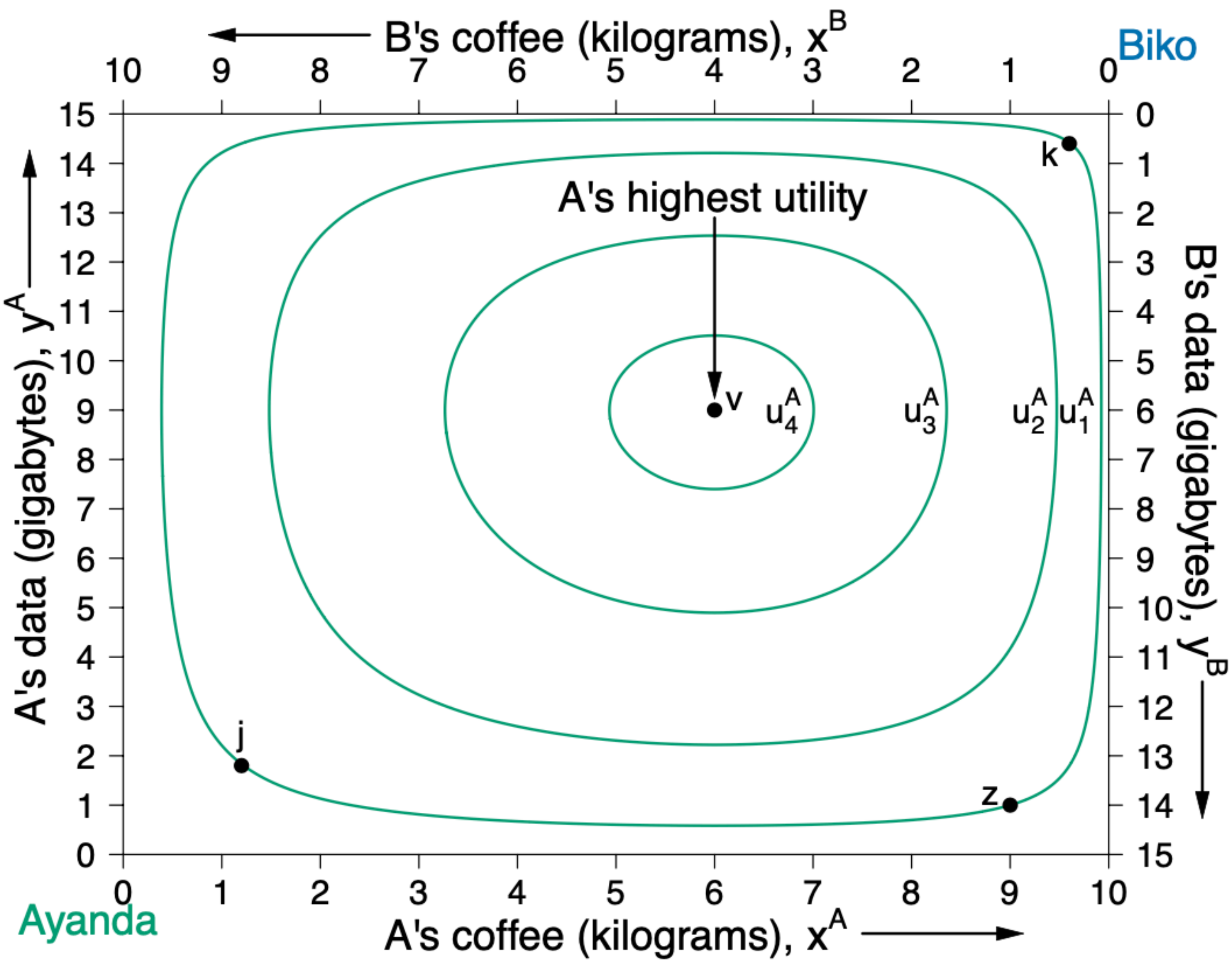
Example:

- Ayanda has *altruistic preferences*:

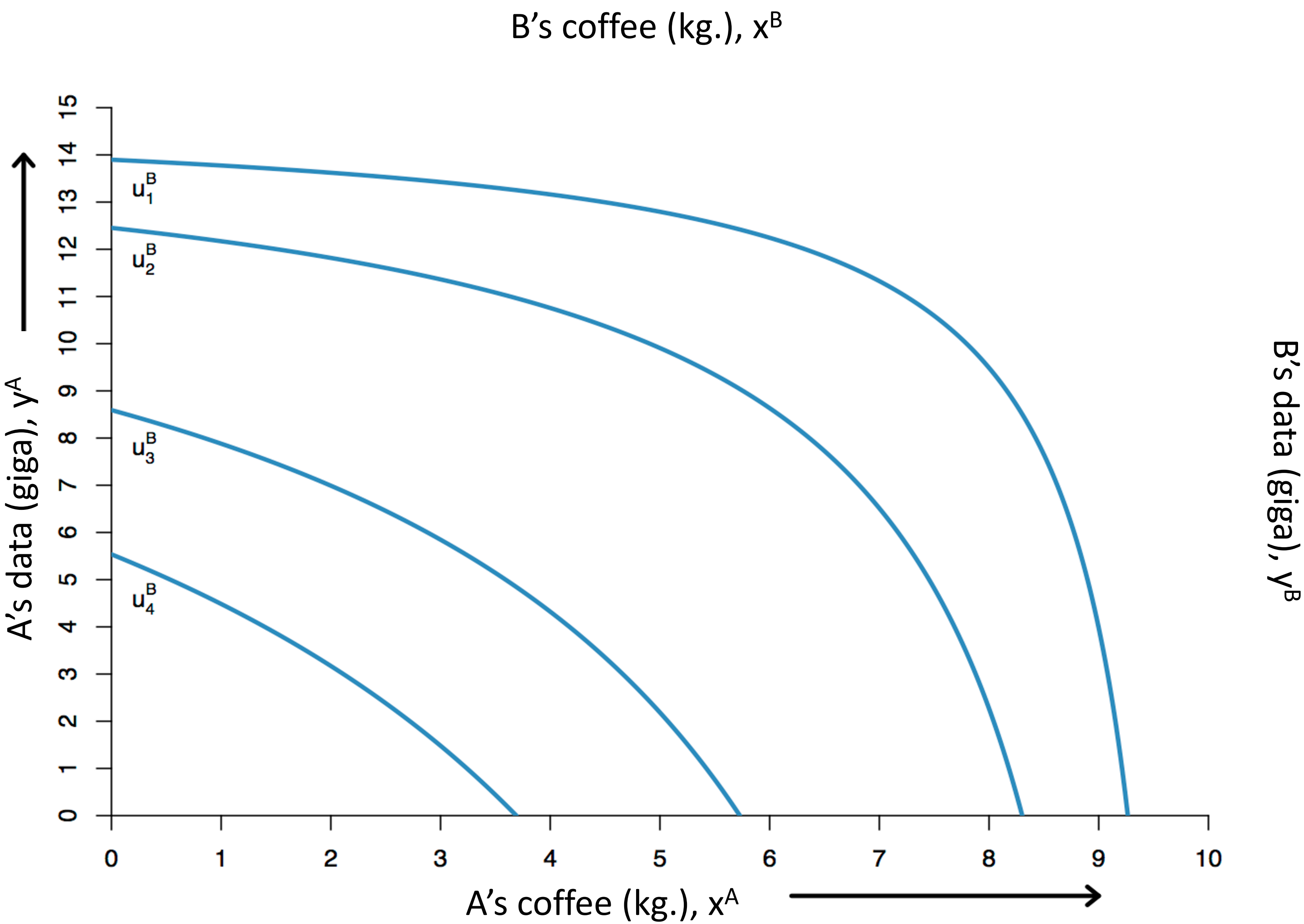
$$u^A(x^A, y^A, x^B, y^B) = \left(x_A^\alpha y_A^\beta\right)^{(1-\lambda)} (x_B^\alpha y_B^\beta)^\lambda$$

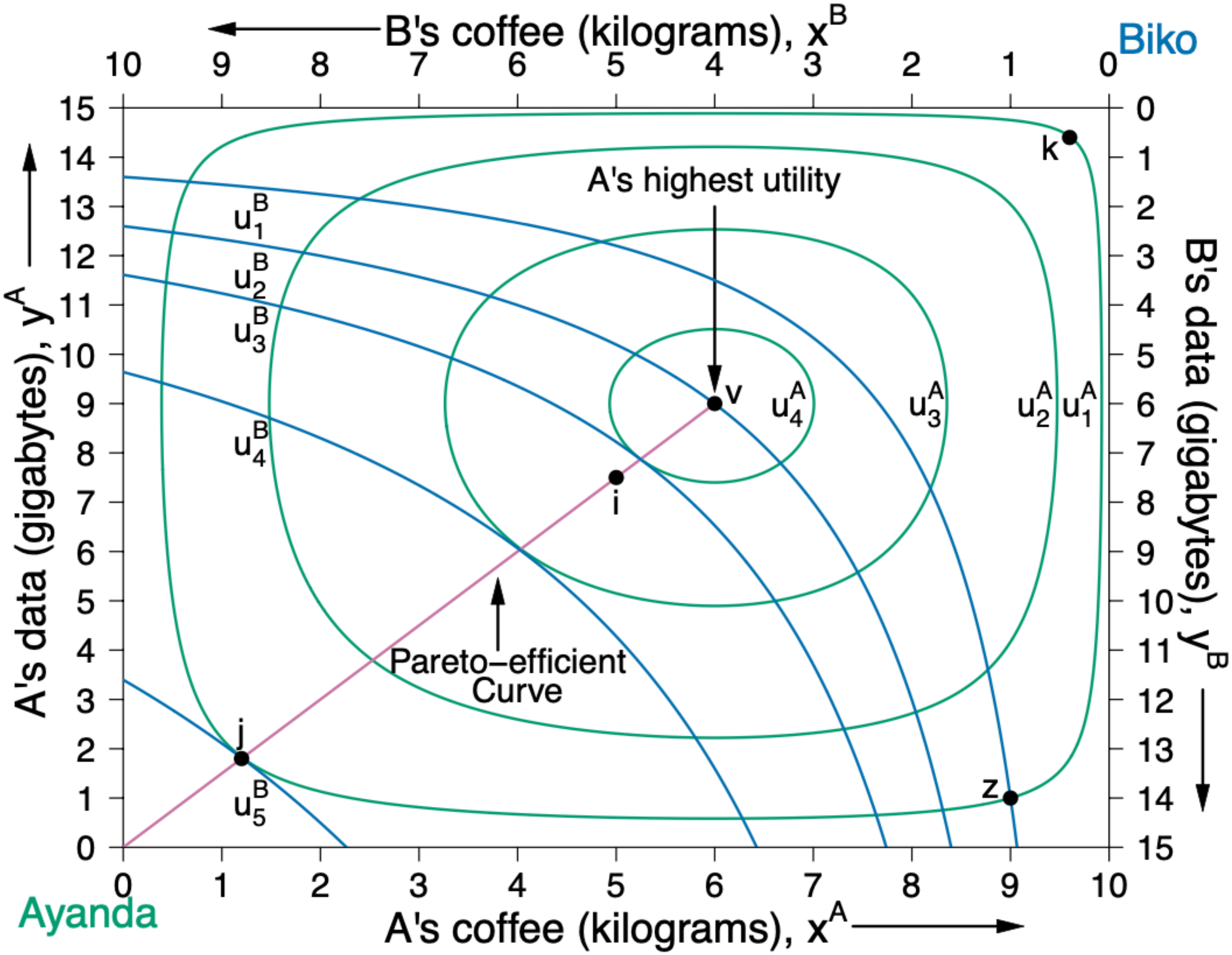
- for now Biko remains *homo economicus*:

$$u^B(x^A, y^A, x^B, y^B) = x_B^\alpha y_B^\beta$$



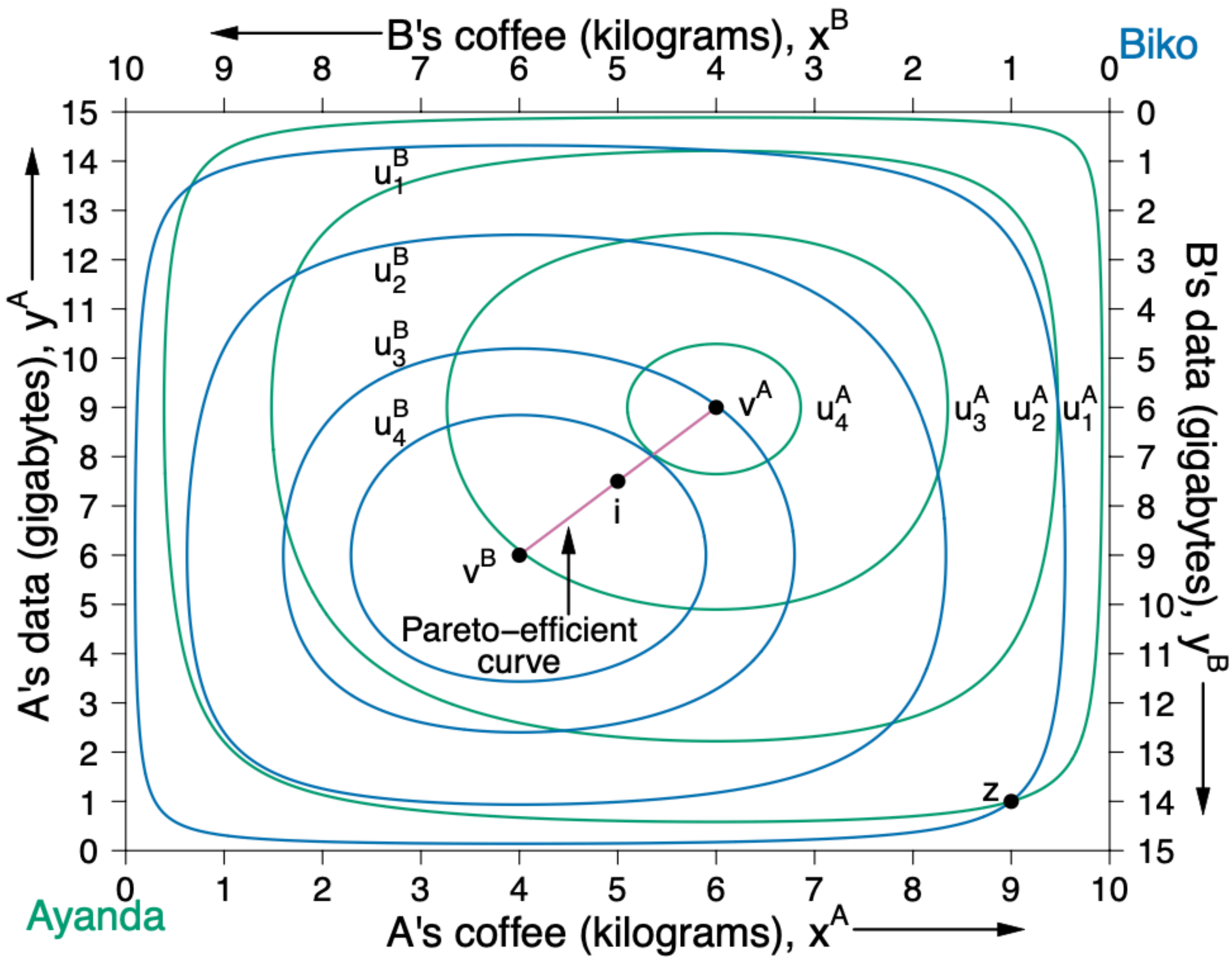
(a) Altruistic Ayanda's indifference curves


B’s coffee (kg.), x^B
A’s data (giga), y^A
B’s data (giga), y^B
A’s coffee (kg.), x^A
u_1^B
u_2^B
u_3^B
u_4^B
0 1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



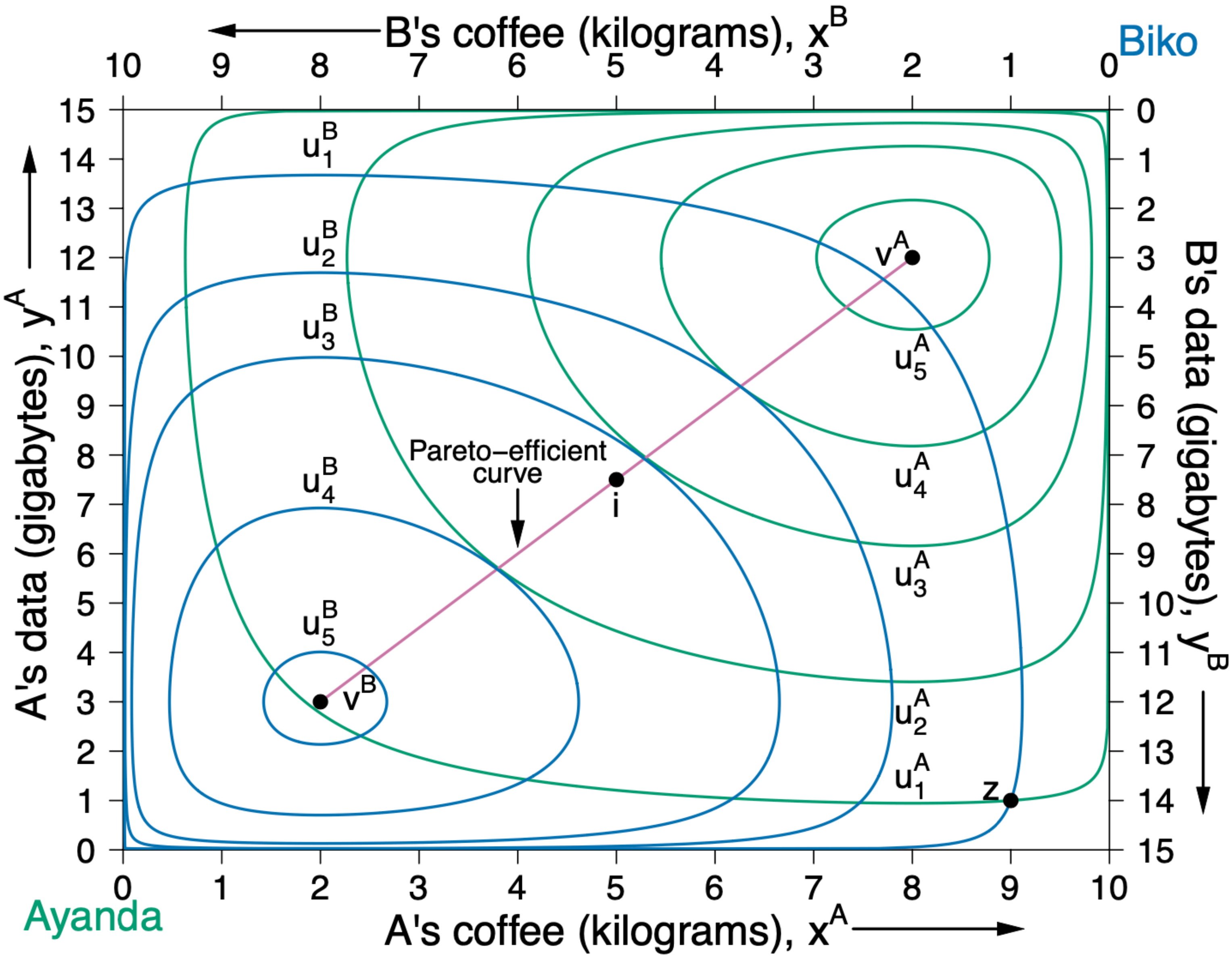
(b) Altruistic Ayanda and self-regarding Biko

- What if both A. and B. are altruistic?
- How will the Pareto-efficient curve look like?
- How does the degree of generosity (the value of parameter λ) affect the Pareto-efficient curve?



(a) More altruism ($\lambda = 0.4$)

High altruism (λ = 0.4)



(b) Less altruism ($\lambda = 0.2$)

Lower altruism (λ = 0.2)

Take-home messages:

- Altruism reduces the number of allocations that are Pareto-efficient
  - the higher the level of altruism, the shorter the Pareto-efficient curve.
- So altruism reduces the scope of conflict and increases the scope of cooperation in exchange.
- If both Ayanda and Biko were *perfectly altruistic* (λ=1), there would be only one Pareto-efficient point and it would be the 'bliss point' of both players: no conflict at all.

Conclusions

- We some possible rules to govern exchange, and we saw that they produce very different outcomes in terms of efficiency and fairness.
- A central planner ('Impartial Spectator') can impose an efficient allocation
  - independent on the initial endowment but reflecting a politically-determined social criterion;
  - But central planner needs to have a great deal of information! (mrs of all players)
- With private property, power and initial endowments determine the outcome
  - Can be efficient or not.
  - Can often be unequal;
- *Altruism* can reduce the scope of conflict over distribution and decrease inequality;