

Labor Productivity and Comparative Advantage: The Ricardian Model

Krugman, Chapter 3

Topics

- Comparative advantage
- CA: Simple model
- CA with many goods
- CA with frictional cost
- Empirical Evidences

Comparative Advantage

Opportunity Cost

- Definition: Benefit from alternative choice
- Example: If a country A can produce m units of product X instead of n units of product Y
 \Rightarrow OC of product X is n/m units of Y
- OC of product Y: m/n units of X

Comparative Advantage

- A country has a **comparative advantage** in producing a good if the **opportunity cost** of producing that good in terms of other goods is **lower** in that country than it is in other countries.

	Million Roses	Thousand Computers
United States	-10	+100
Colombia	+10	-30

TABLE 3-1

Hypothetical Changes in Production

	Million Roses	Thousand Computers
United States	-10	+100
Colombia	+10	-30
Total	0	+70

Opportunity Costs	Roses (M)	Computers (k)
USA	10k Computers	1/10 M Roses
Colombia	3k Computers	1/3 M Roses

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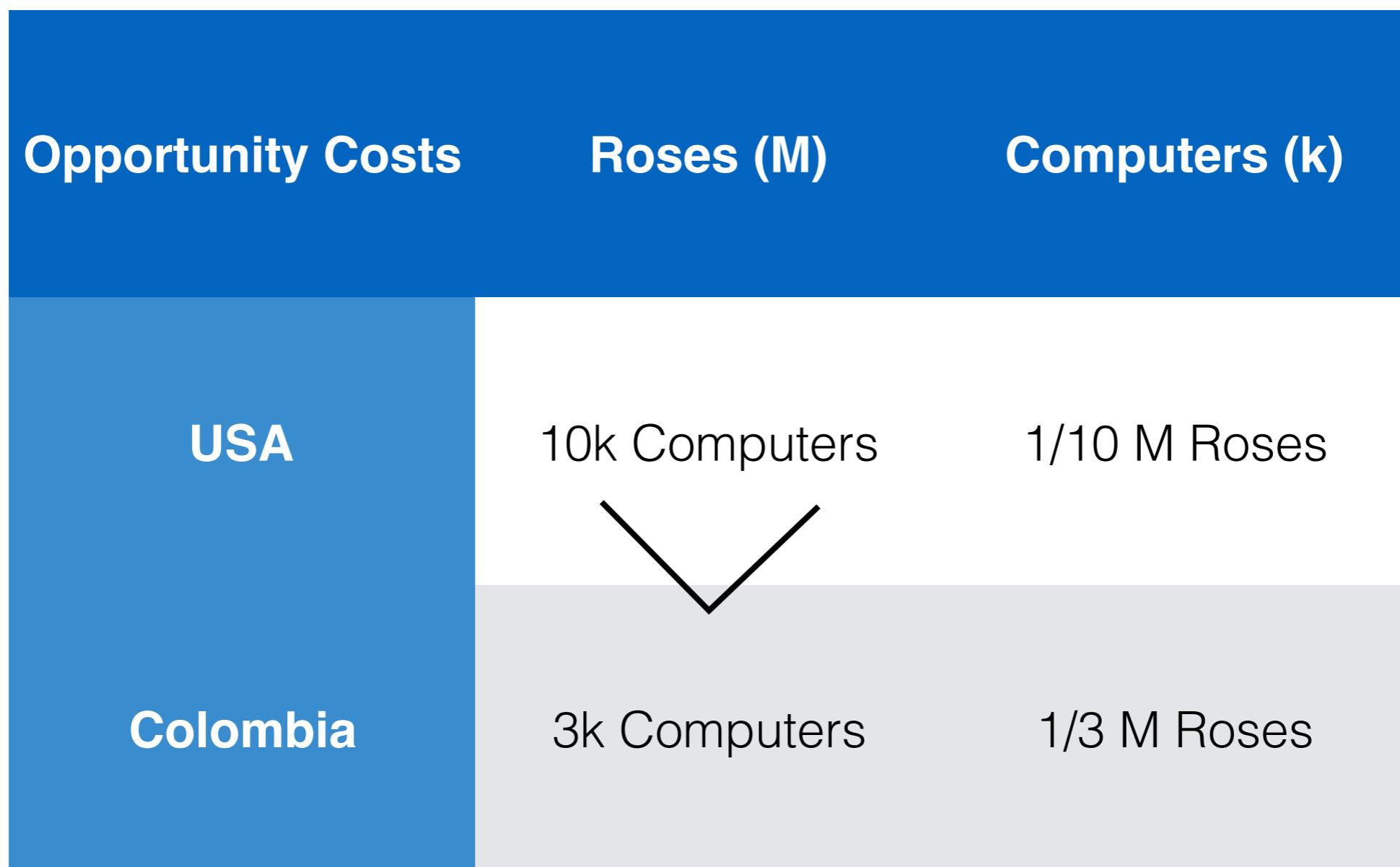


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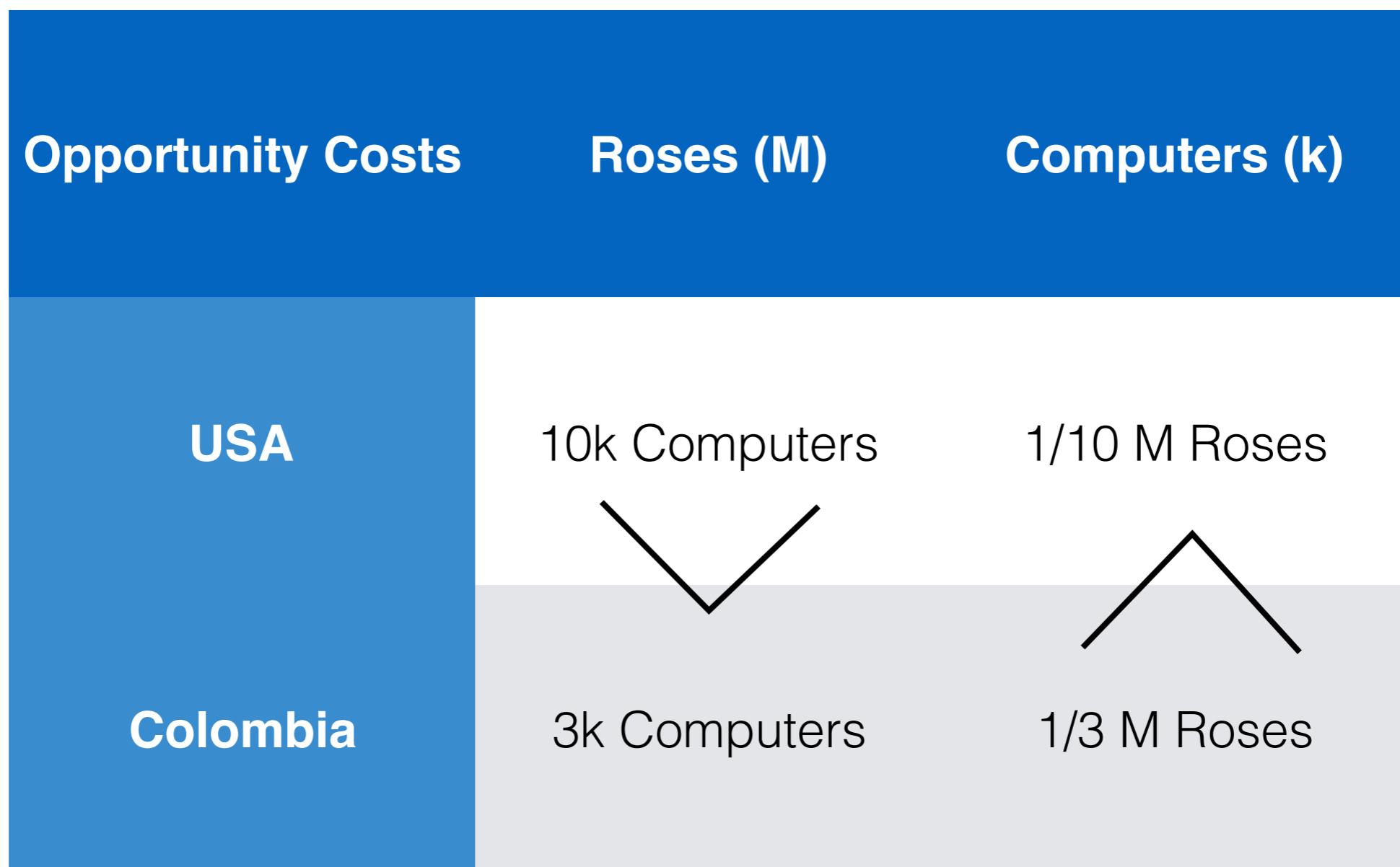


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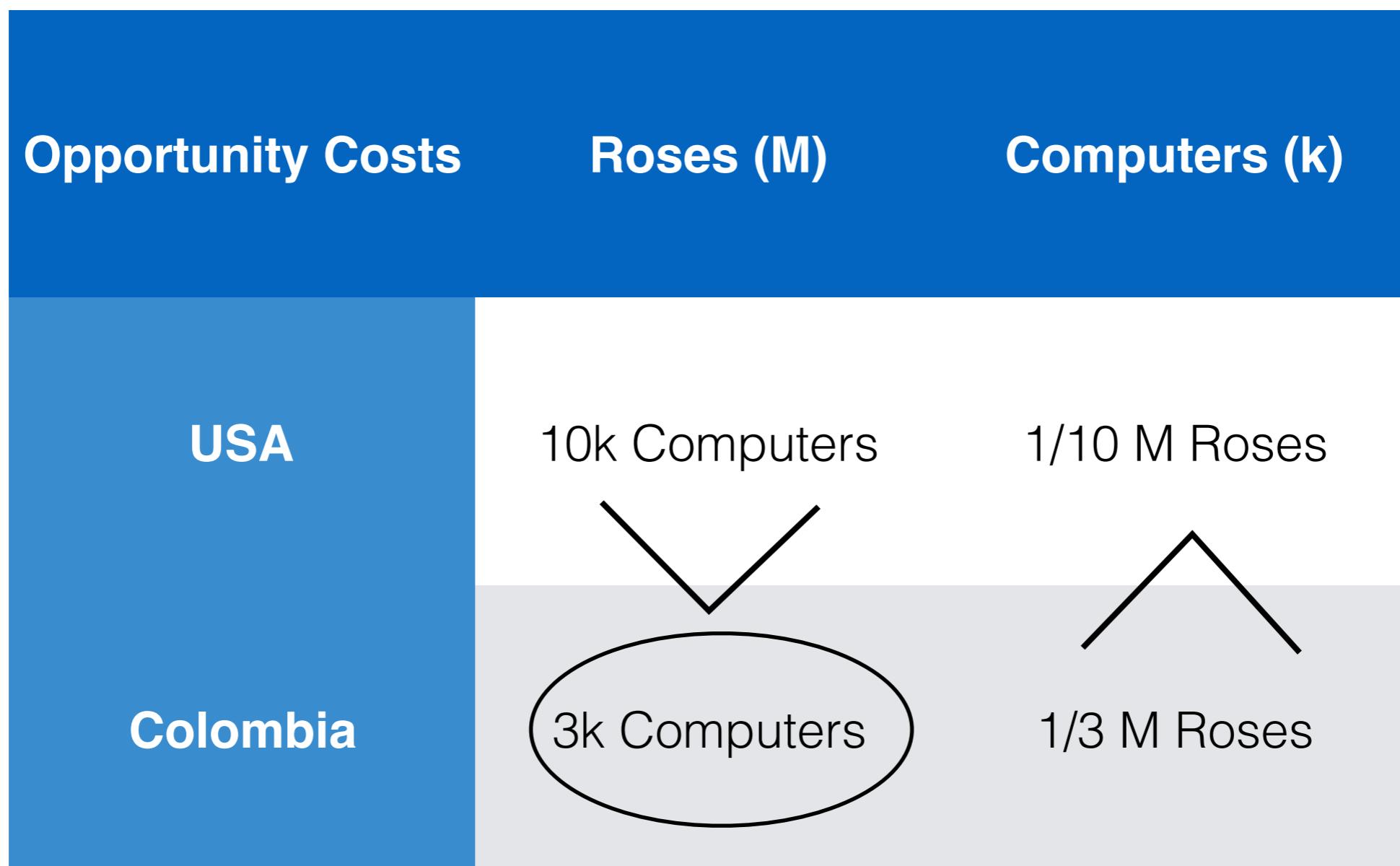


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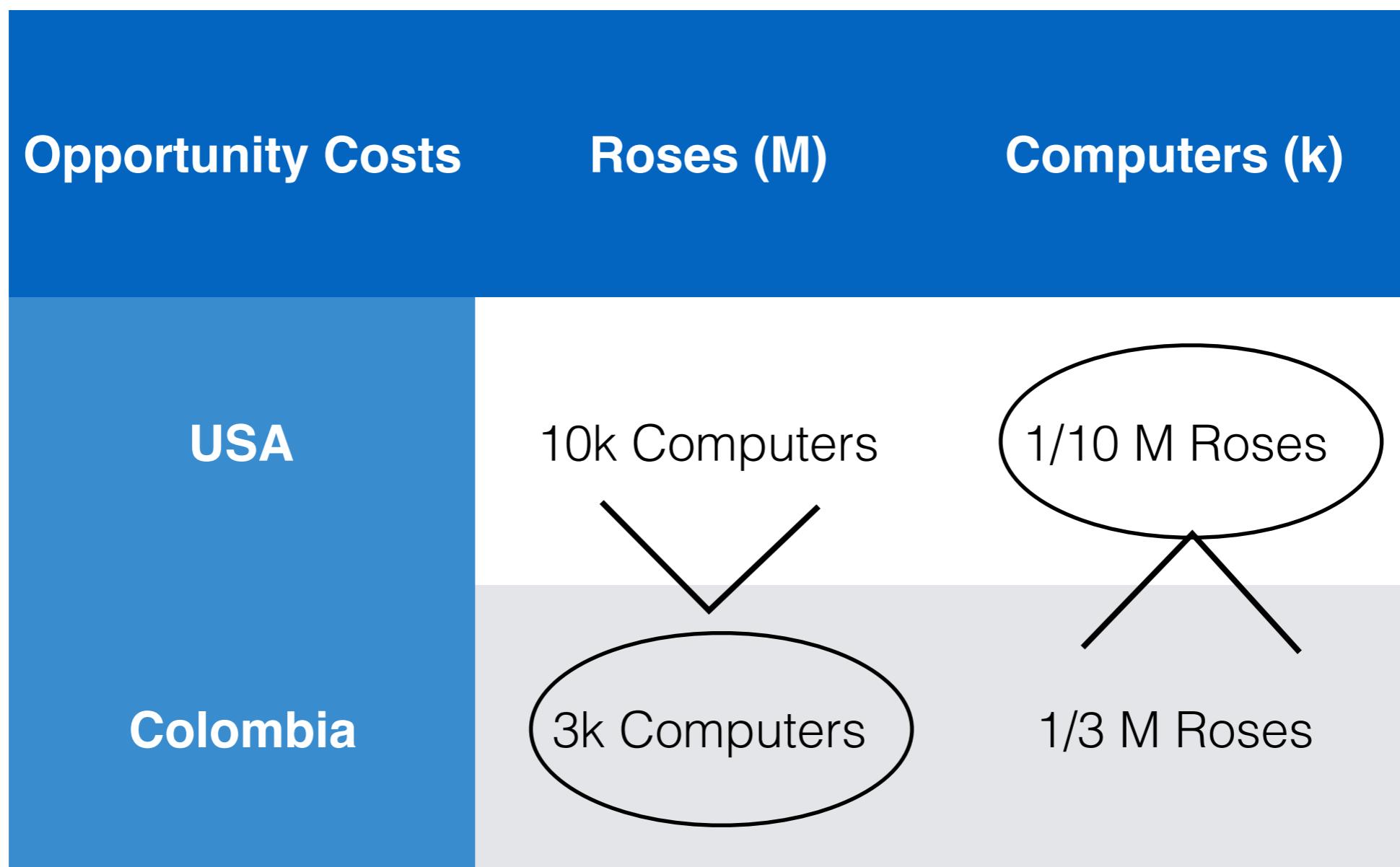


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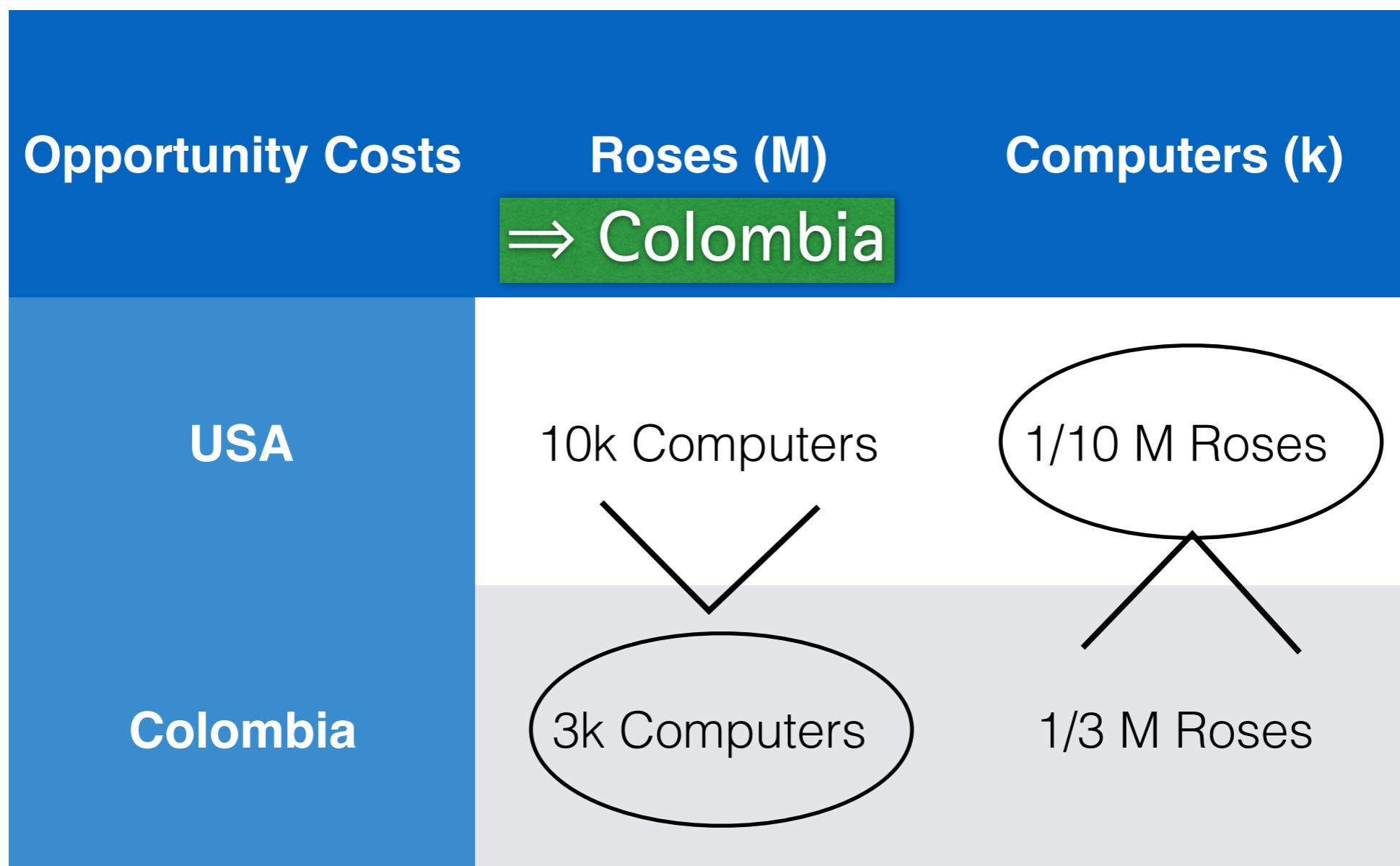
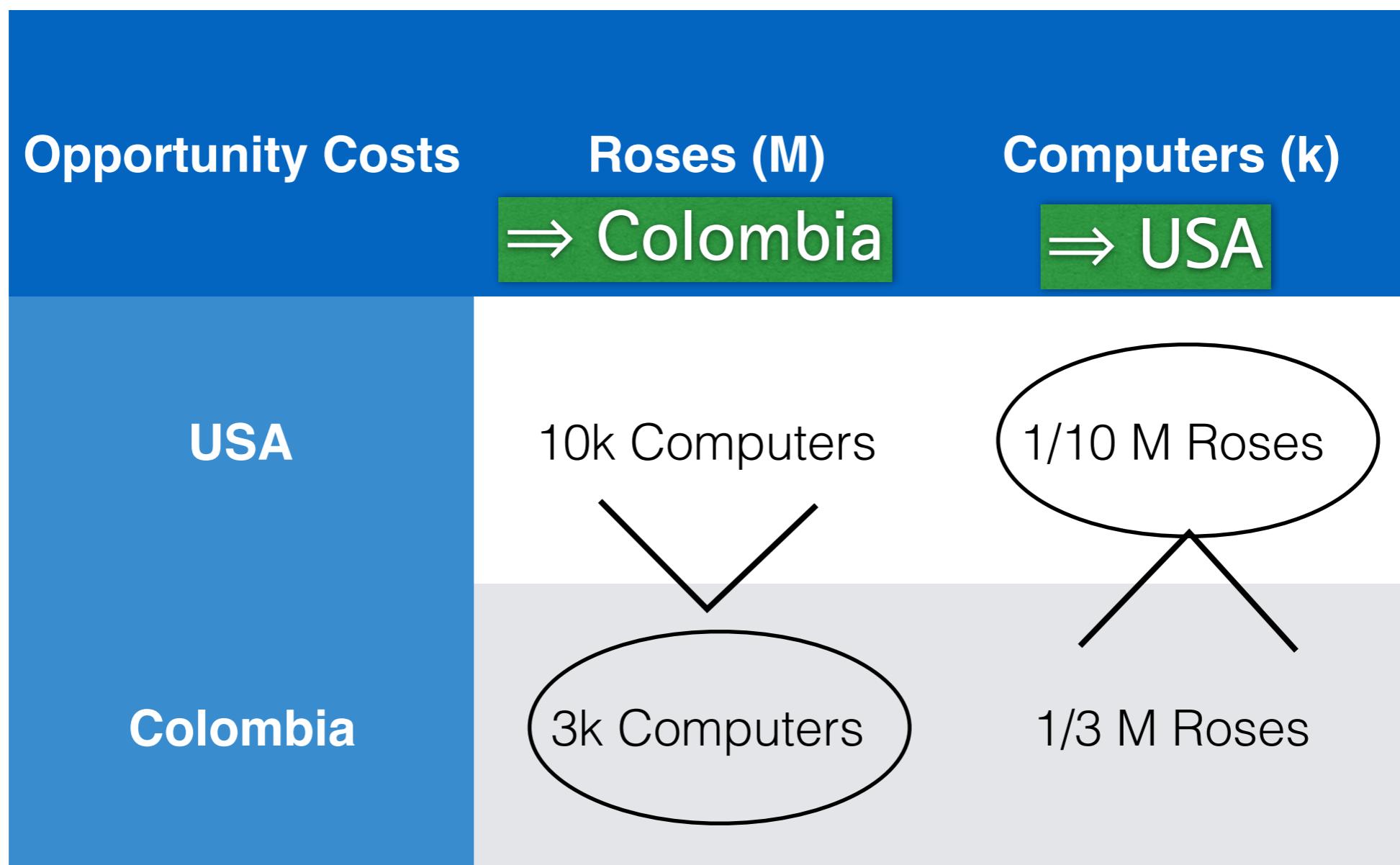


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Simple Model: A One-Factor Economy

Basic Settings and Notation

- A country: Home
- Only ONE factor of production: [labor]
- Only TWO goods: [wine] and [cheese]
- [unit labor requirement]
:= [labor required] / [goods to produce]
 $a_{LW} := L_W/Q_W$
- [labor productivity]
:= 1/[unit labor requirement]
= [goods to produce] / [labor required]
 $a_{LC} := L_C/Q_C$

$$L \leq L_W + L_C$$

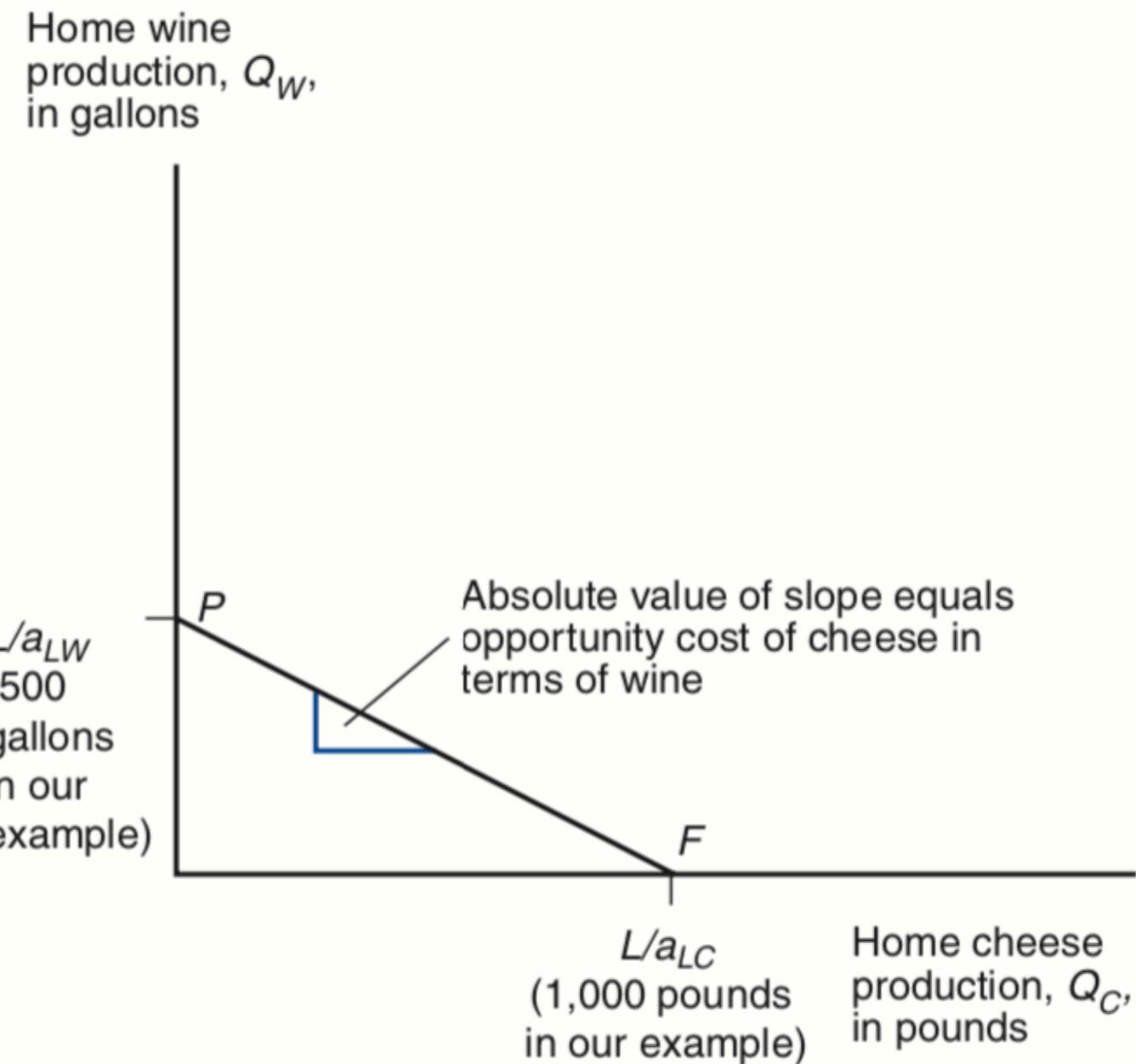
$$a_{LW}, a_{LC}, Q_W, Q_C$$

Production Possibility Frontier (PPF)

FIGURE 3-1

Home's Production Possibility Frontier

The line PF shows the maximum amount of cheese Home can produce given any production of wine, and vice versa.

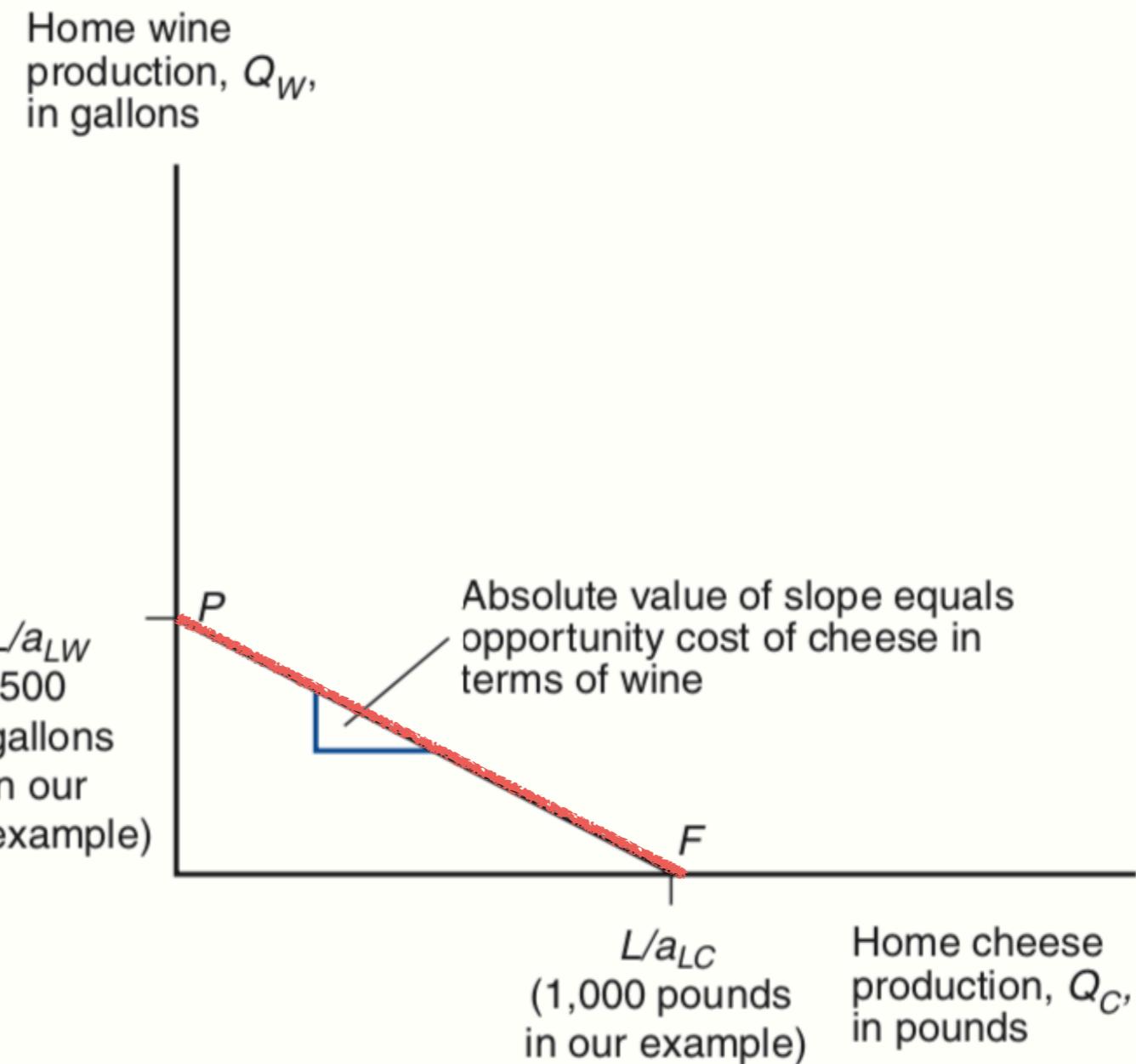


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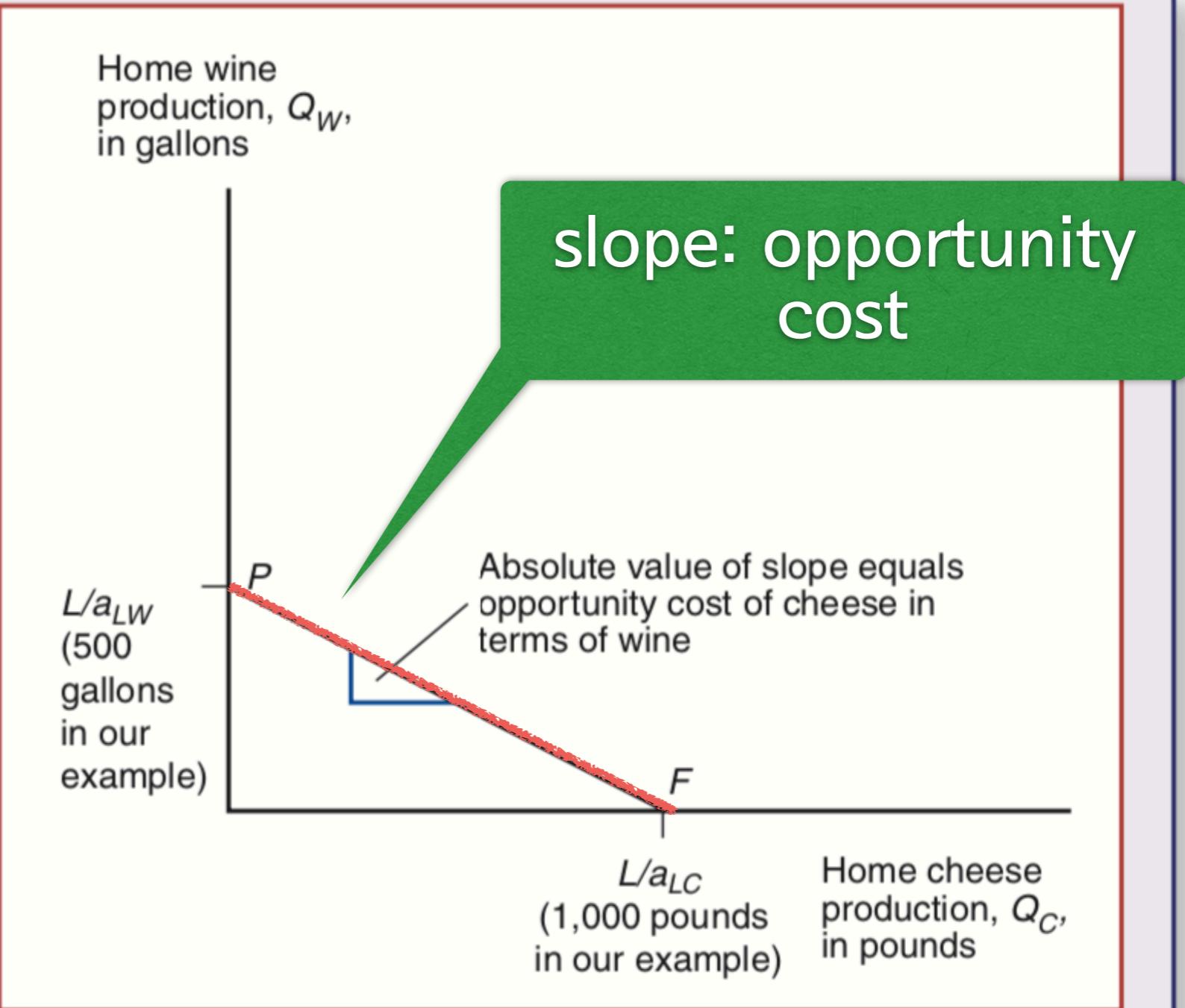


Production Possibility Frontier (PPF)

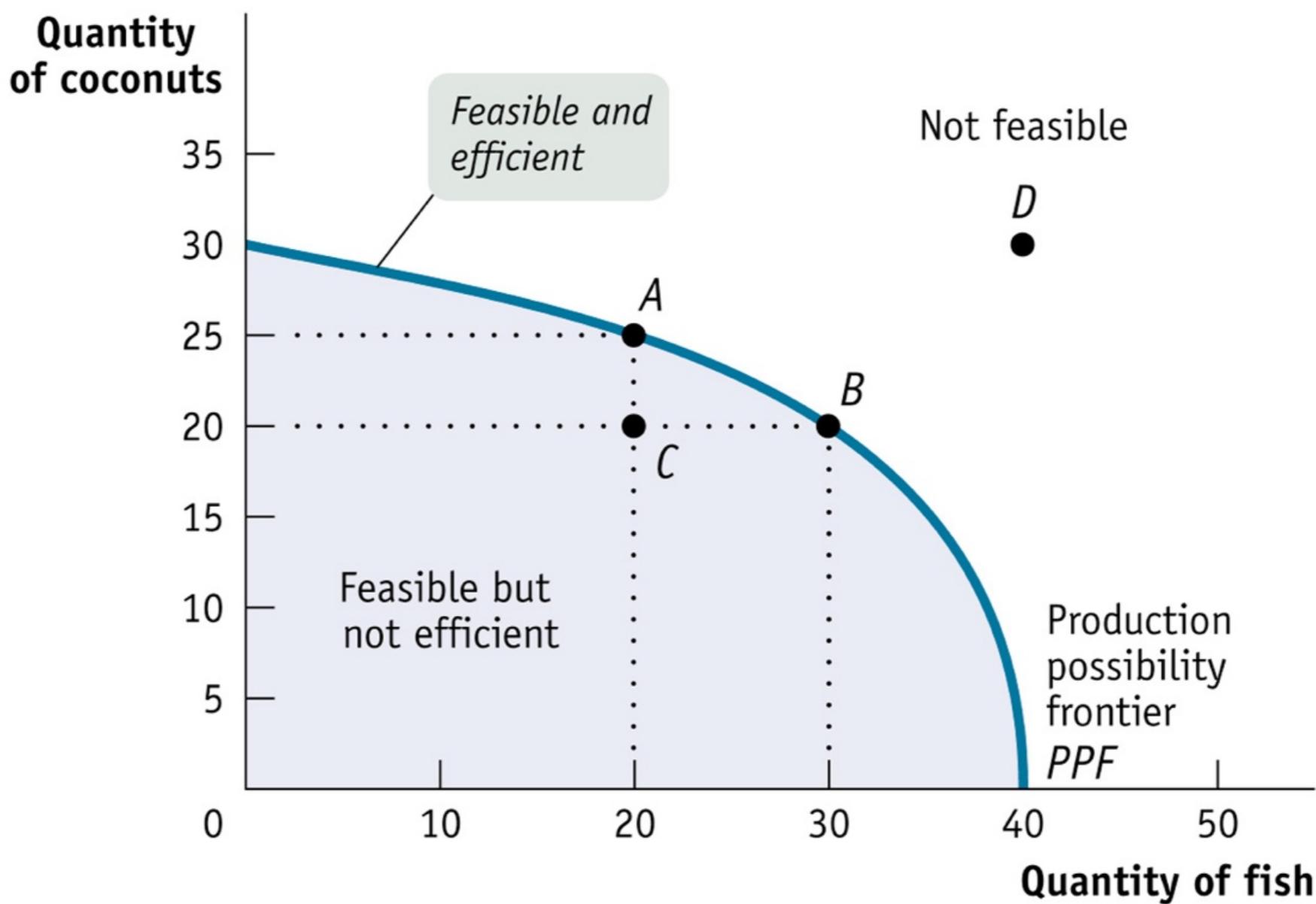
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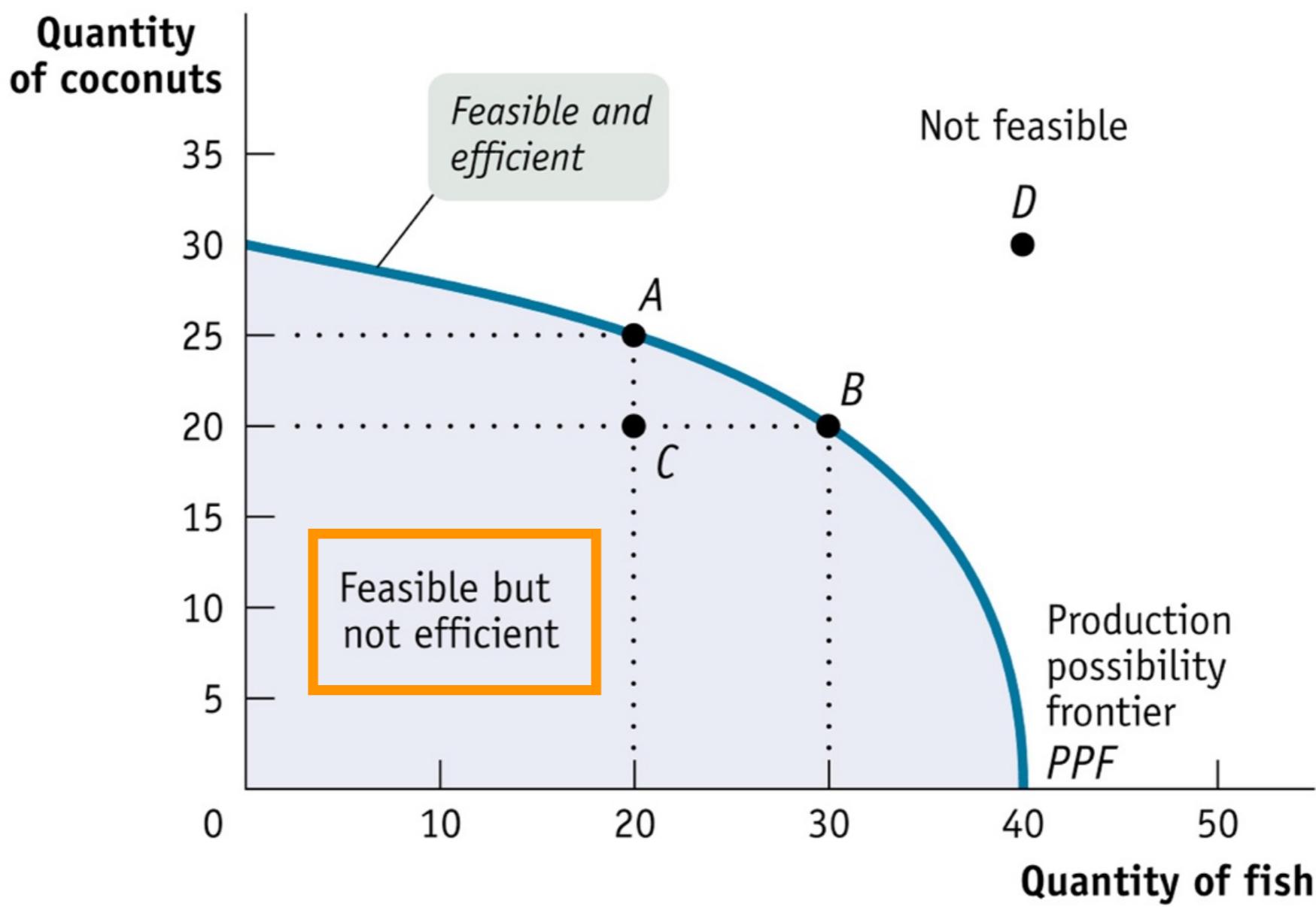
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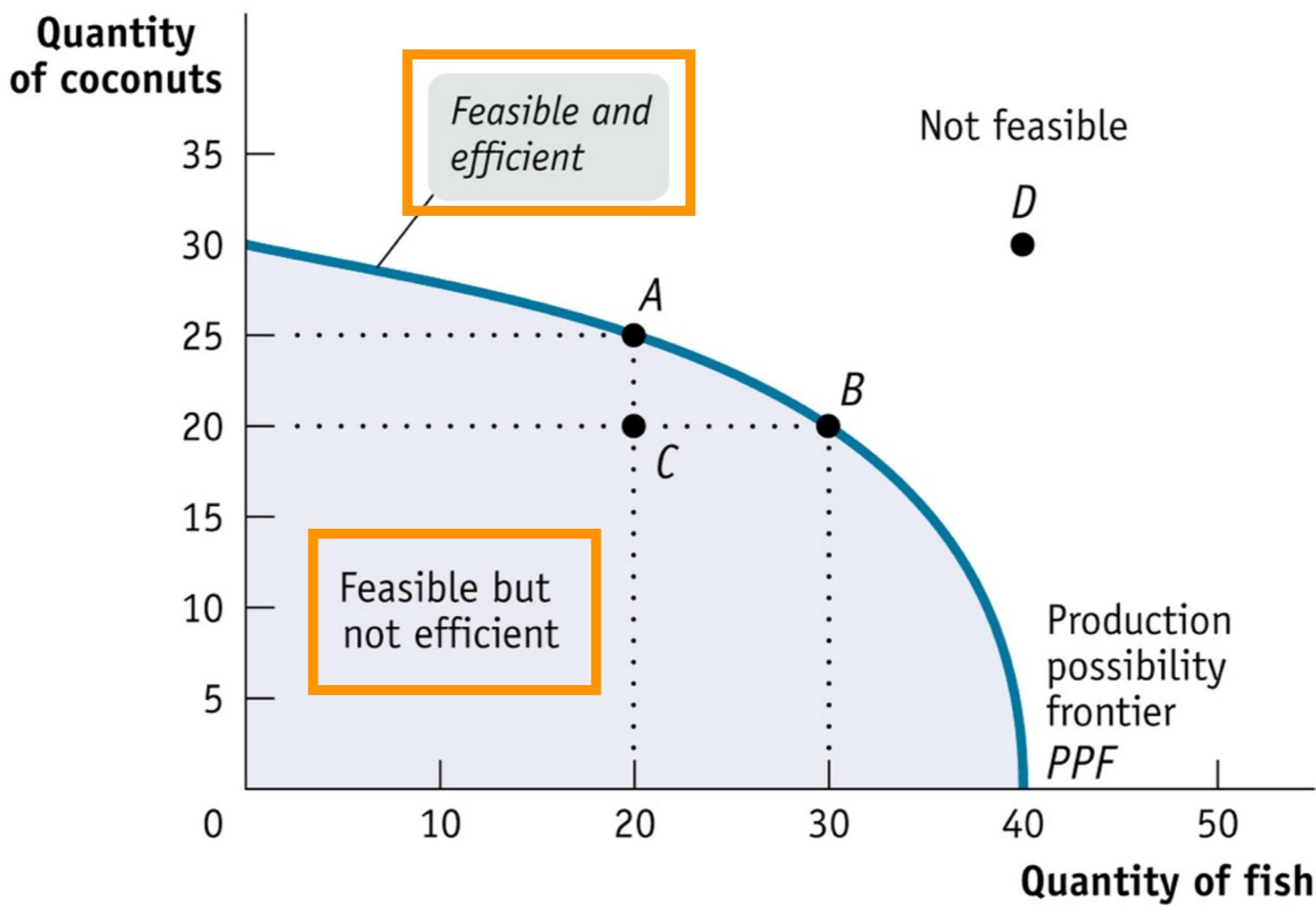
More Realistic PPF



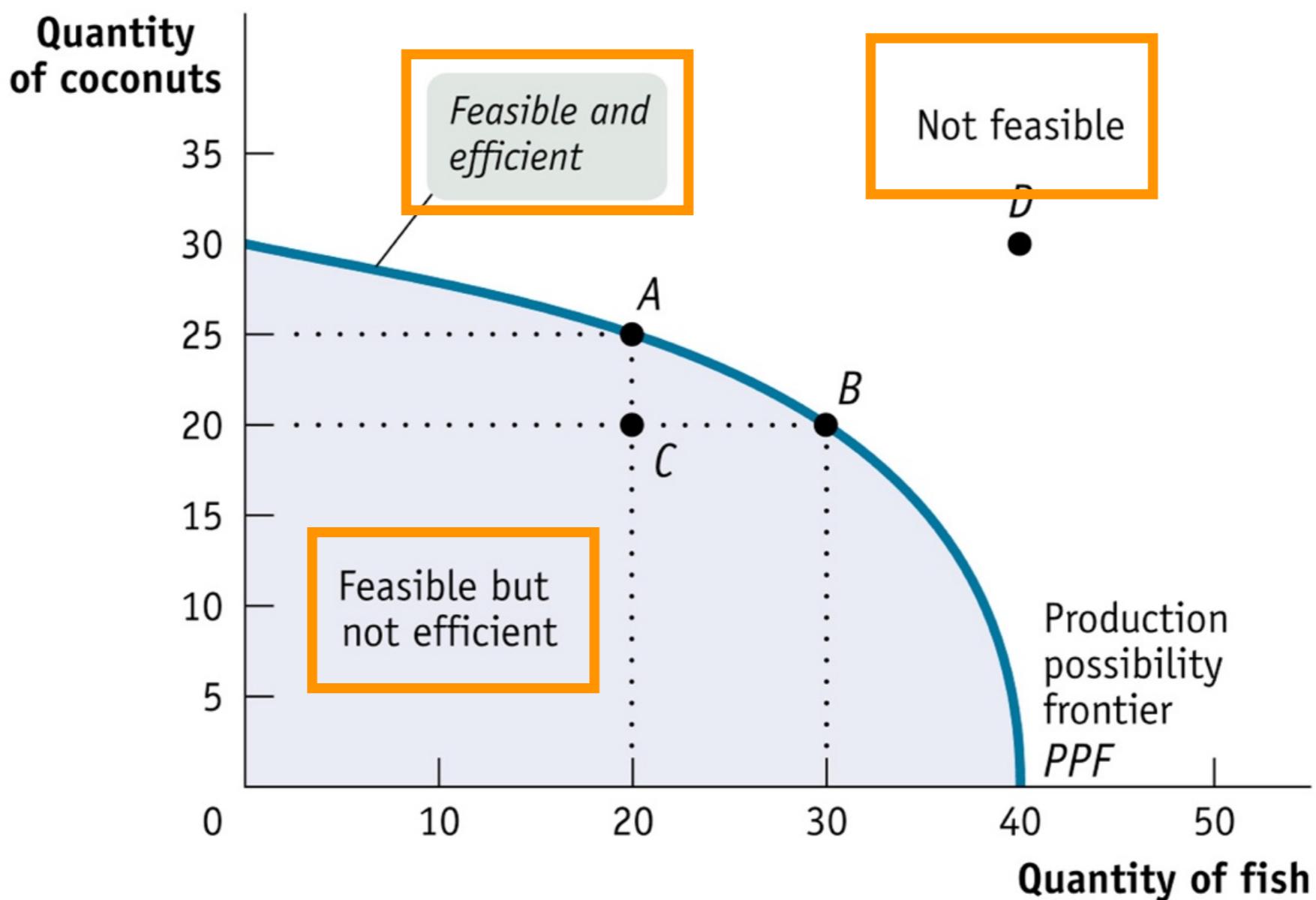
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More Realistic PPF



Eq 3-1

- $a_{LW} := L_W/Q_W$
- $a_{LC} := L_C/Q_C$
- $L_W + L_C \leq L$
- $\therefore a_{LC}Q_C + a_{LW}Q_W \leq L.$
- OC of wine = | slope of PPFw | = a_{LC}/a_{LW}

Price P_W , P_C

- Value of Q_W of Wine = $P_W Q_W$
- ONE Hour's labor (wine) → $1/a_{LW}$ of wine
- Value of 1H labor (wine) = P_W/a_{LW} = Hourly wage of wine industry (W_W)
- P_C/a_{LC} = Hourly wage of cheese industry (W_C)

Three Cases

- Works prefer higher wage
- $W_C > W_W \Rightarrow P_C/a_{LC} > P_W/a_{LW} \Rightarrow P_C/P_W > a_{LC}/a_{LW}$ = slope of PPF \Rightarrow Workers prefer cheese industry
- $W_C < W_W \Rightarrow$ workers prefer wine industry
- $W_W = W_C \Rightarrow$ workers prefer BOTH industries

Comparative Advantage

- $P_C/P_W > a_{LC}/a_{LW} \Rightarrow$ Concentrate on cheese
- LHS: relative price of cheese i.t.o. wine
- RHS: opportunity cost of cheese i.t.o. wine
- Commodity A's Relative price > A's OC \Rightarrow Concentrate on A: Comparative advantage
- In the absence of international trade, the relative prices of goods are equal to their relative unit labor requirements.

Trade in a One-Factor World

Model Setting

- Two countries:[Home] and [Foreign]
- Home: L, a_{LW}, a_{LC}
- Foreign: L^*, a_{LW}^*, a_{LC}^*
- Home has a comparative advantage on cheese if:
 - $a_{LC}/a_{LW} < a_{LC}^*/a_{LW}^*$ or,
 - $a_{LC}/a_{LC}^* < a_{LW}/a_{LW}^*$
- We assume $a_{LC}/a_{LW} < a_{LC}^*/a_{LW}^*$

Absolute Advantage

- High a_L implies low productivity
- Home has an absolute advantage in wine if:
 - $a_{LW} < a_{LW}^*$

Foreign's PPF

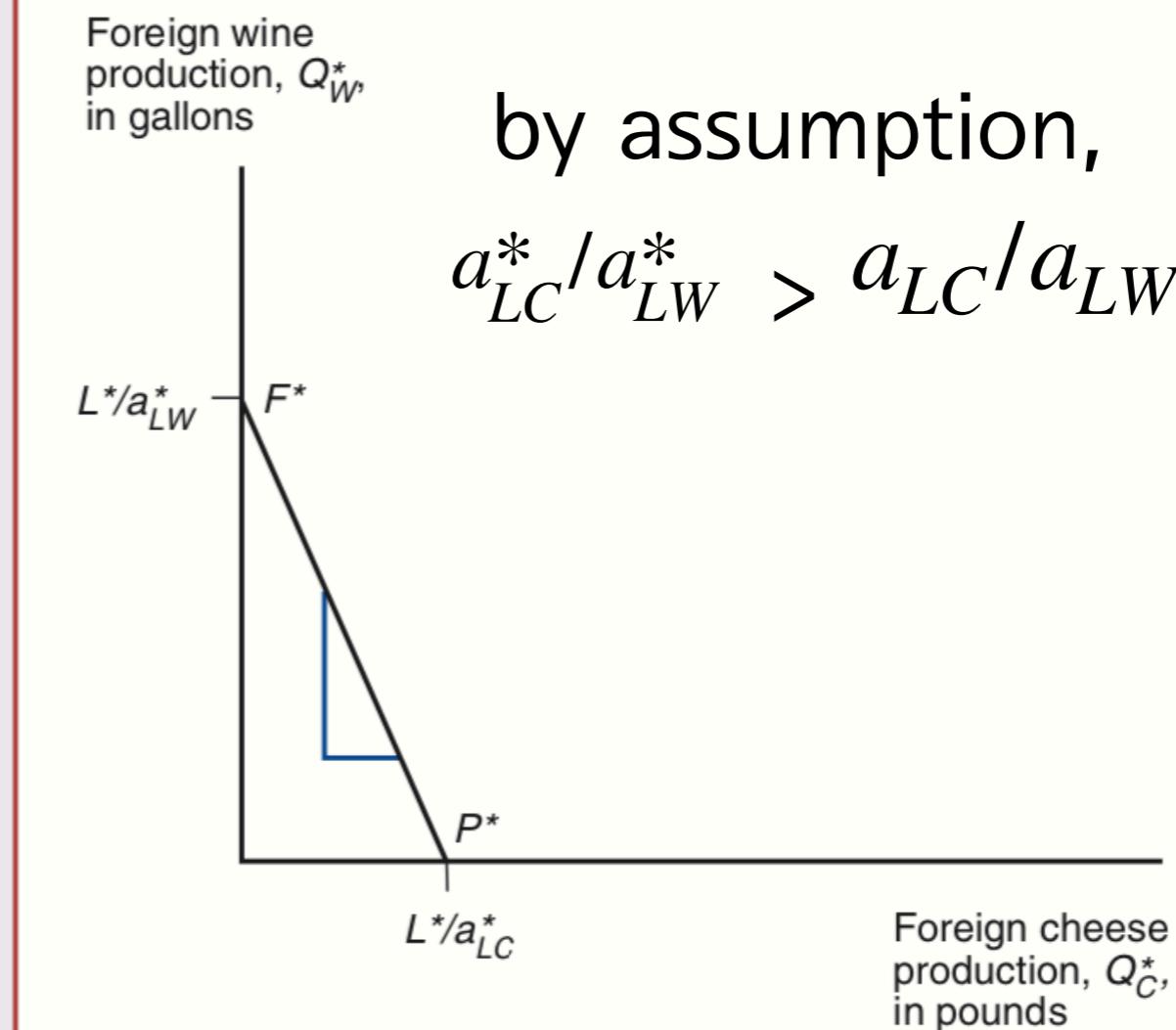
FIGURE 3-2

Foreign's Production Possibility Frontier

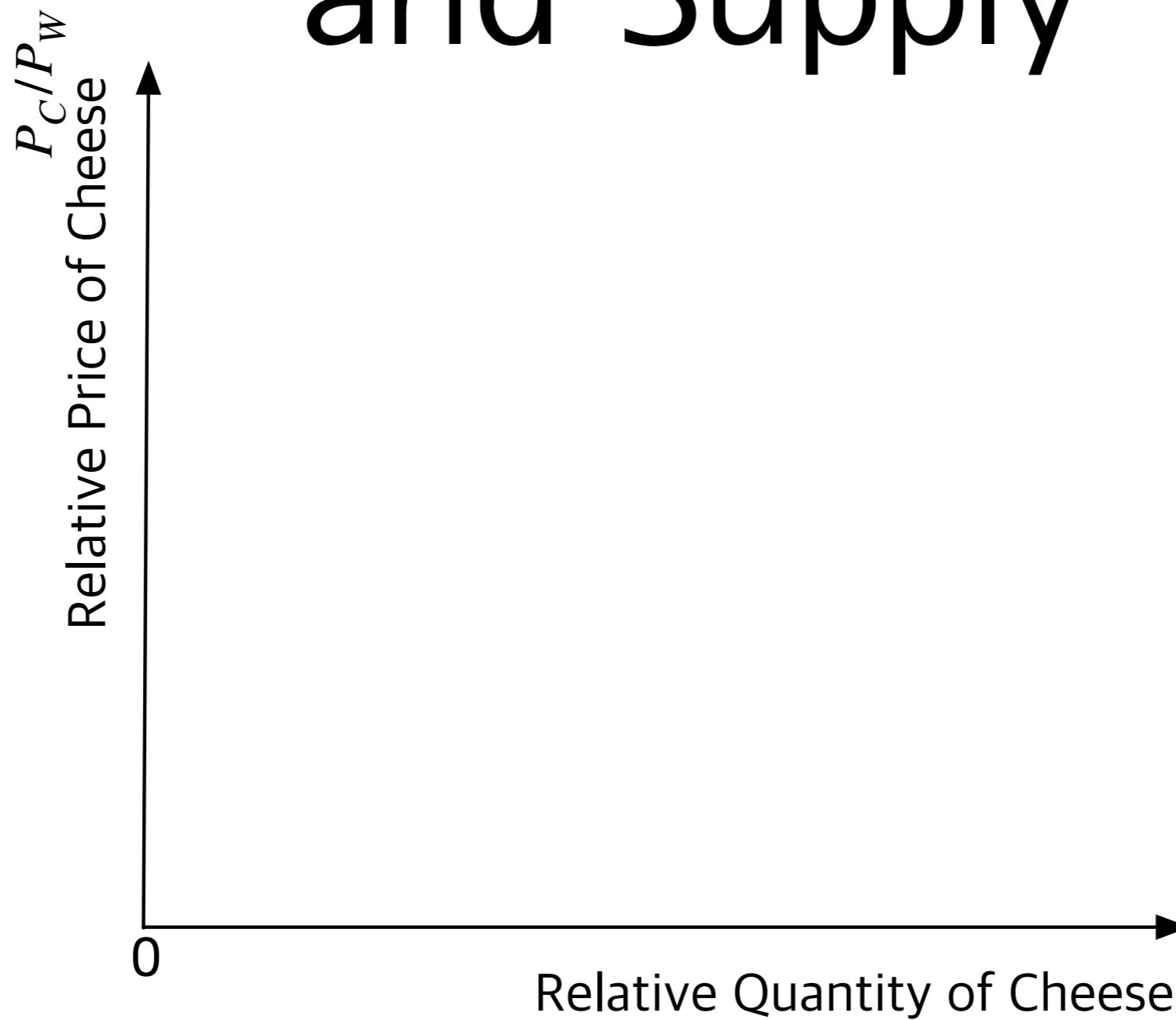
Because Foreign's relative unit labor requirement in cheese is higher than Home's (it needs to give up many more units of wine to produce one more unit of cheese), its production possibility frontier is steeper.

by assumption,

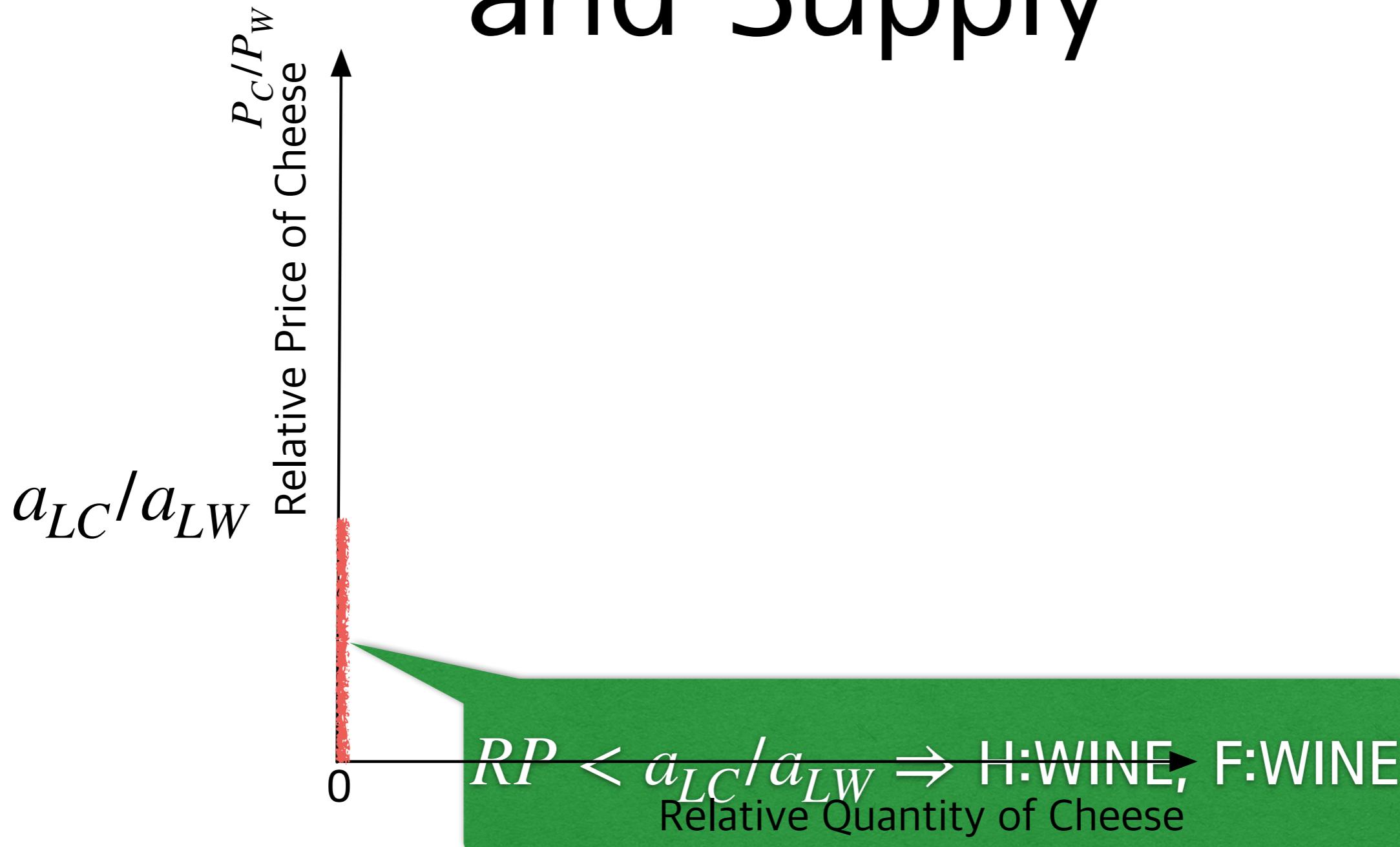
$$a_{LC}^*/a_{LW}^* > a_{LC}/a_{LW}$$



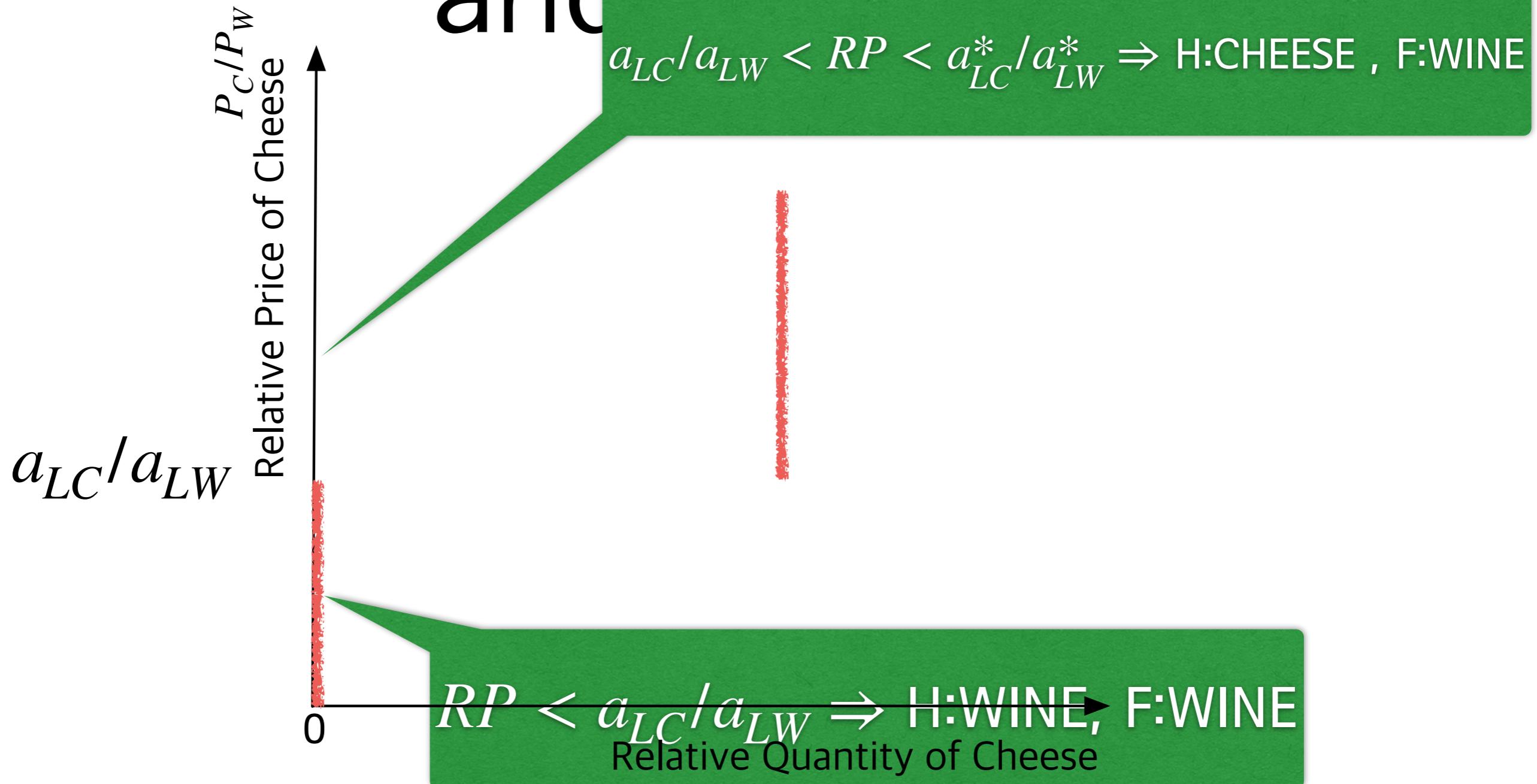
World Relative Demand and Supply



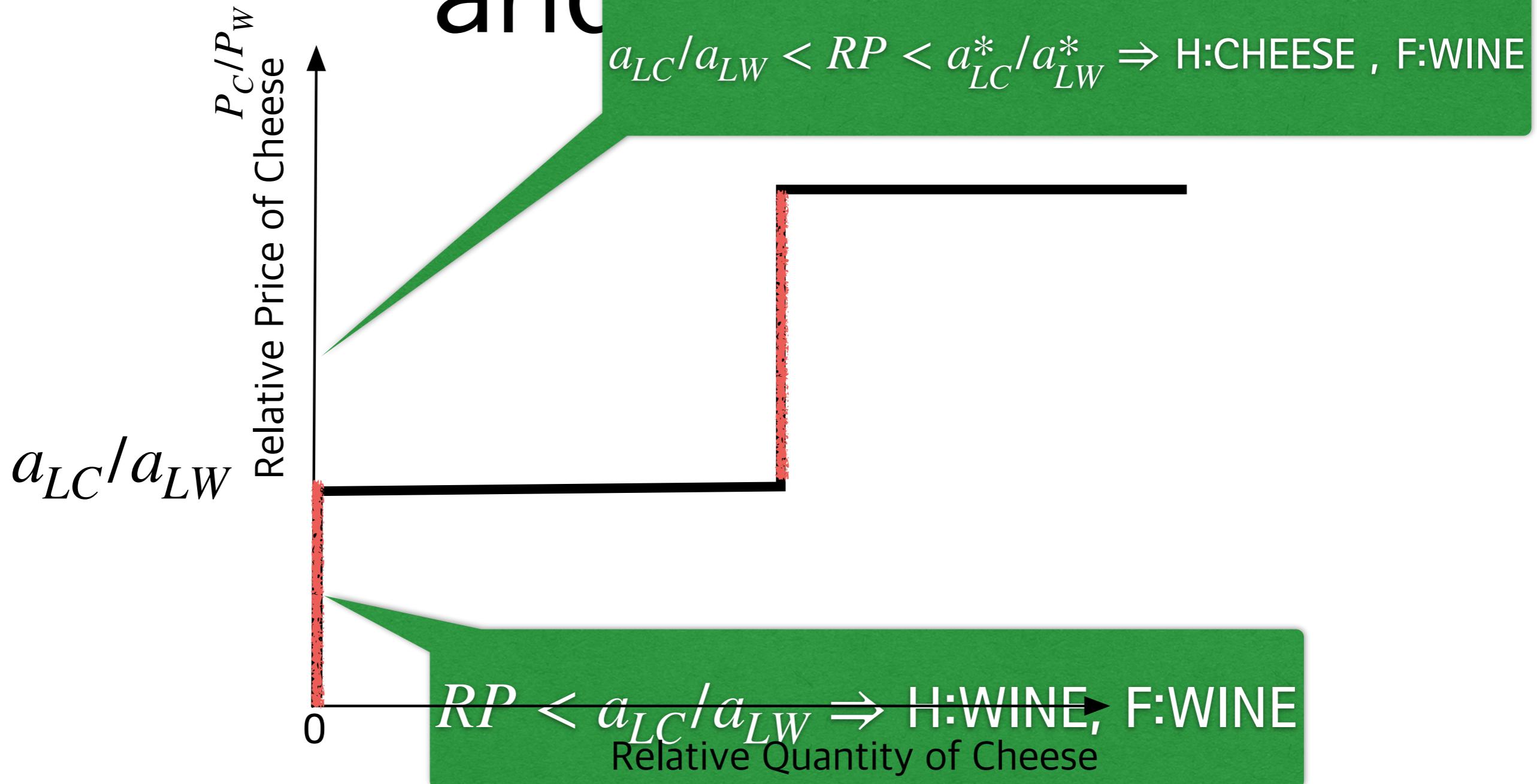
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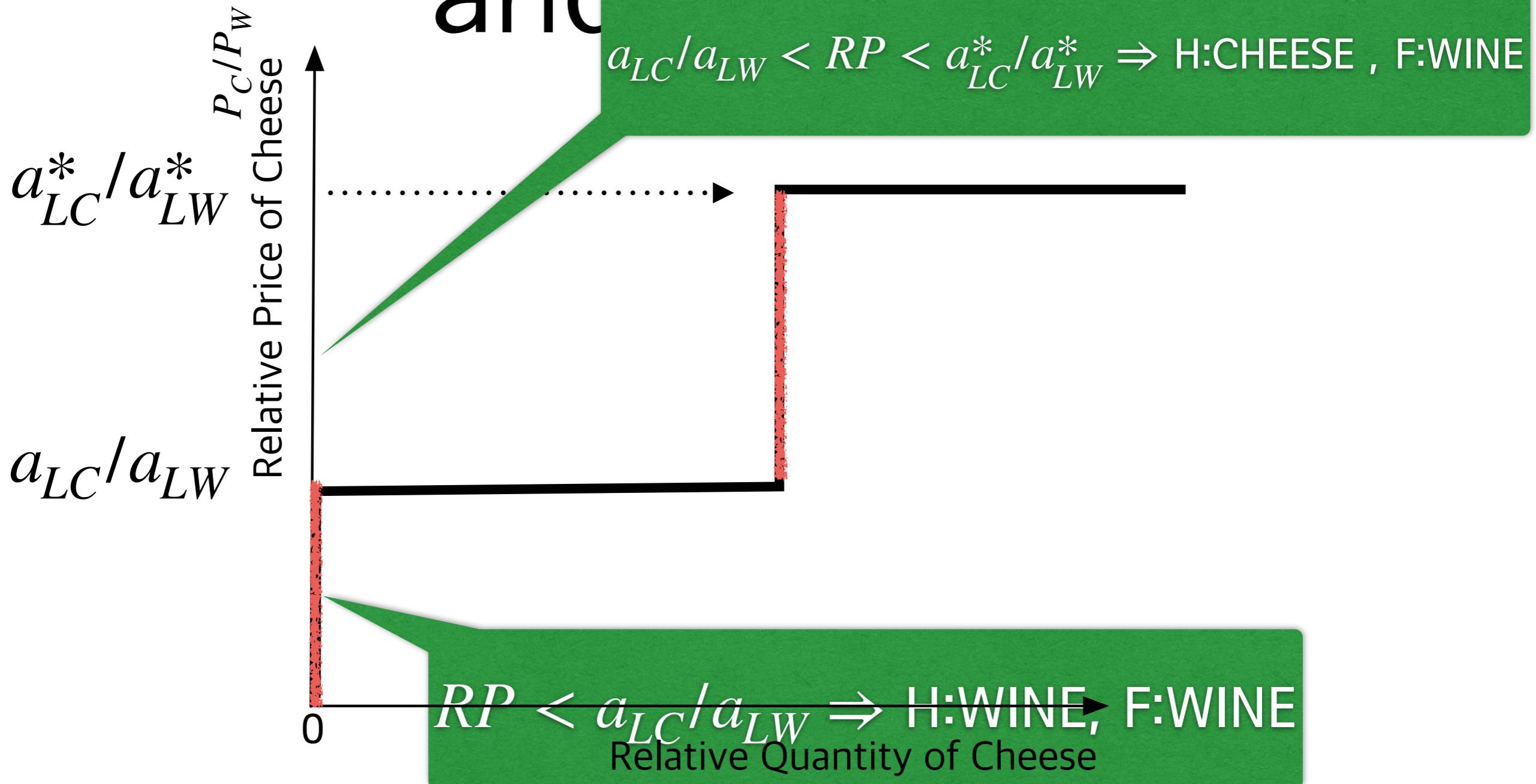
World Relative Demand and Supply Curves



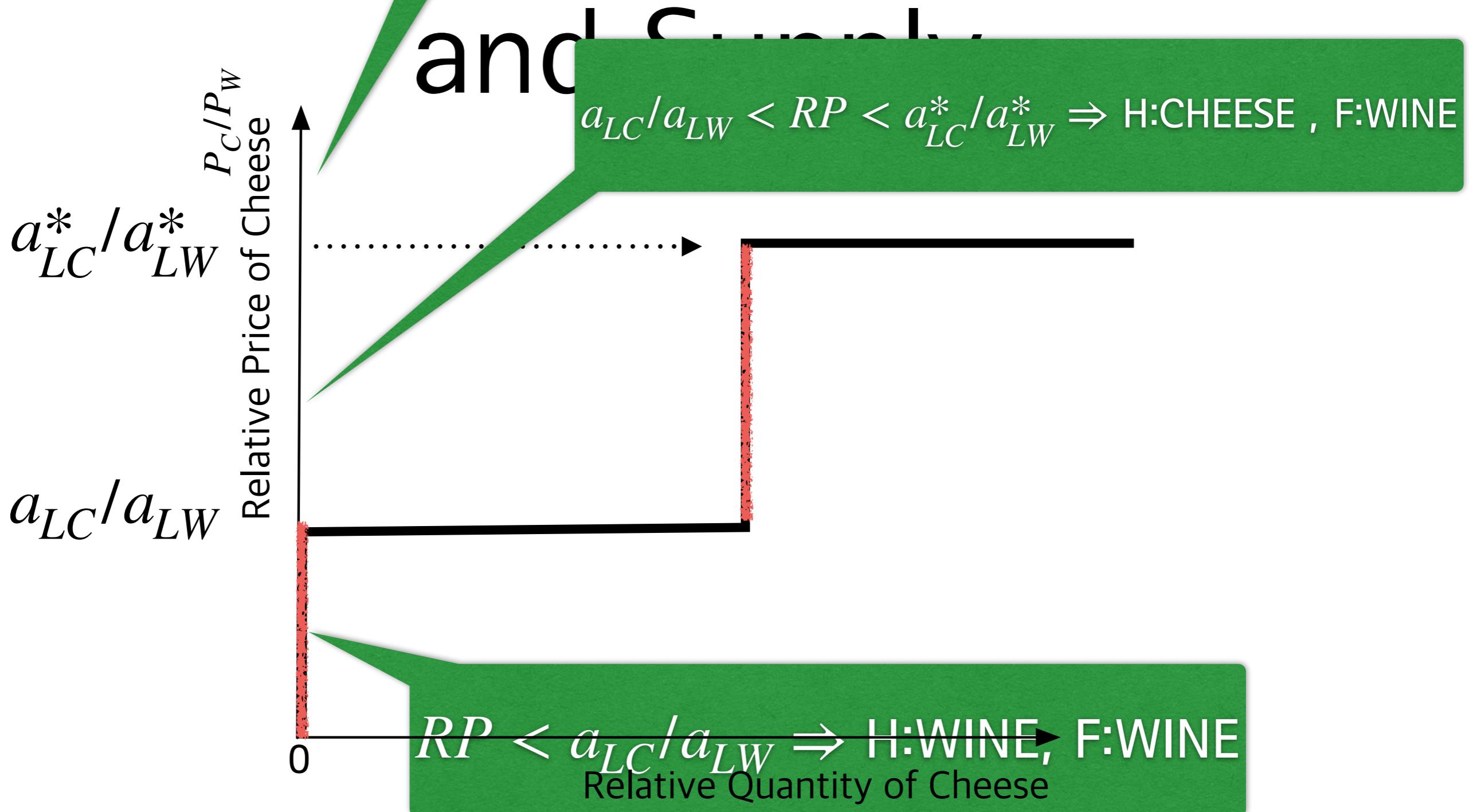
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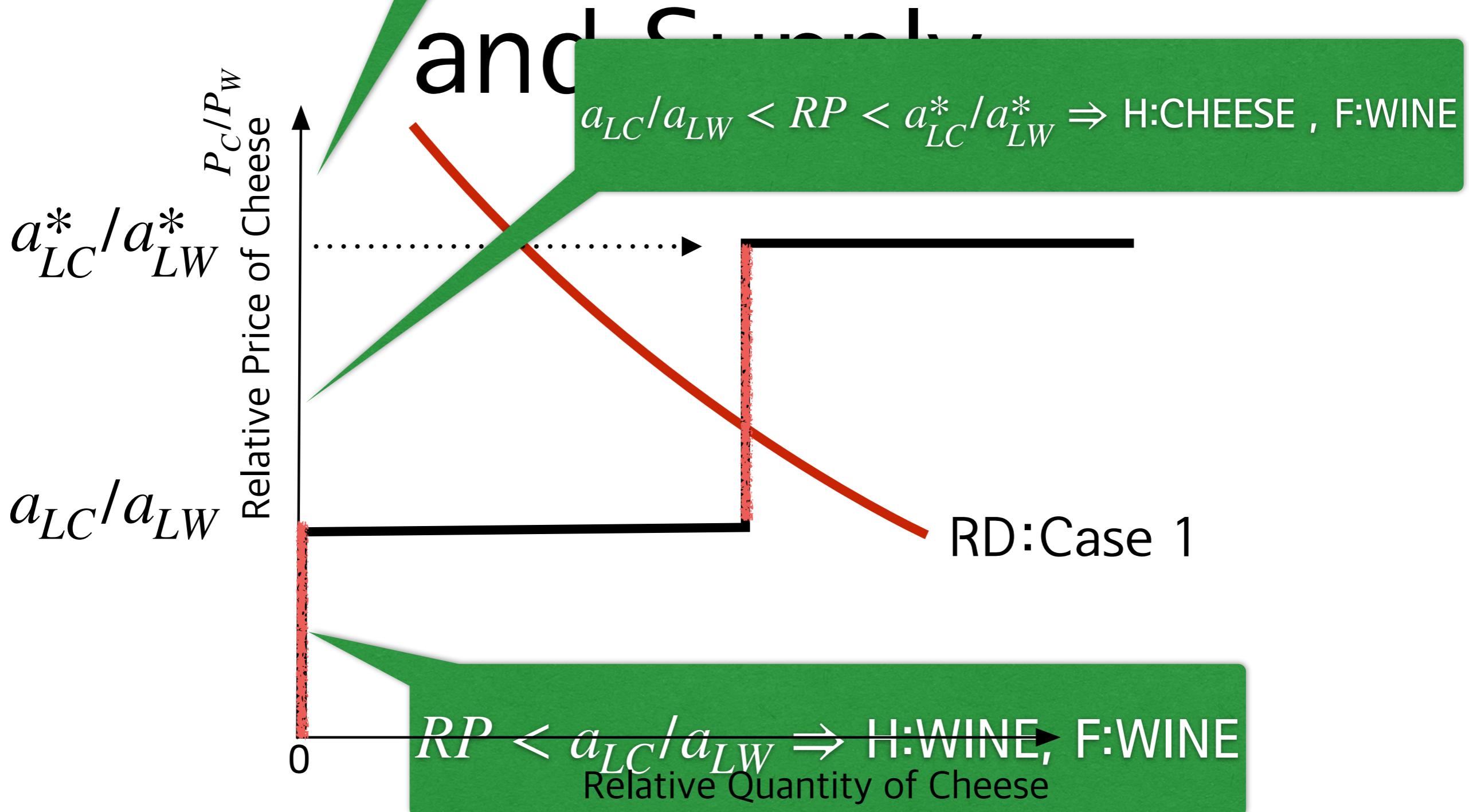
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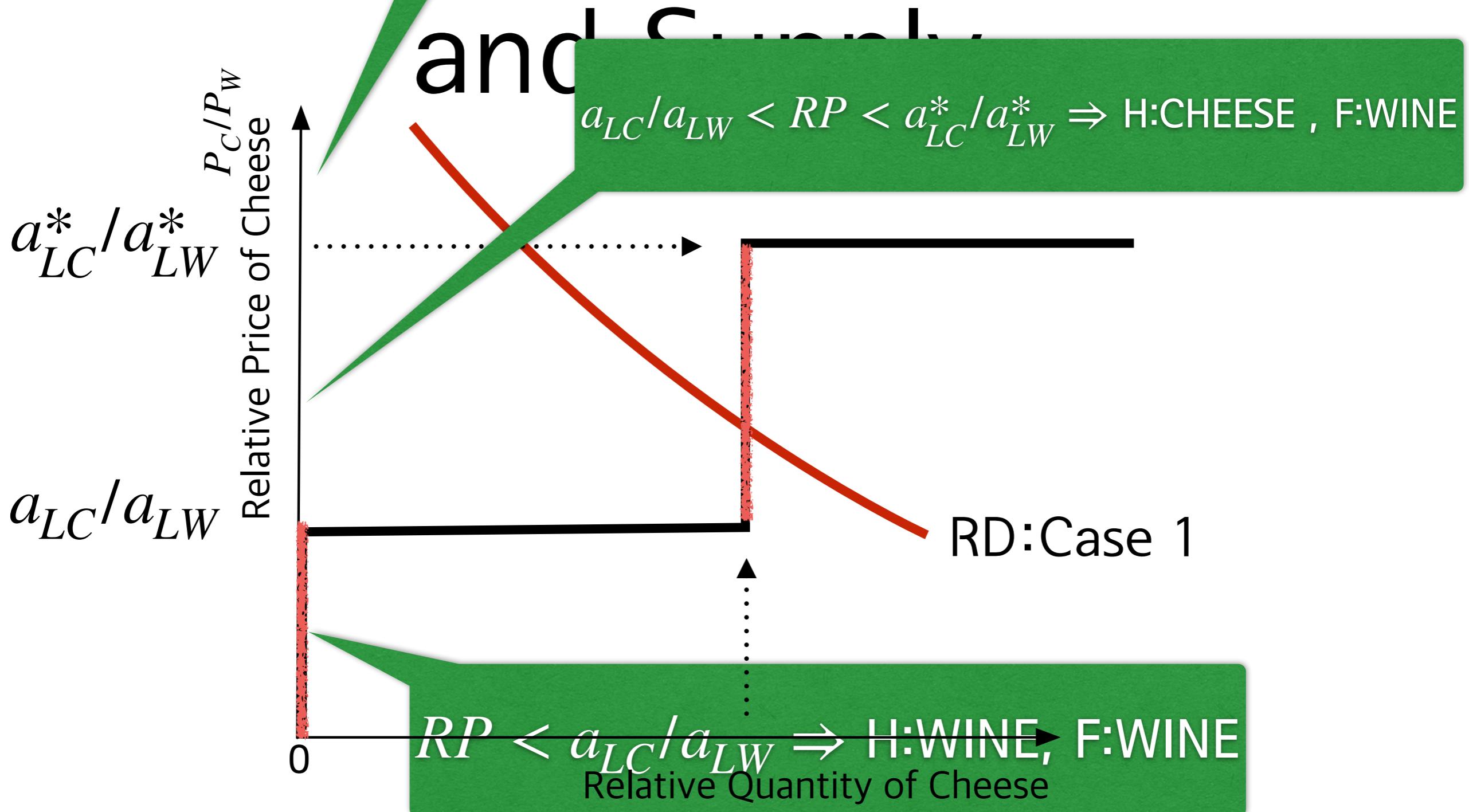
World and Supply



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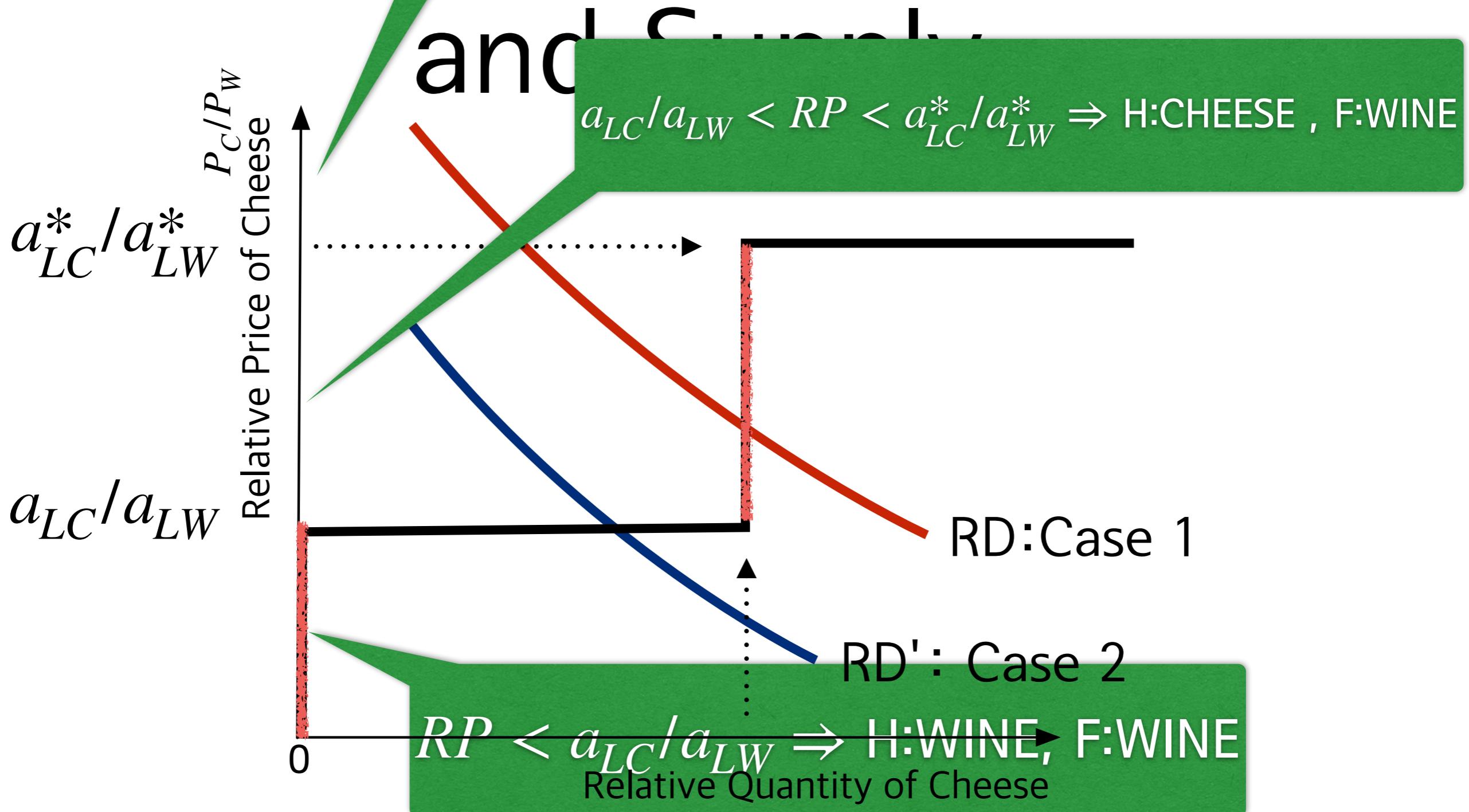


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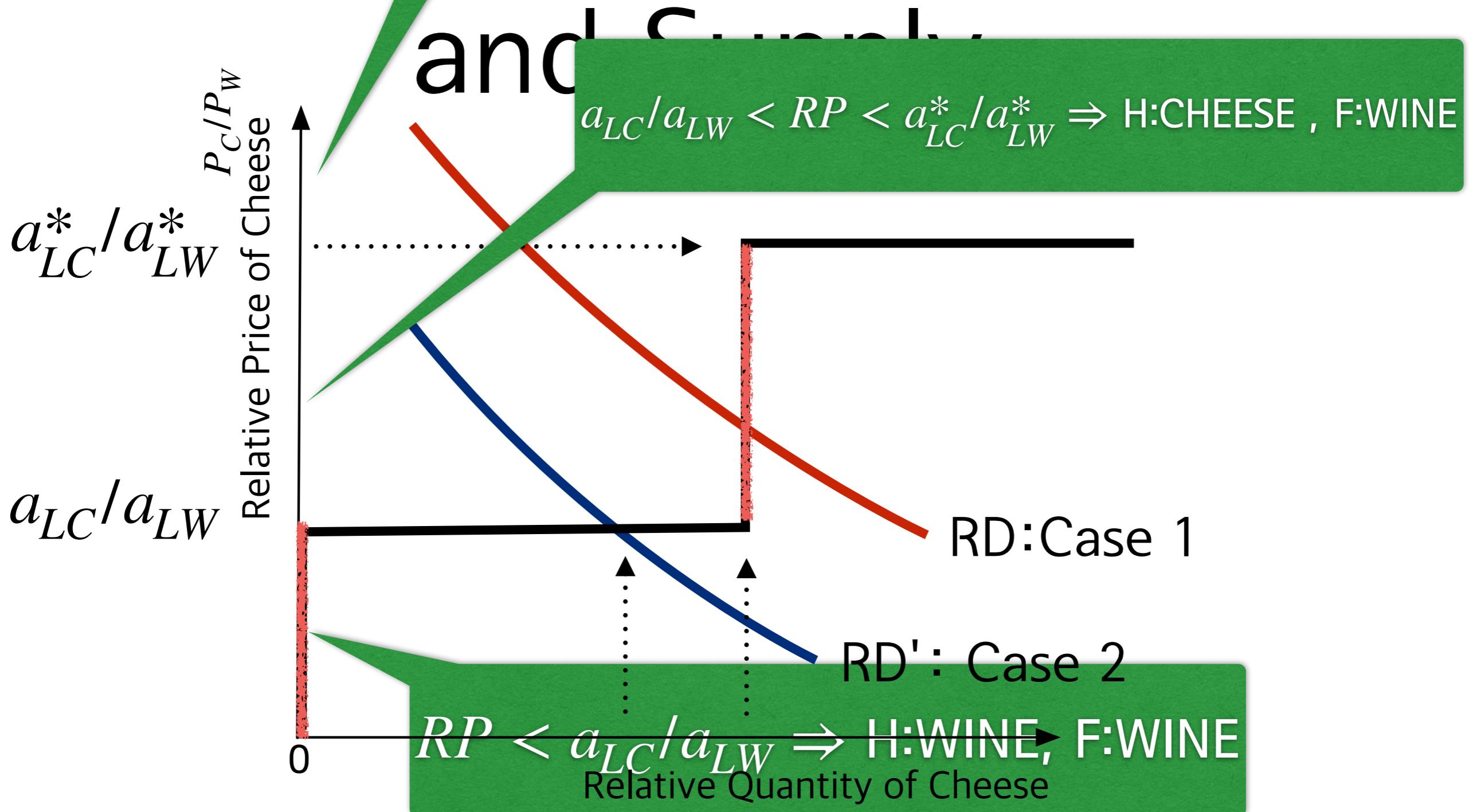
$$\frac{Q_C}{Q_W^*} = \frac{L/a_{LC}}{L^*/a_{LW}^*}$$

World and Supply

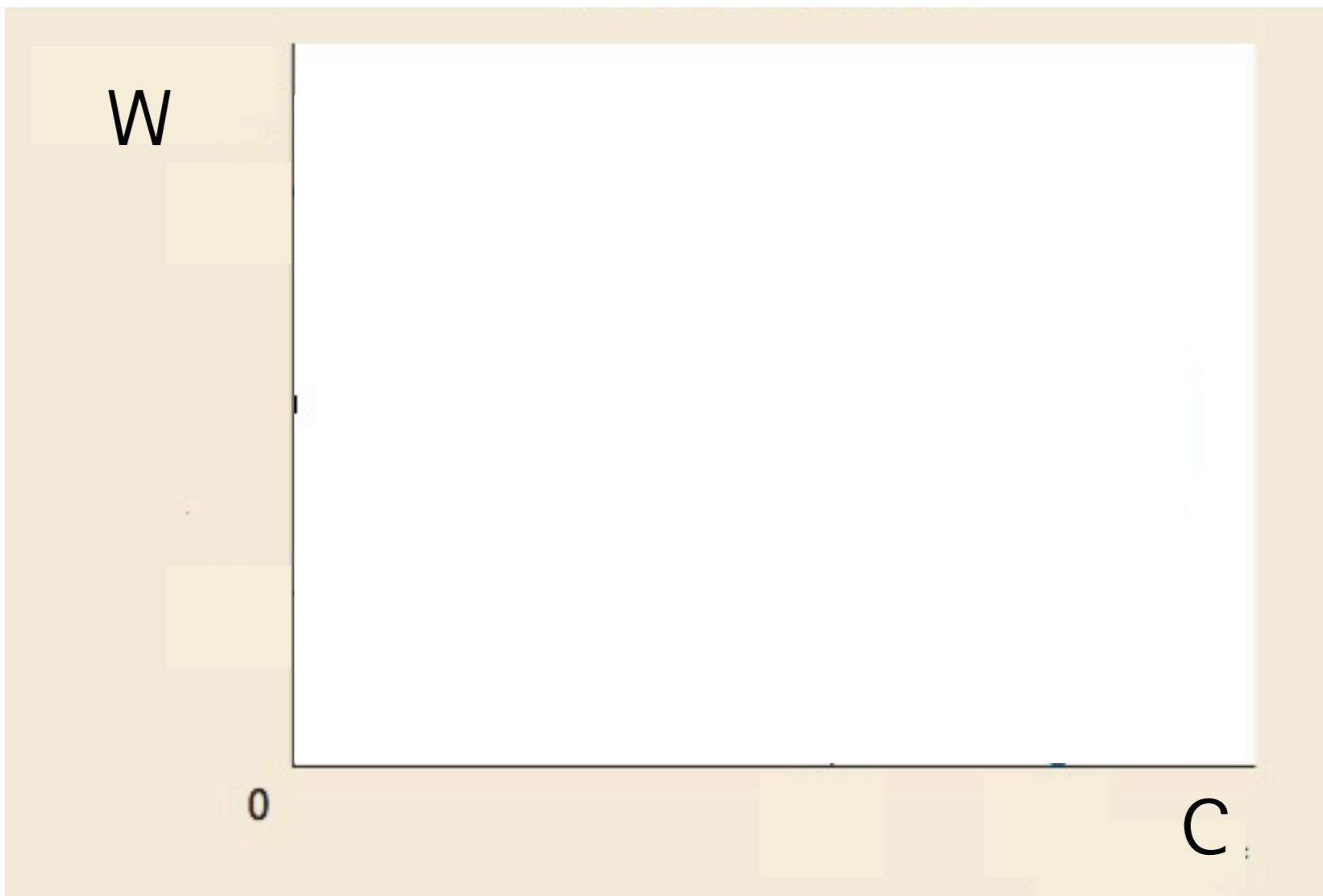


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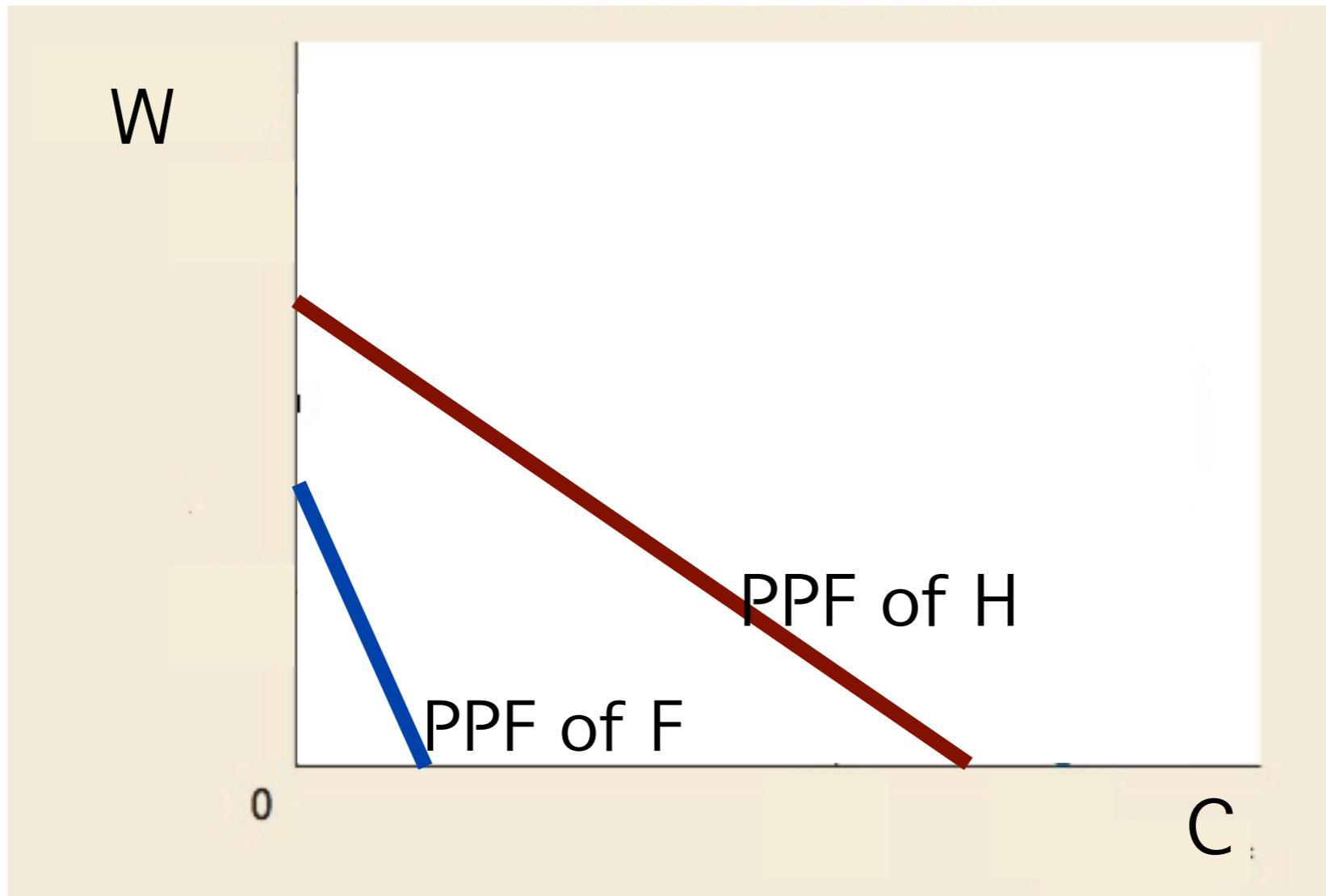
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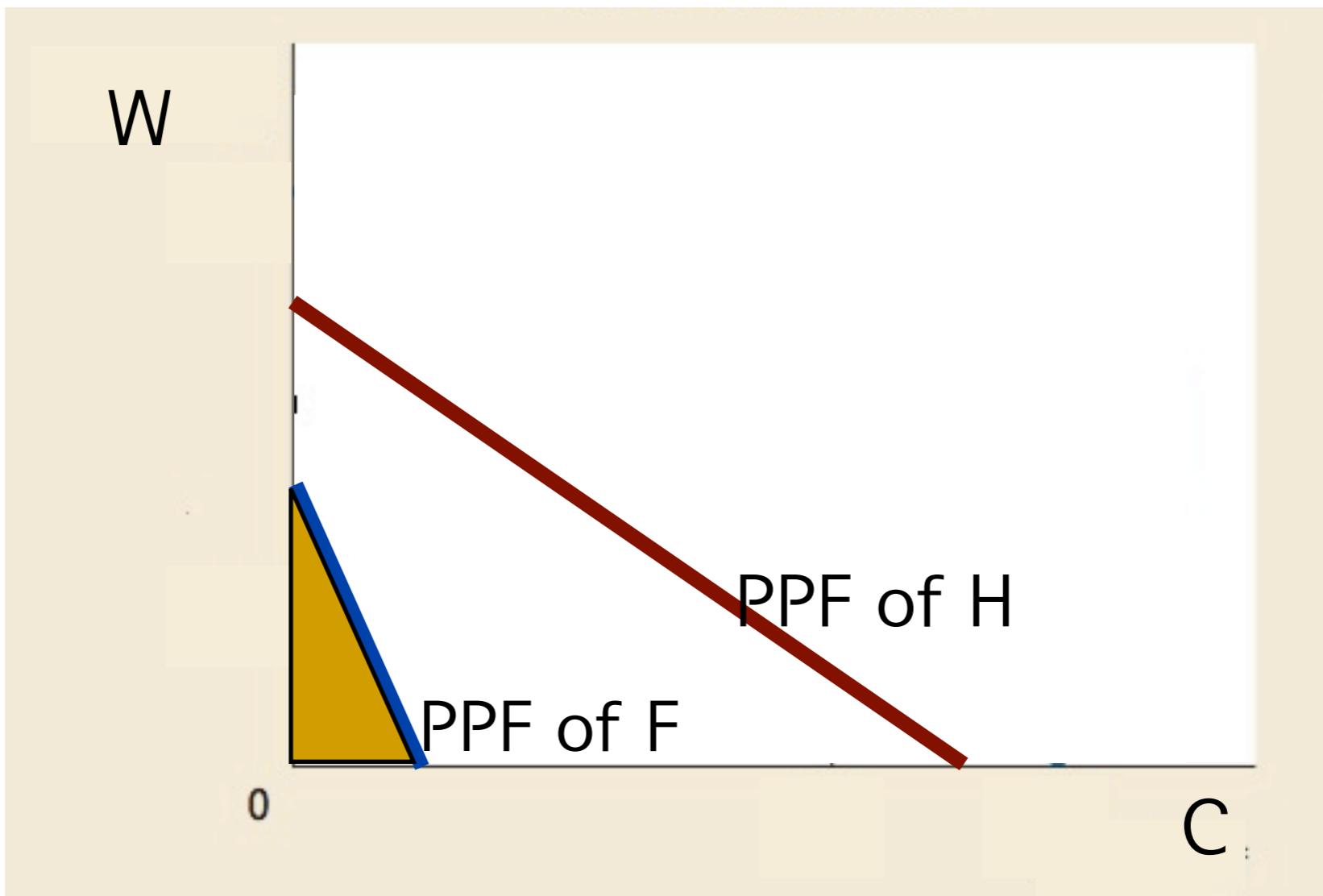
Other Explanation: Joint PPF



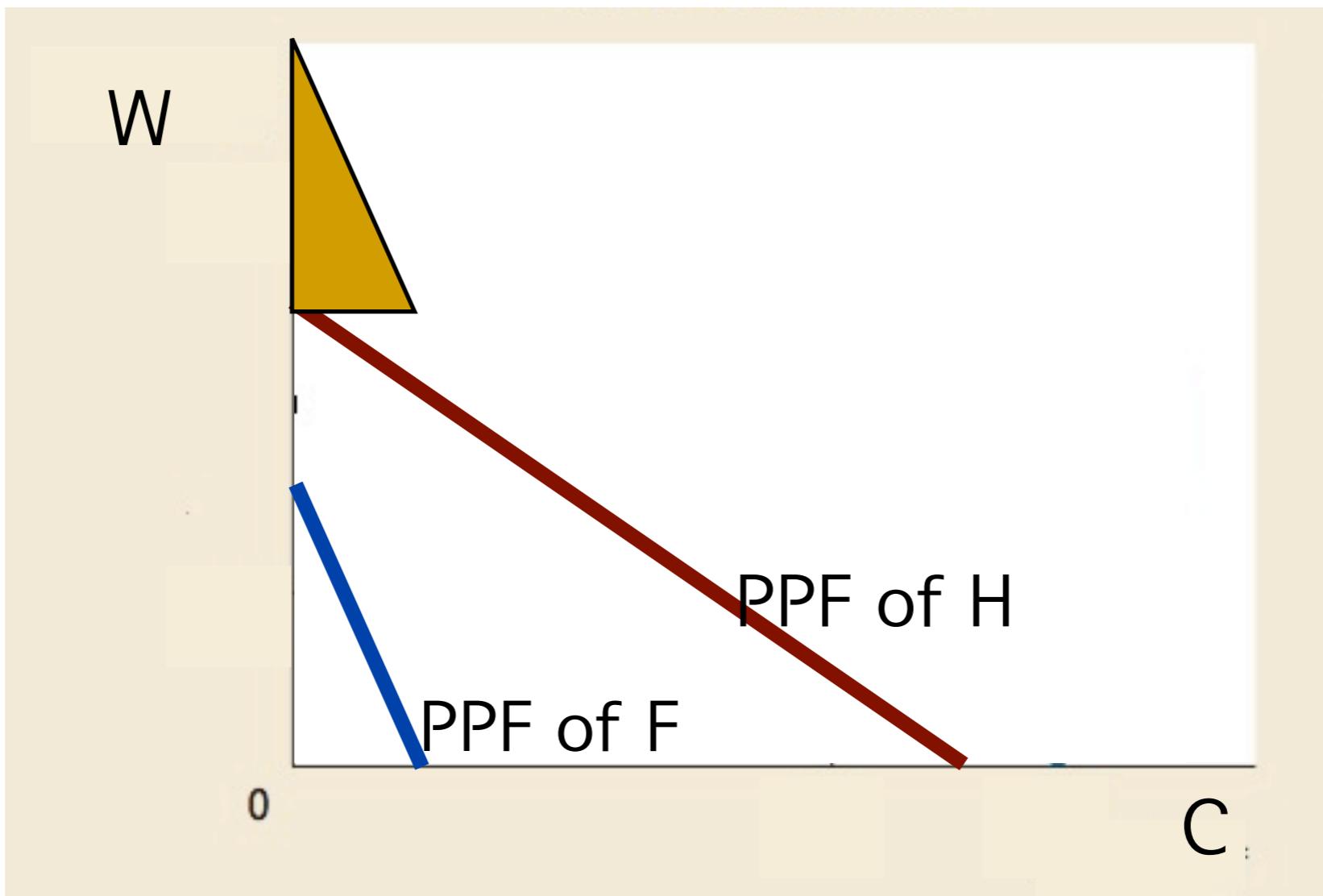
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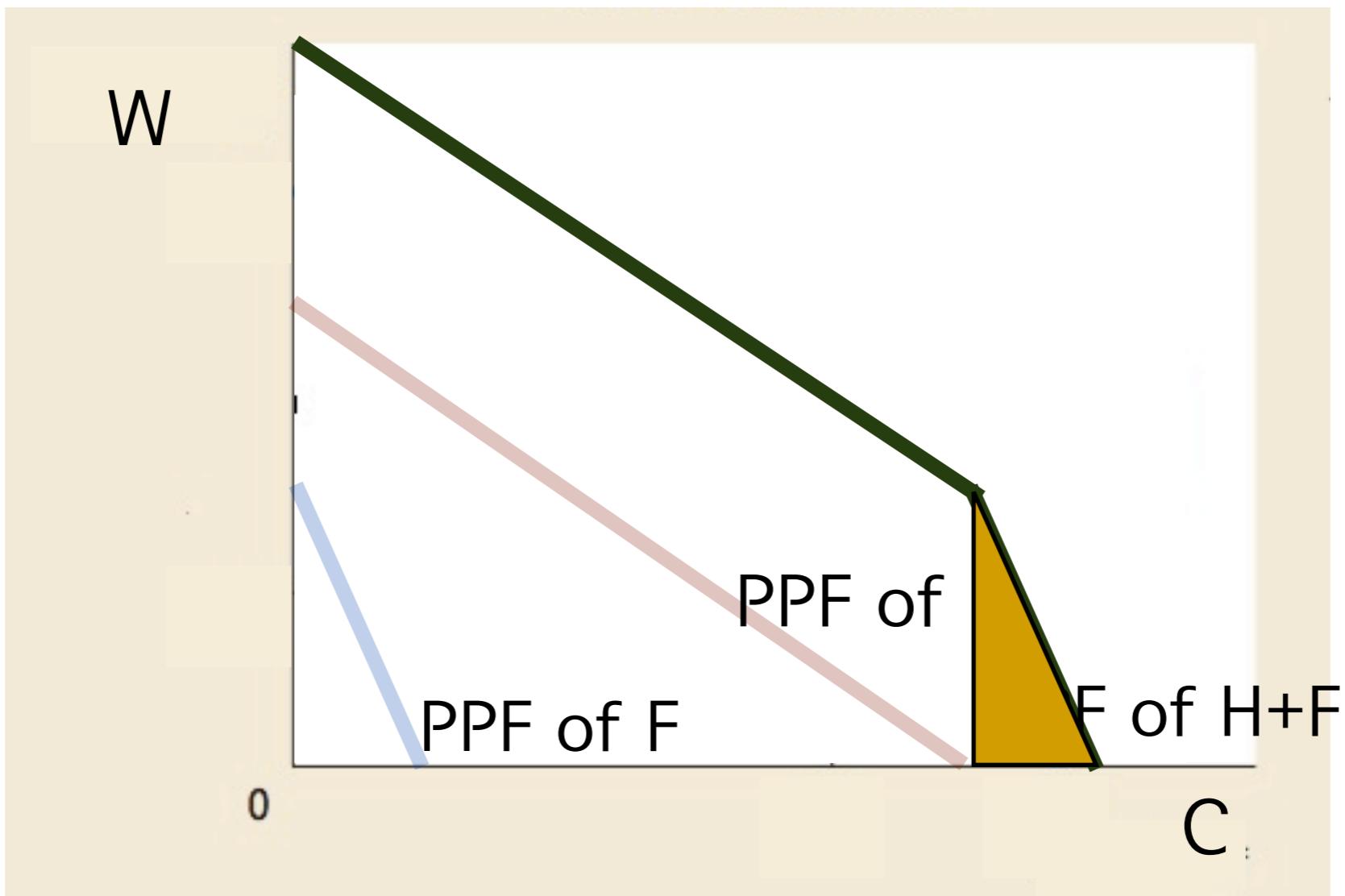
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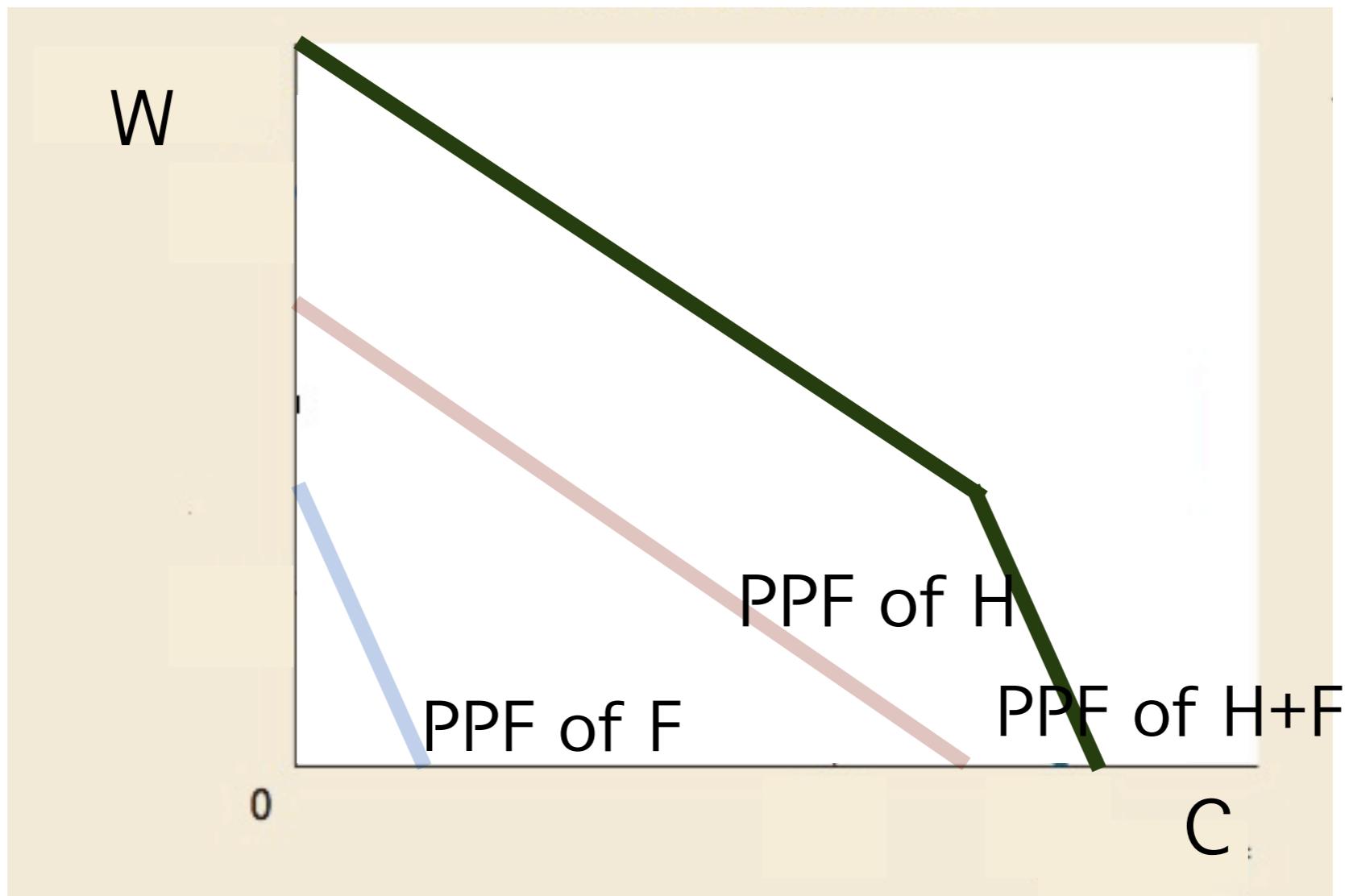
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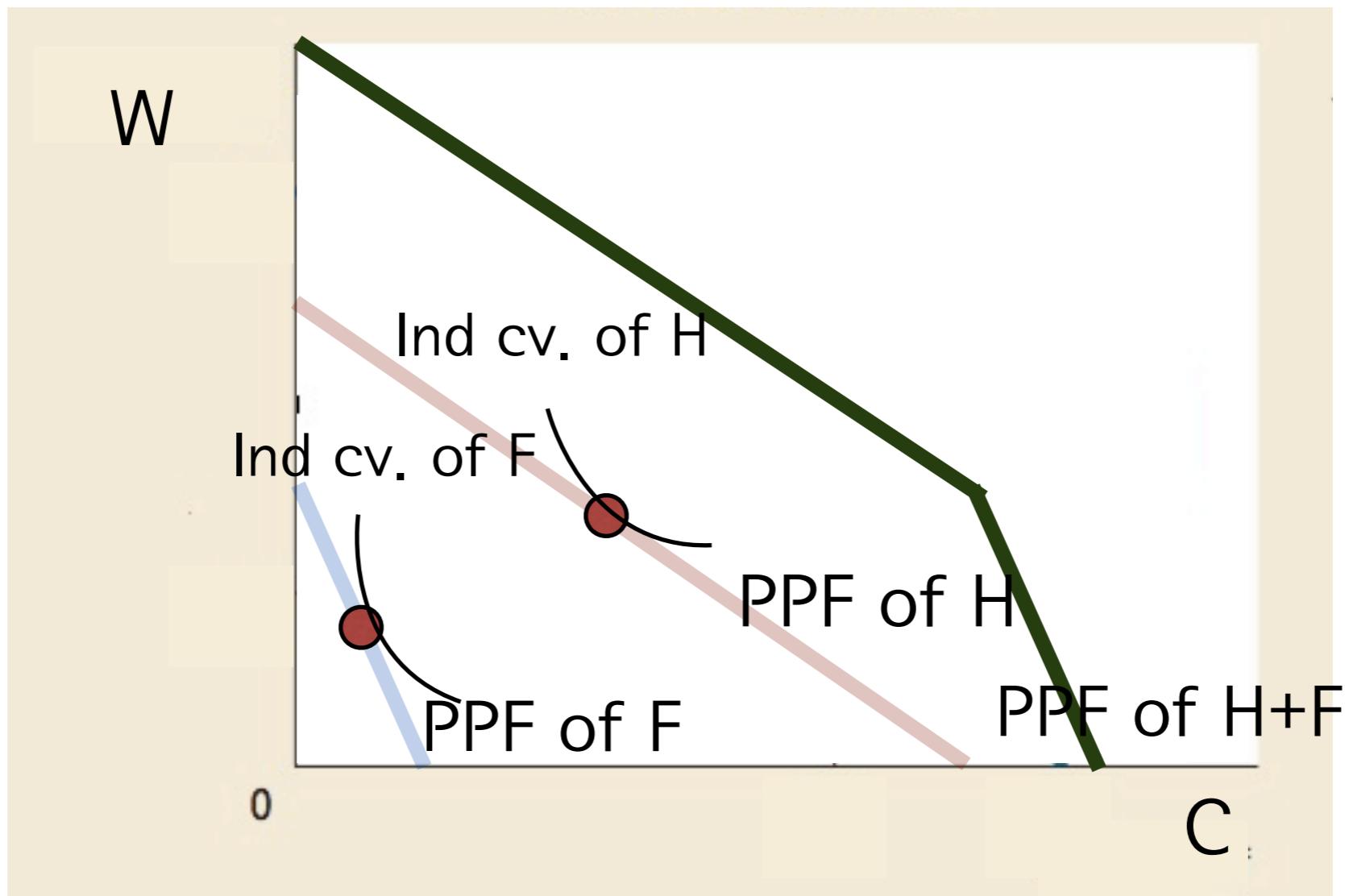
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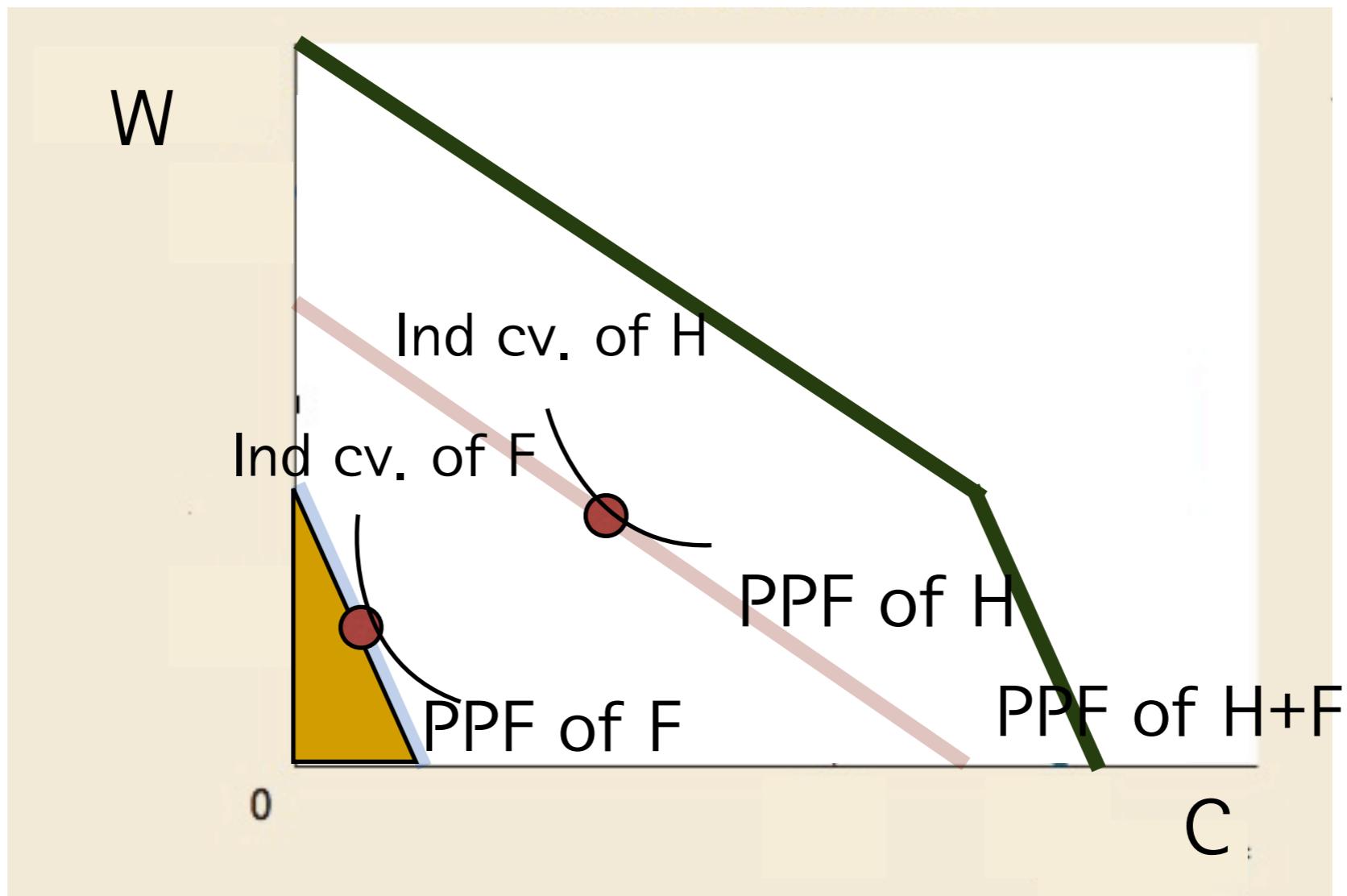
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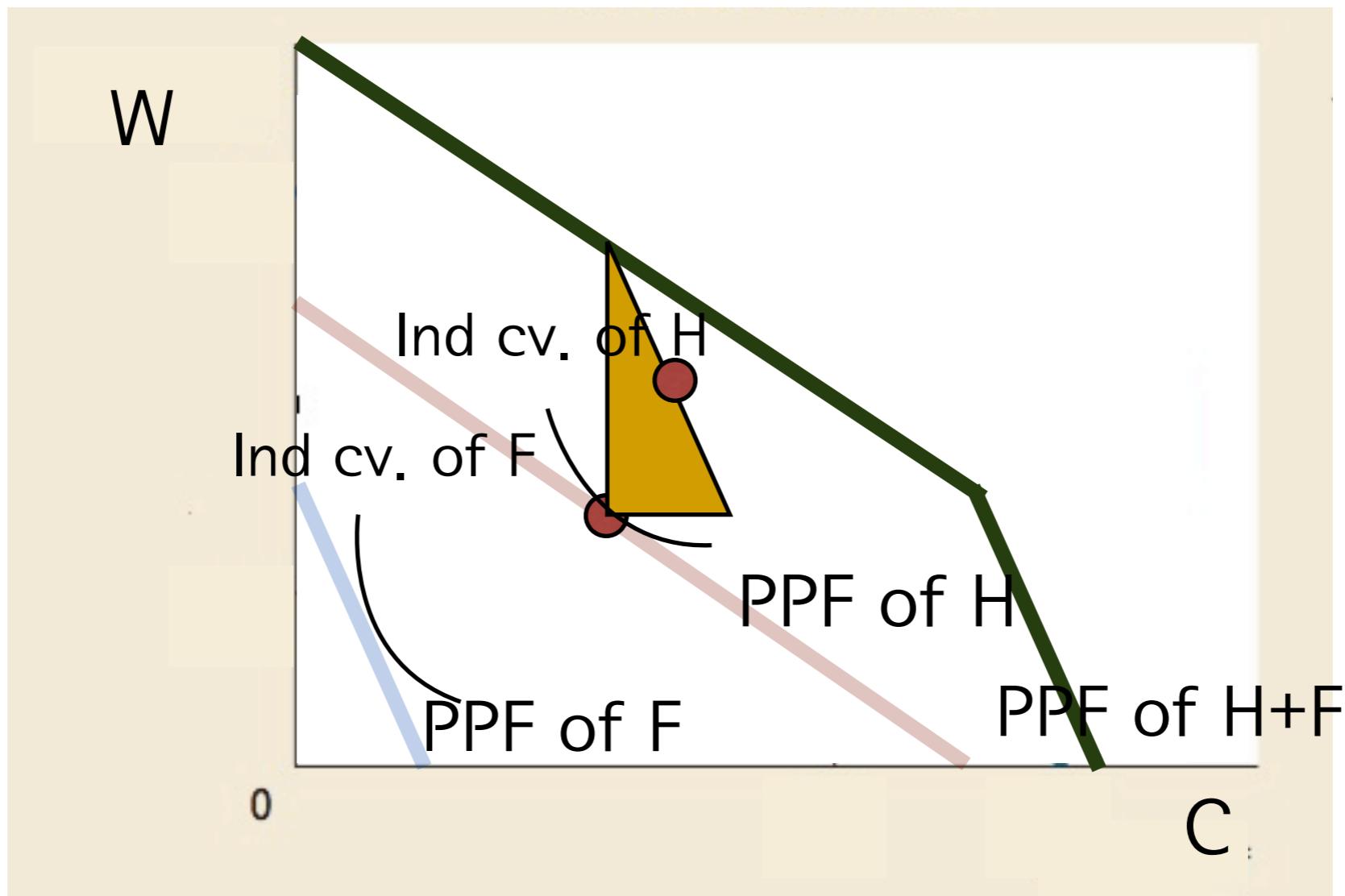
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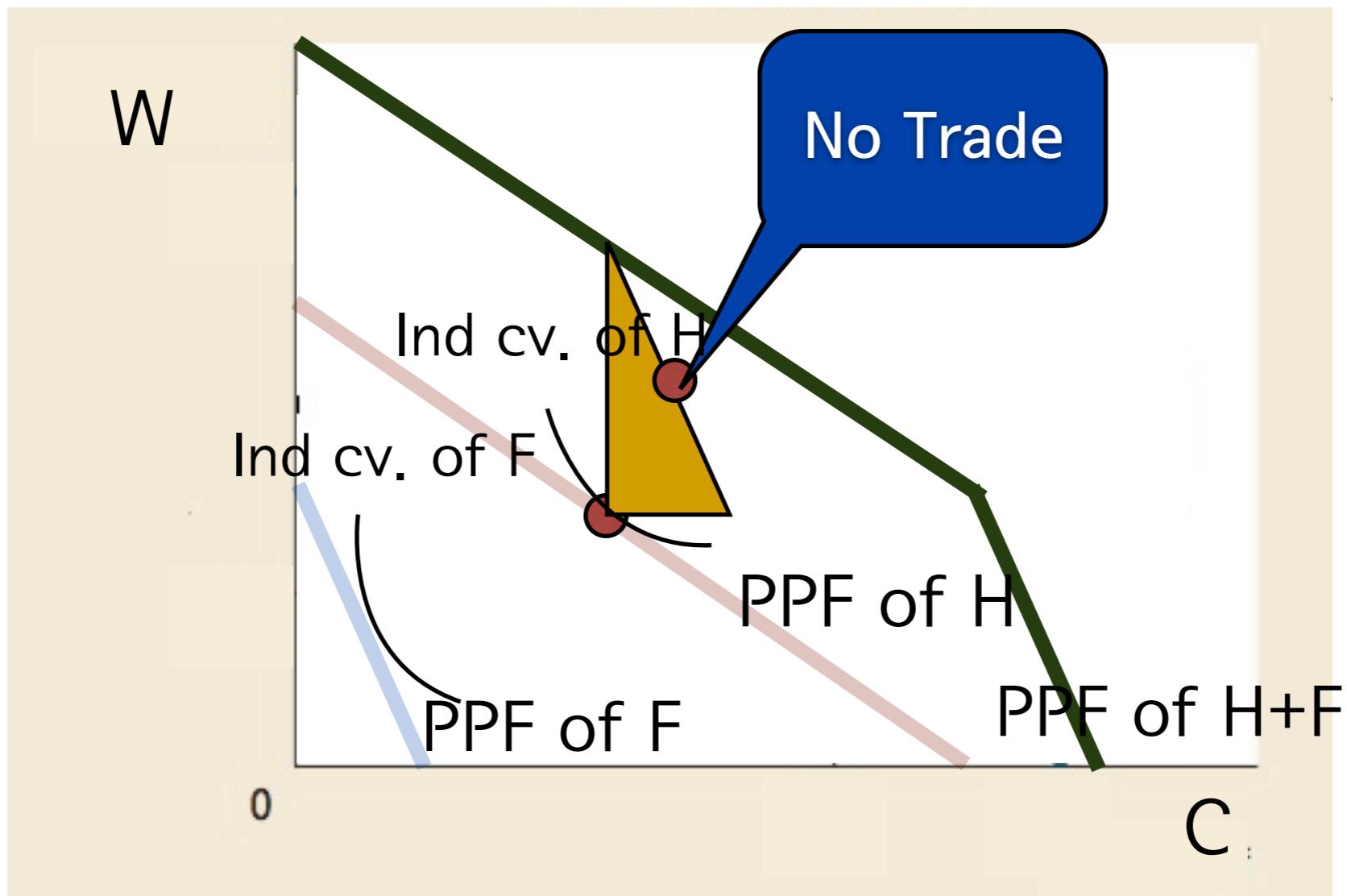
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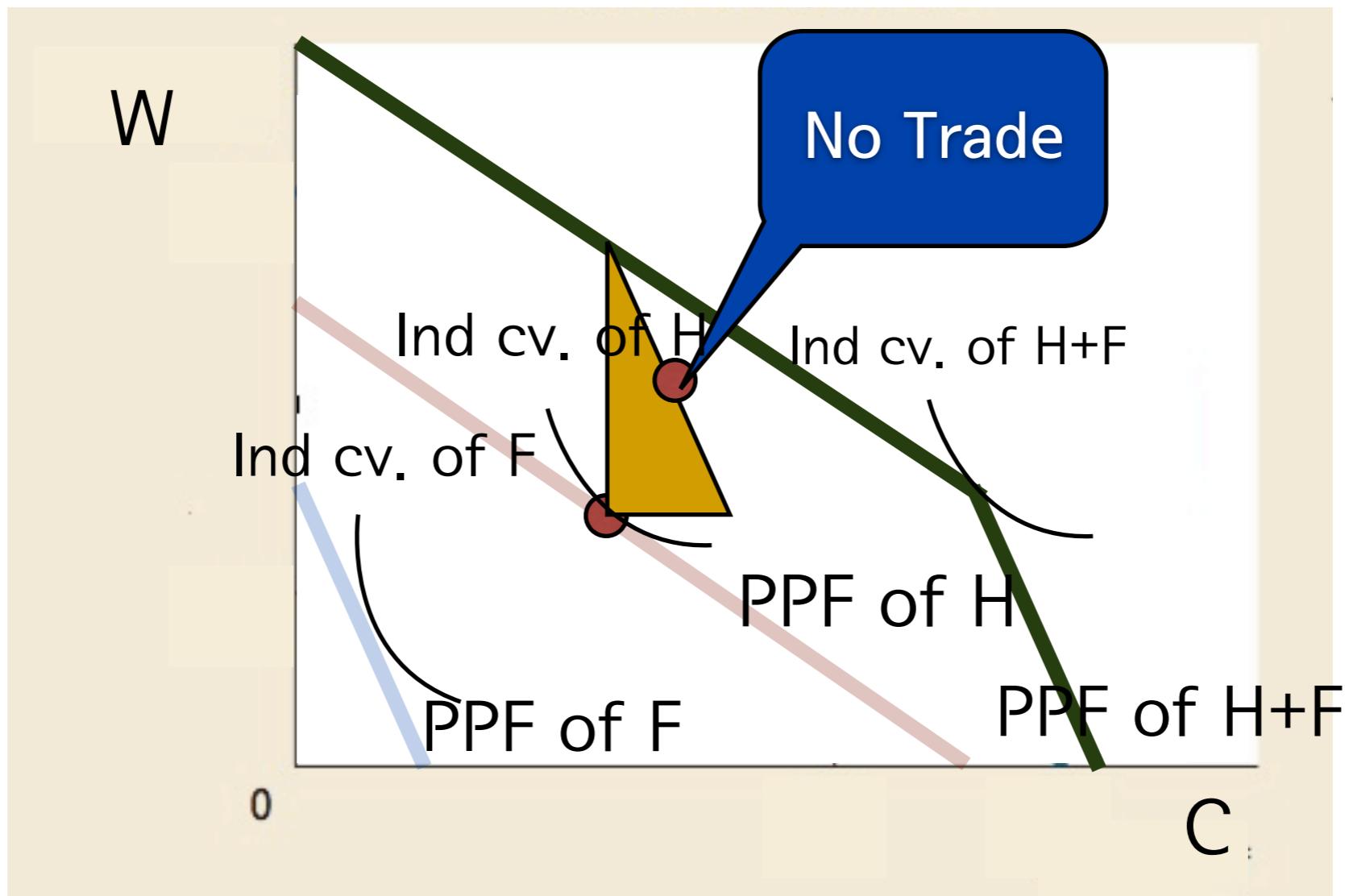
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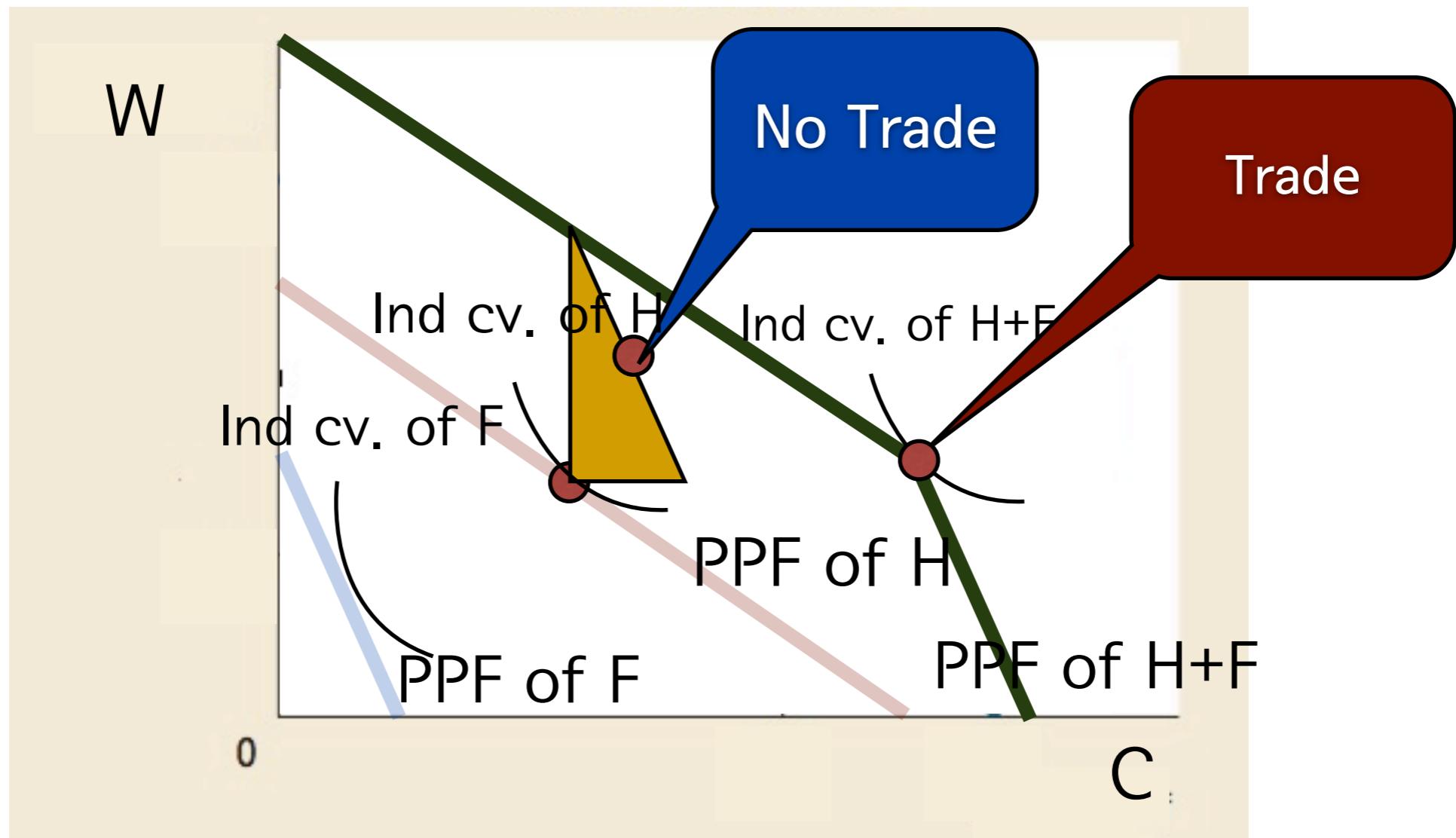
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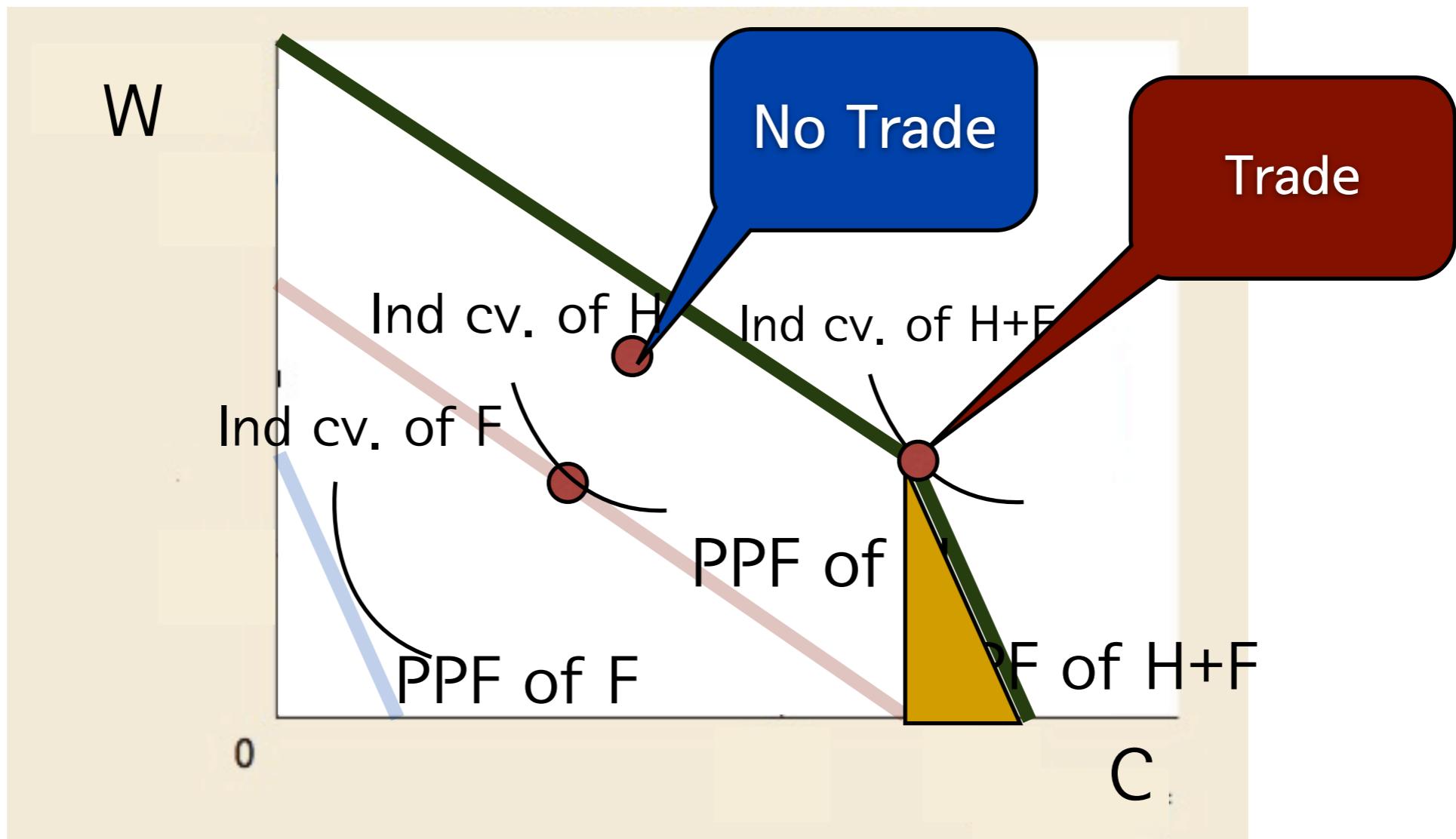
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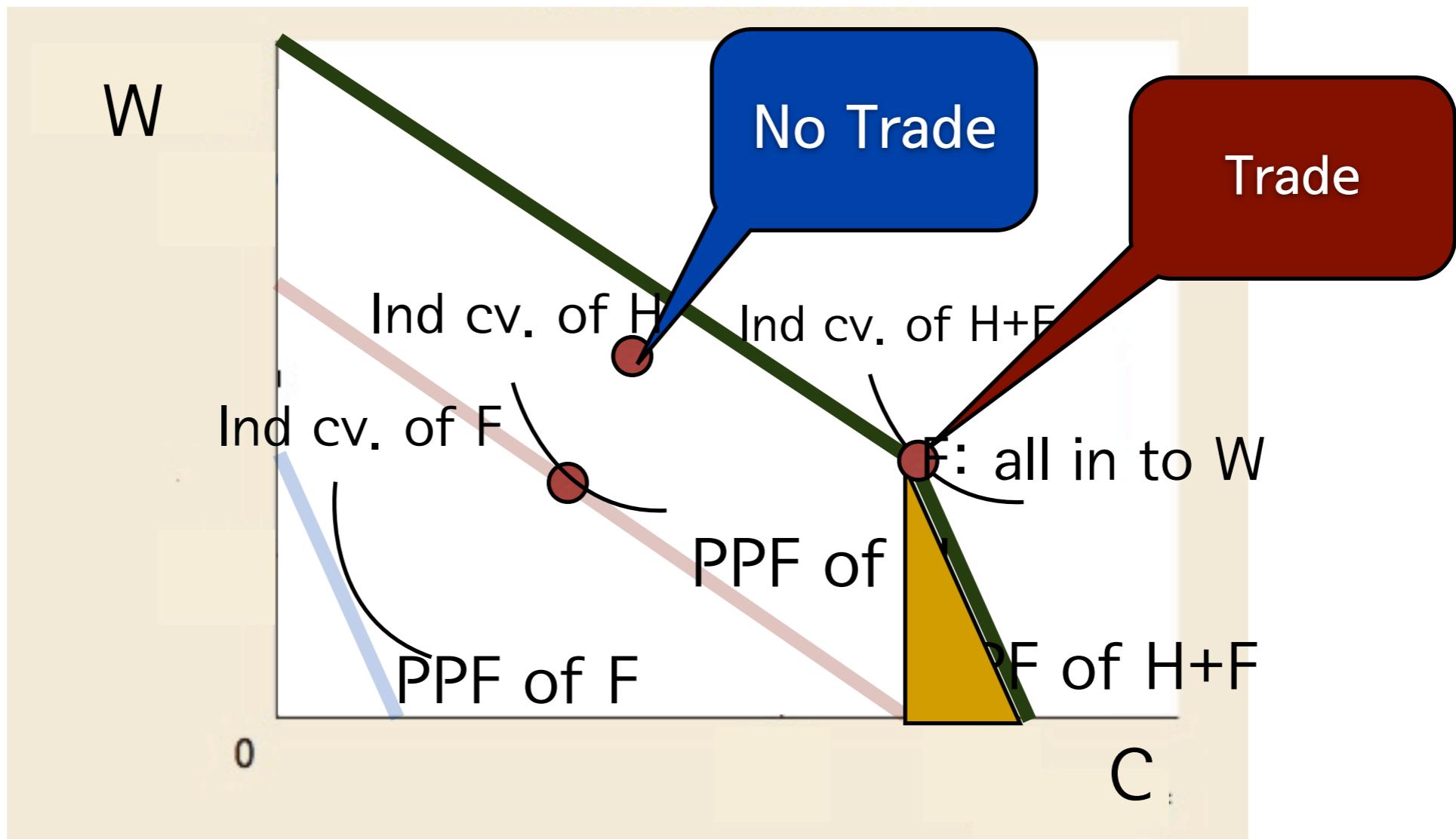
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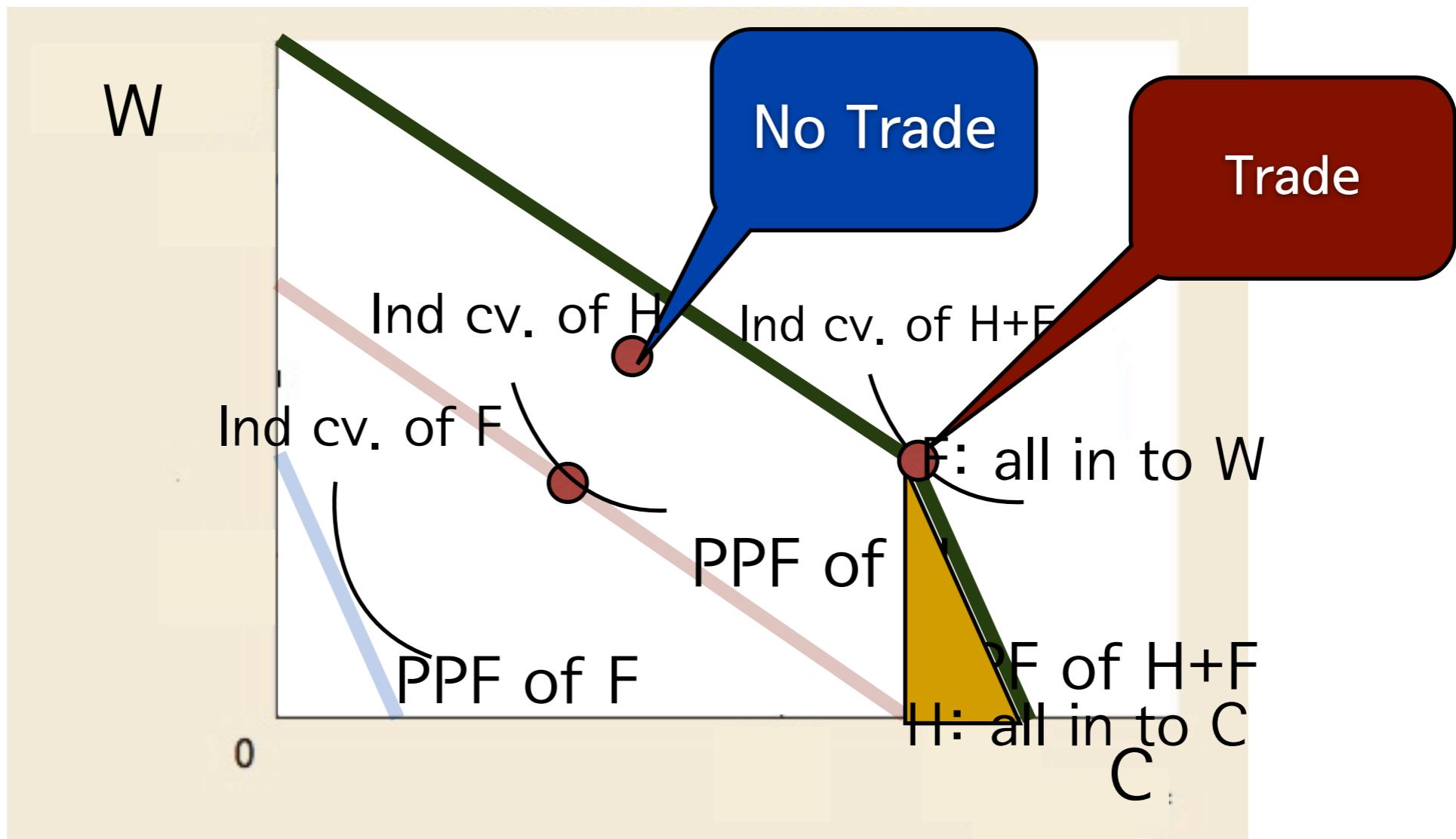
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Other Explanation: Joint PPF



Indirect Production of Wine (Home)

- STEP1: Produce Cheese
 - 1H Labor → $1/a_{LC}$ of cheese (home)
- STEP2: Exchange Wine with Cheese by Trade
 - Exchange rate of wine i.t.o. cheese: P_W/P_C
 - 1H Labor → $1/a_{LC}$ of cheese
→ $1/a_{LC} \times P_W/P_C$ of wine
- Home's 1H labor can produce $1/a_{LW}$ of wine directly and,
$$1/a_{LW} < 1/a_{LC} \times P_W/P_C$$

The Gains from Trade

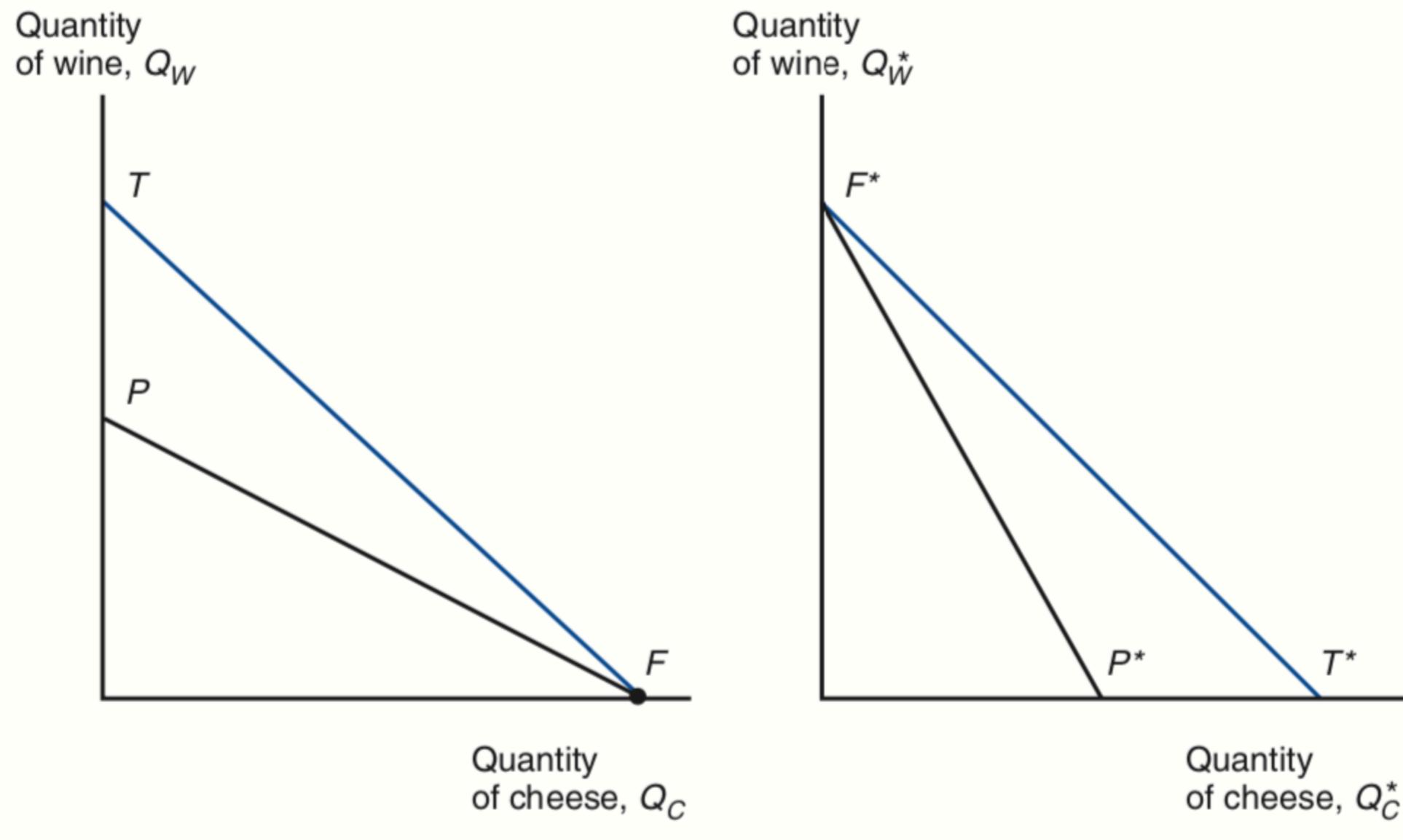


FIGURE 3-4
Trade Expands Consumption Possibilities

The Gains from Trade

Quantity
of wine, Q_W

T

P

Indirect
Production
of Wine

Quantity
of wine, Q_W^*

F^*

P^*

T^*

Quantity
of cheese, Q_C

(a) Home

Quantity
of cheese, Q_C^*

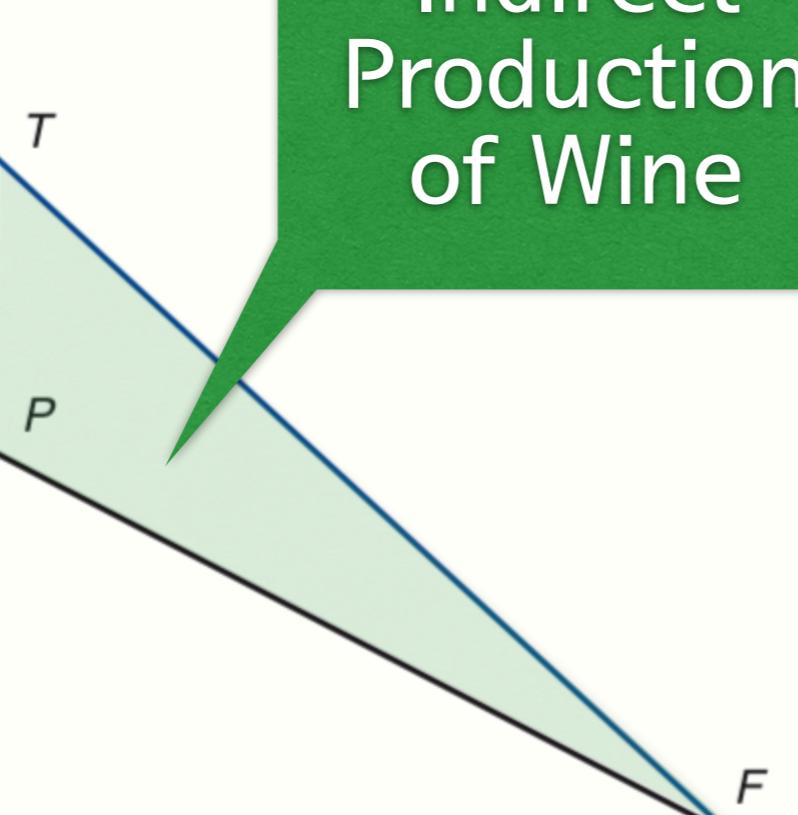
(b) Foreign

FIGURE 3-4

Trade Expands Consumption Possibilities

The Gains from Trade

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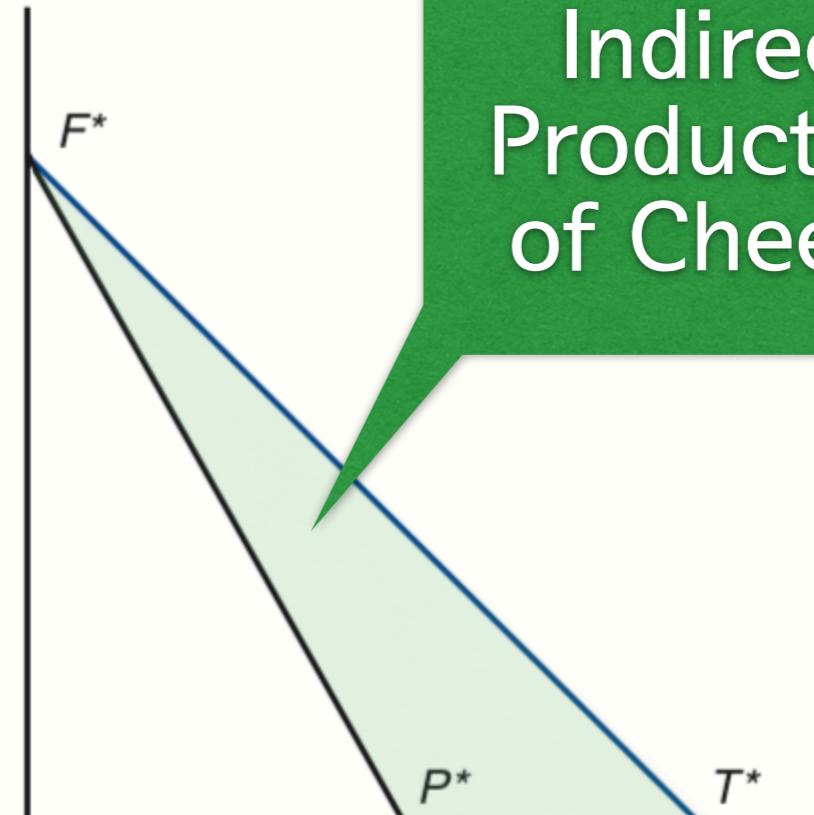


Indirect
Production
of Wine

Quantity
of cheese, Q_C

(a) Home

Quantity
of wine, Q_W^*



Indirect
Production
of Cheese

Quantity
of cheese, Q_C^*

(b) Foreign

FIGURE 3-4

Trade Expands Consumption Possibilities

Misconceptions about Comparative Advantage

Productivity and Competitiveness

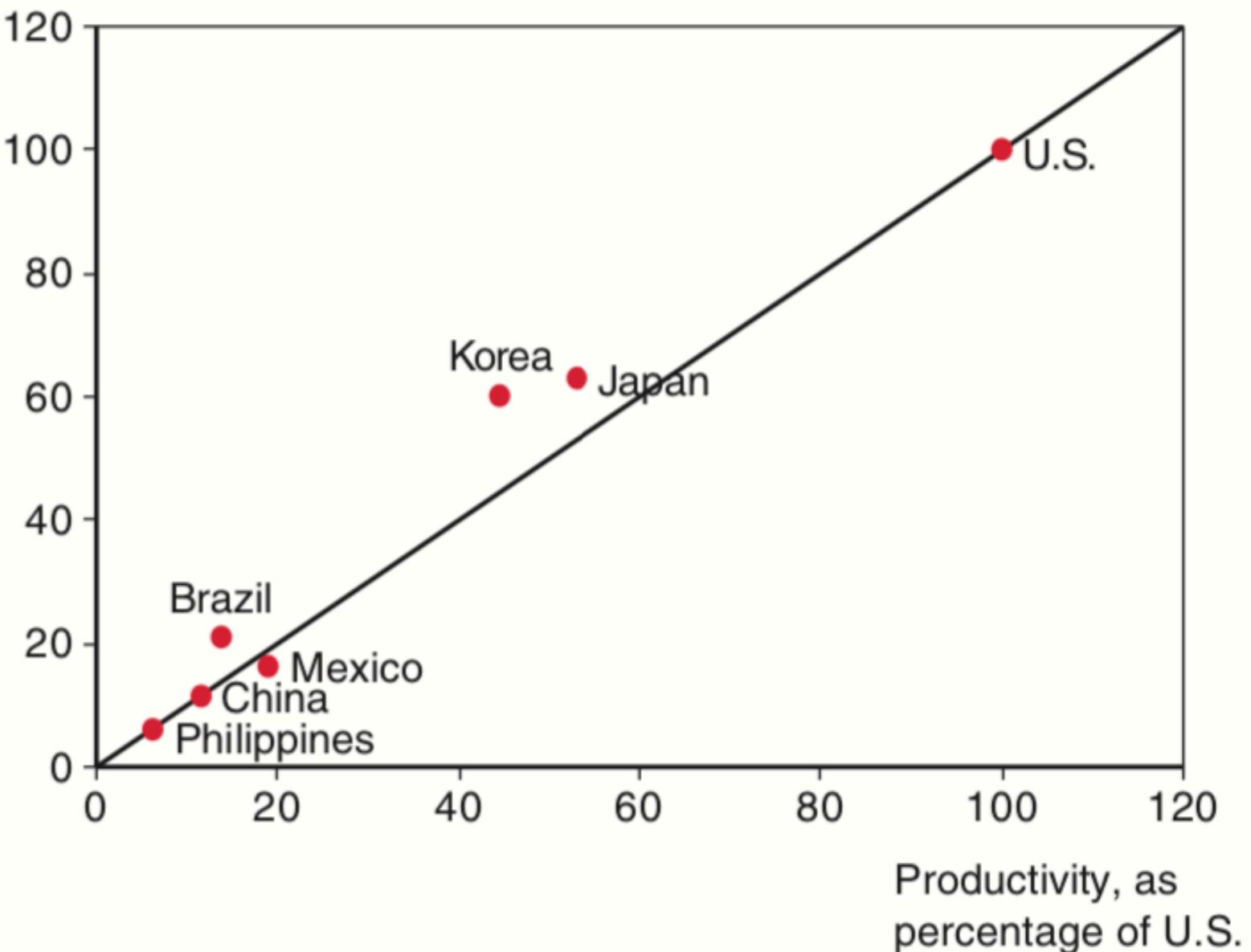
- Myth 1: "*Free trade is beneficial only if your country is strong enough to stand up to foreign competition.*"
- The competitive advantage of an industry depends not only on its productivity relative to the foreign industry, but also on the domestic wage rate relative to the foreign wage rate.
- Comparative advantage comes from relative wage rate
- Low absolute advantage \Rightarrow low wage

Productivity and Wages

A country's wage rate is roughly proportional to the country's productivity

Source: International Monetary Fund and The Conference Board.

Hourly wage, as percentage of U.S.



The Pauper Labor Argument

- Myth 2: "*Foreign competition is unfair and hurts other countries when it is based on low wages.*"
- Whether the lower cost of wine produced in Foreign is due to high productivity or low wages does not matter.
- All that matters to Home is that it is cheaper in terms of its own labor for Home to produce cheese and trade it for wine than to produce wine for itself.

Exploitation

- Myth 3: "*Trade exploits a country and makes it worse off if its workers receive much lower wages than workers in other nations.*"
- To deny them the opportunity to export and trade might well be to condemn them to even deeper poverty.

Comparative Advantage with Many Goods

Model Setting

- N goods: $i = 1, 2, \dots, N$
- Home's unit labor requirement for good i:
 a_{Li}
- The order of i is arranged by the rule below:
 $a_{L1}/a_{L1}^* < a_{L2}/a_{L2}^* < \dots < a_{LN}/a_{LN}^*$
: condition S1

Relative Wages

- The ratio of wage rates: w/w^*
- Production cost of good i: wa_{Li} (home)
 $w^*a_{Li}^*$ (foreign)
 - $wa_{Li} < w^*a_{Li}^* \Rightarrow$ domestic production
 - $wa_{Li} > w^*a_{Li}^* \Rightarrow$ do not produce

Example

TABLE 3-2

Home and Foreign Unit Labor Requirements

Good	Home Unit Labor Requirement a_{Li}	Foreign Unit Labor Requirement (a_{Li}^*)	Relative Home Productivity Advantage (a_{Li}^*/a_{Li})
Apples	1	10	10
Bananas	5	40	8
Caviar	3	12	4
Dates	6	12	2
Enchiladas	12	9	0.75

Derived Demand

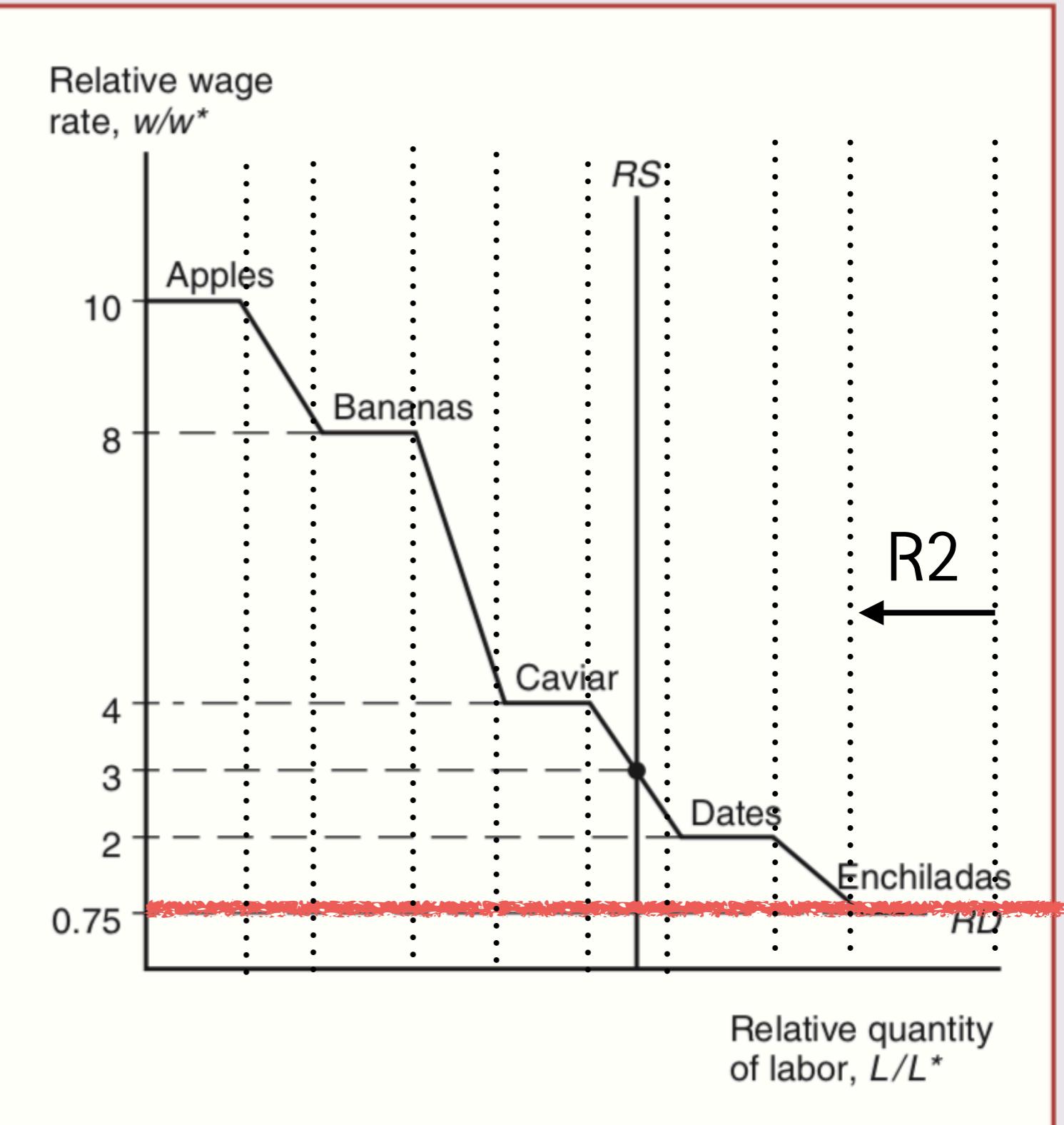
- Relative demand for labor comes from the demand for goods
- $W/W^* \uparrow \Rightarrow L/L^* \downarrow$
 - [Reason 1] Rel. Price of goods produced in Home $\uparrow \Rightarrow$ Rel. Demand $\downarrow \Rightarrow$ Rel. Labor demand \downarrow
 - [Reason 2] Some goods produced in home stop produced and start to be produced in foreign \Rightarrow Rel. Labor demand \downarrow

RS: given value (depends on size)

FIGURE 3-5

Determination of Relative Wages

In a many-good Ricardian model, relative wages are determined by the intersection of the derived relative demand curve for labor, RD , with the relative supply, RS .

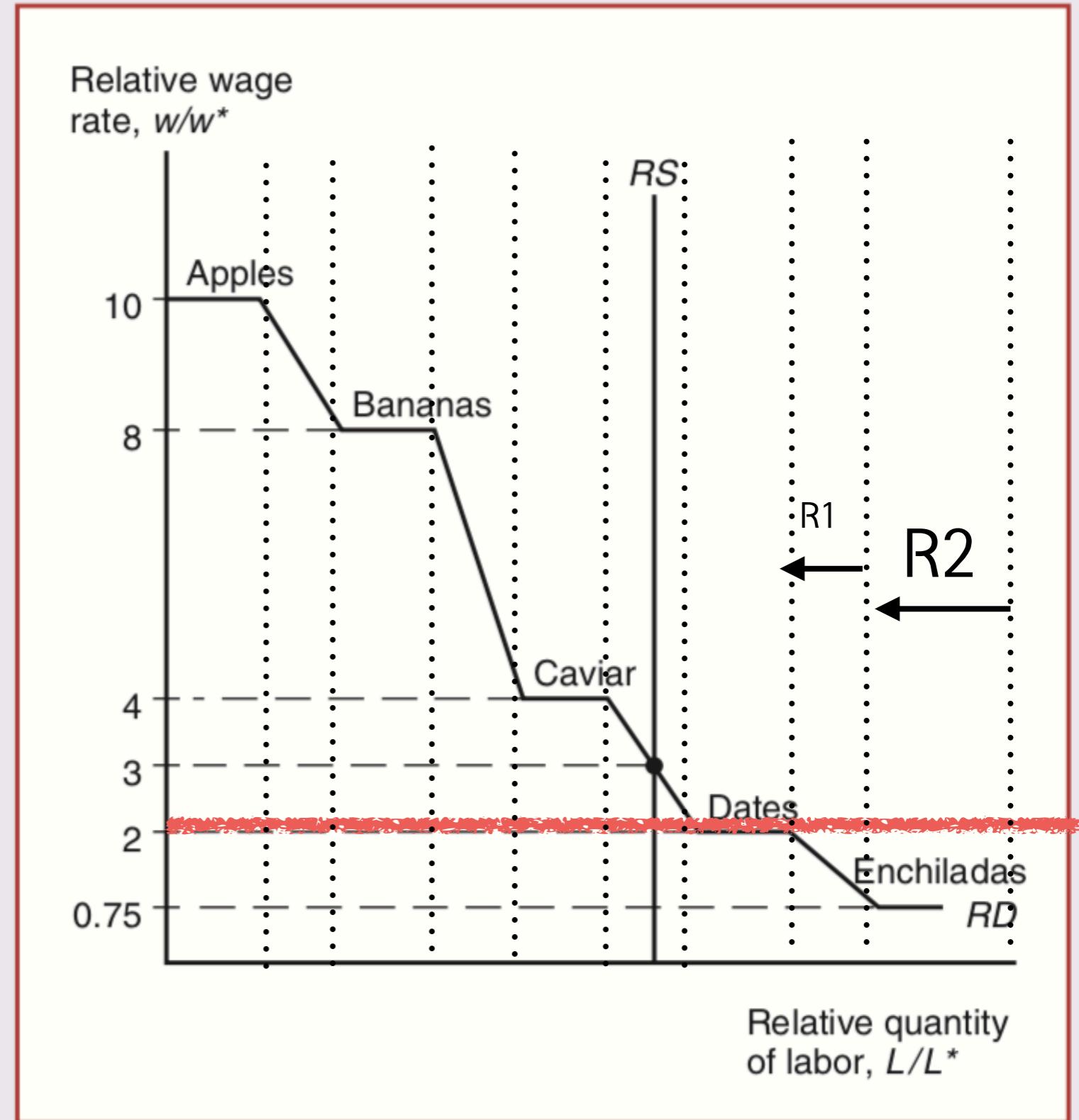


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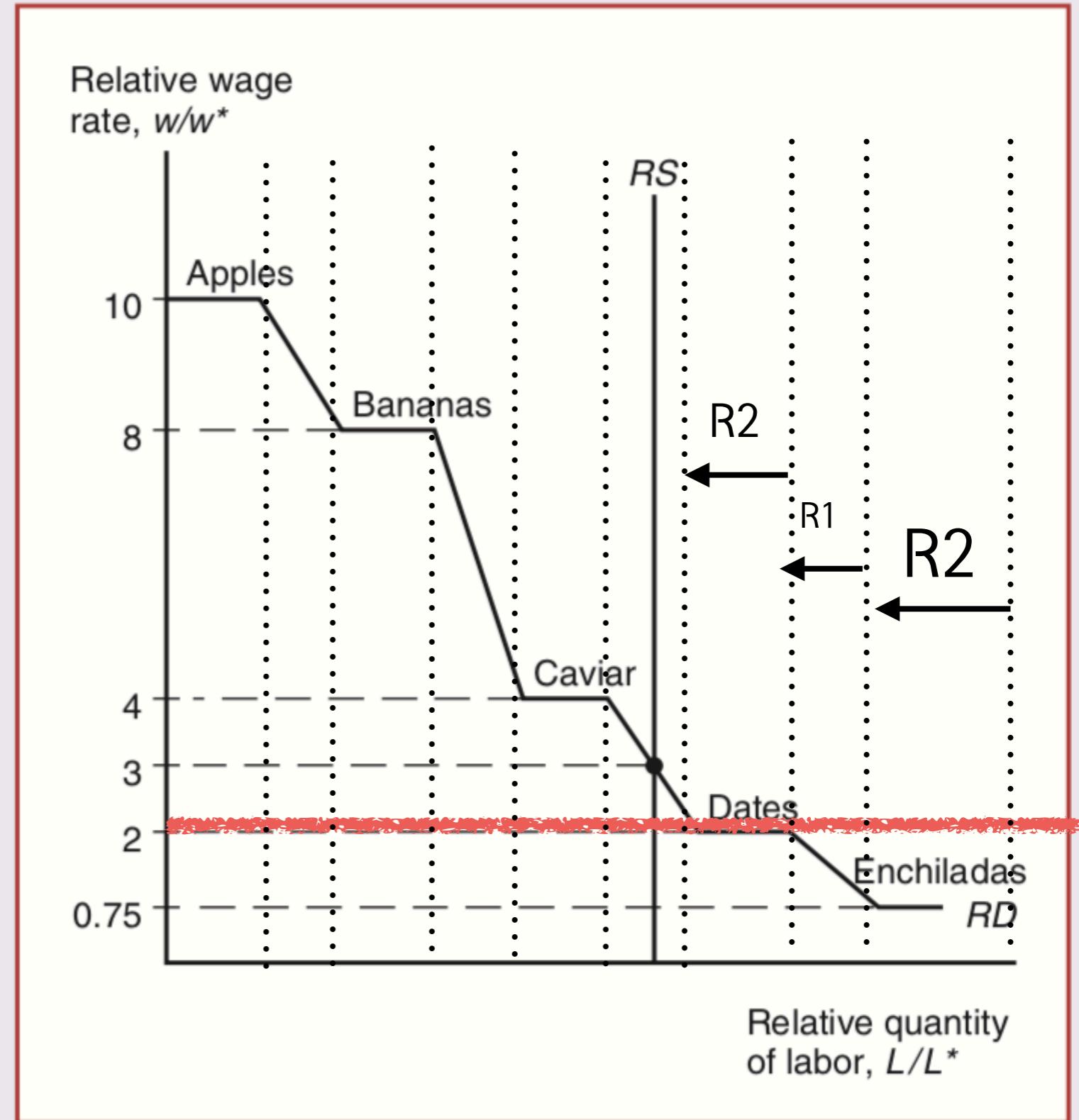


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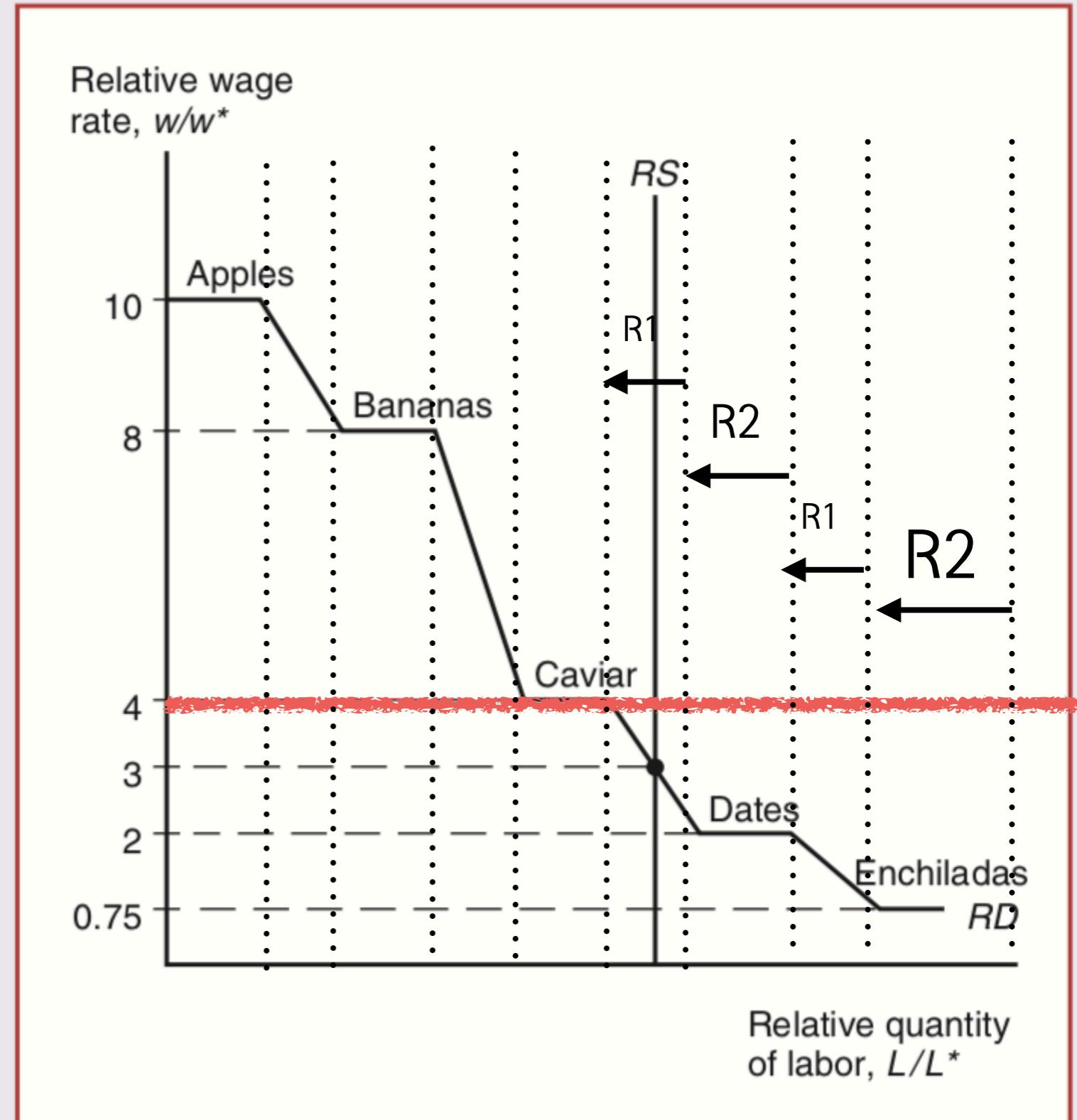


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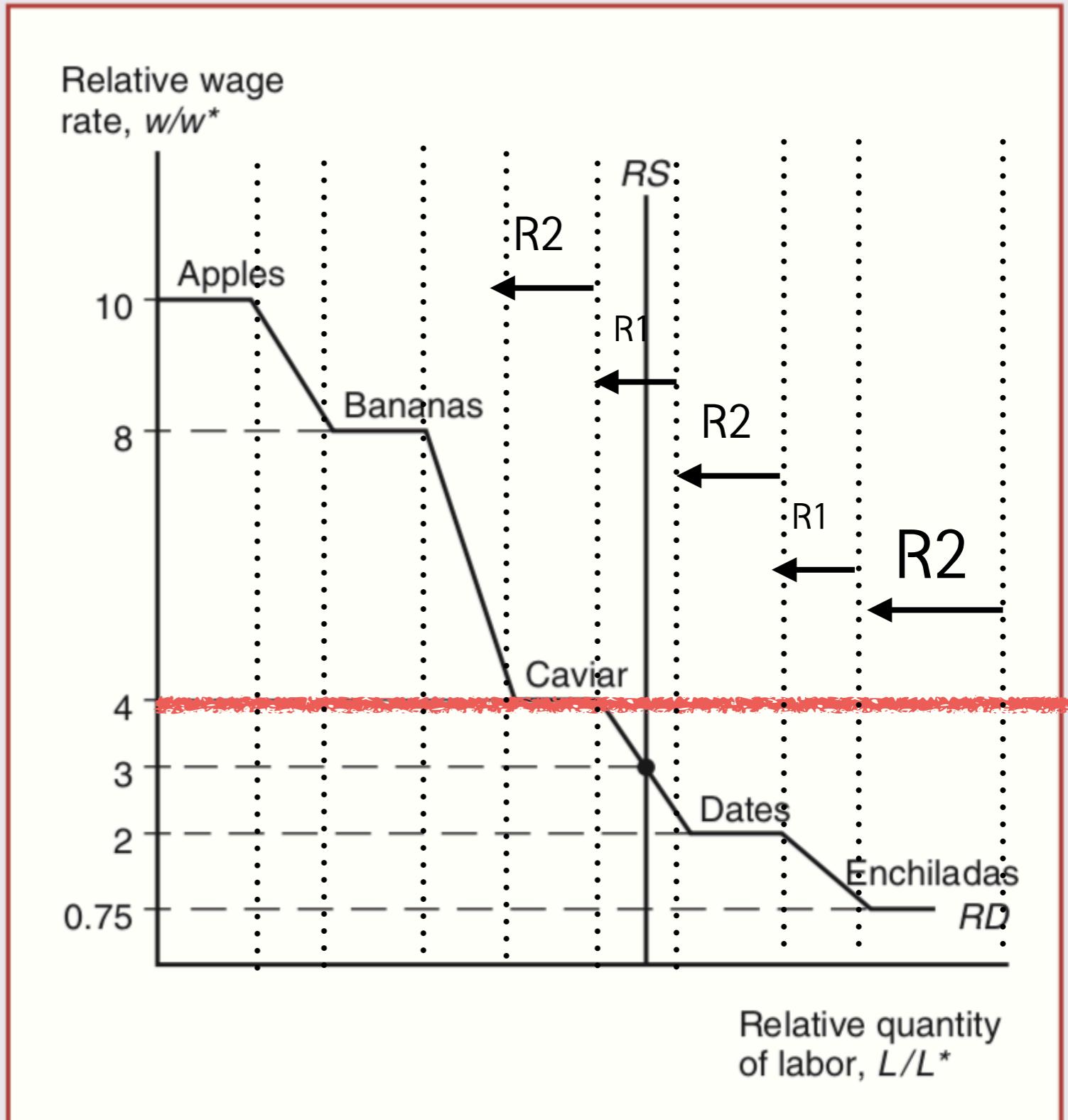


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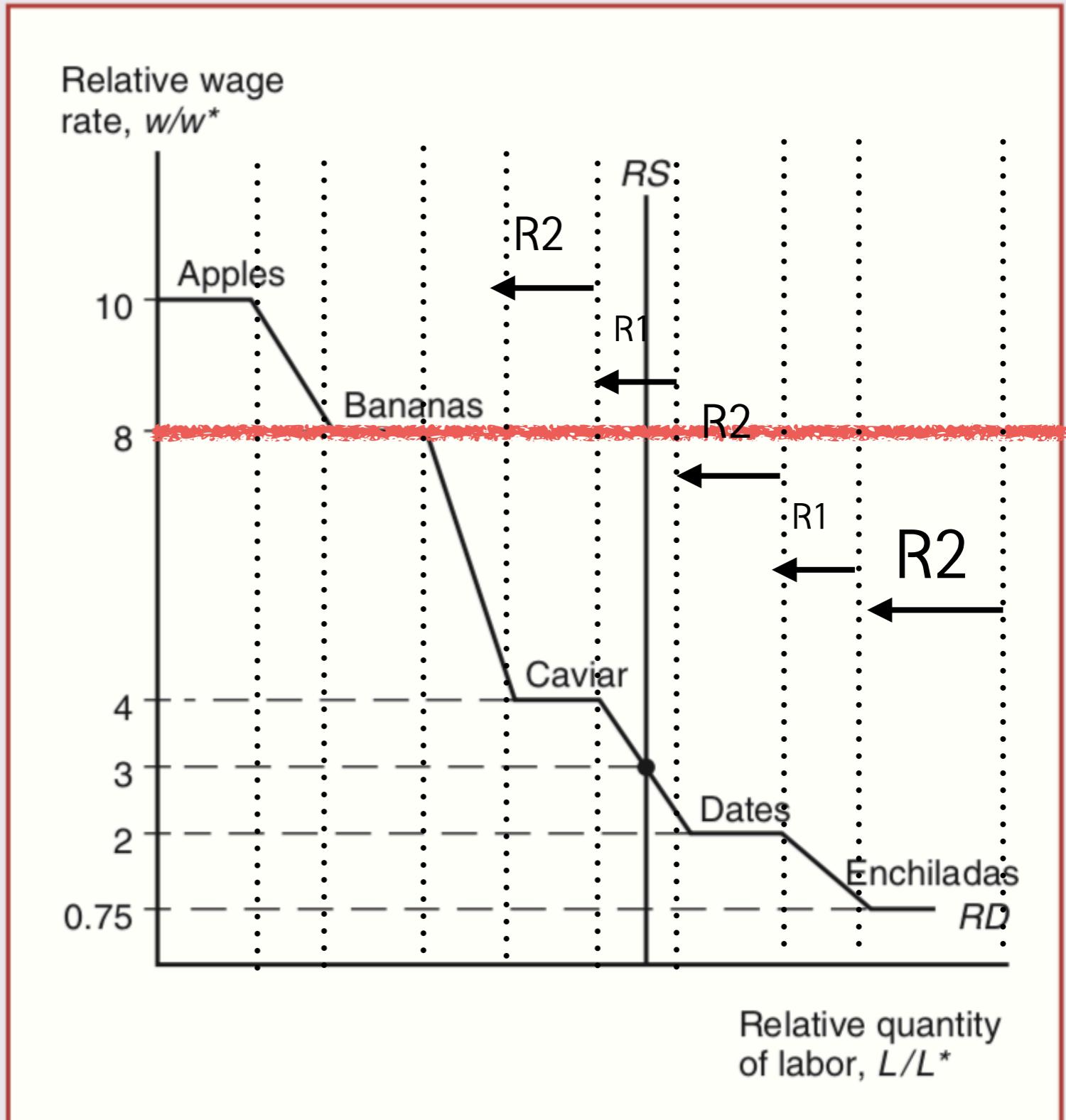


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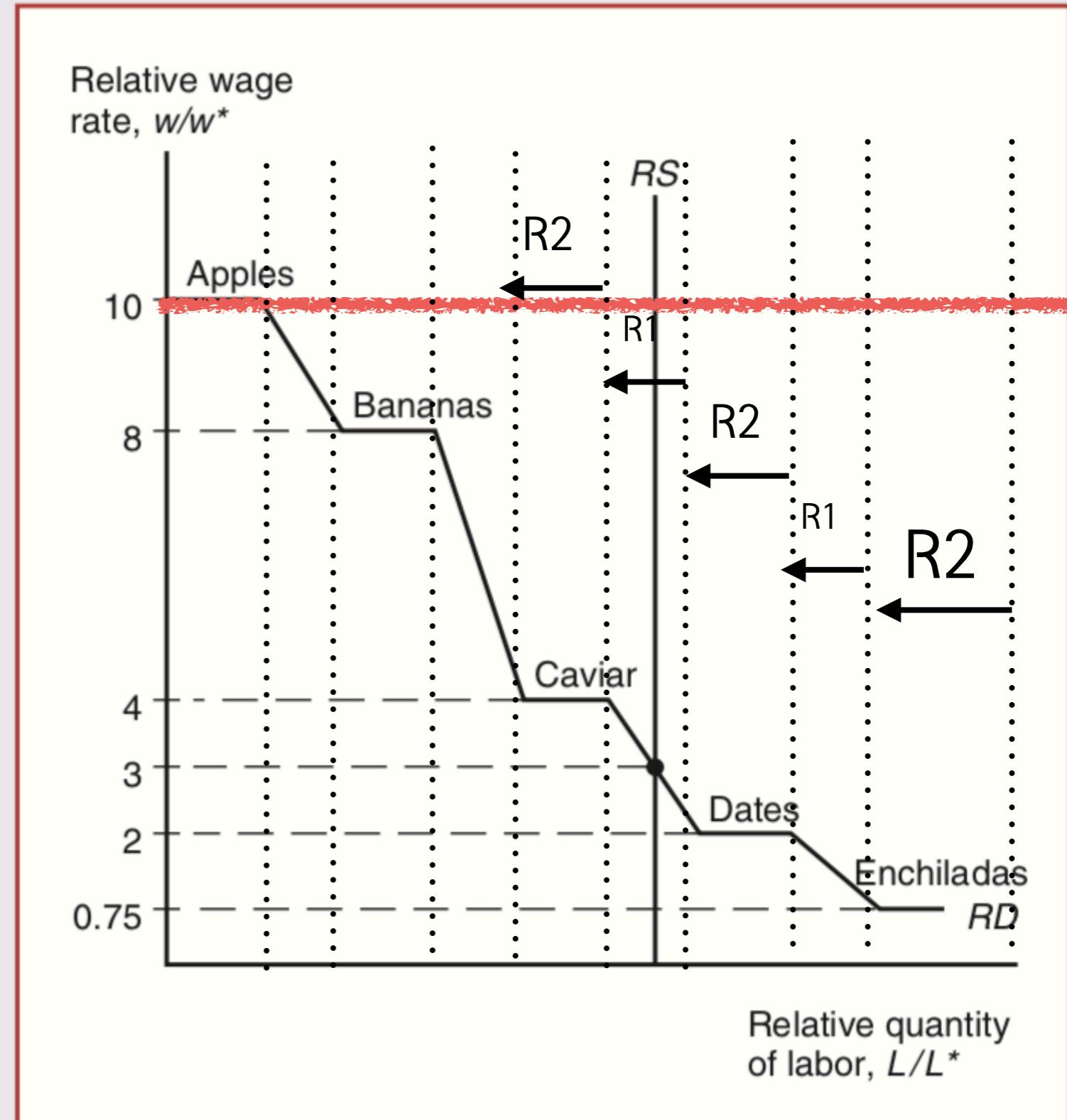


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Transport Costs and Nontraded Goods

Why is the real international economy not specialized extremely?

- # of factors of production $\uparrow \Rightarrow$ specialization \downarrow (Ch4, 5)
- Protectionism (Ch9-12)
- Cost of transportation $\uparrow \Rightarrow$ specialization \downarrow
 - ex: cement, vegetables
- Existence of nontraded goods
 - ex: haircuts service, auto repair service

Empirical Evidence on the Ricardian Model

Limitations of Ricardian Model

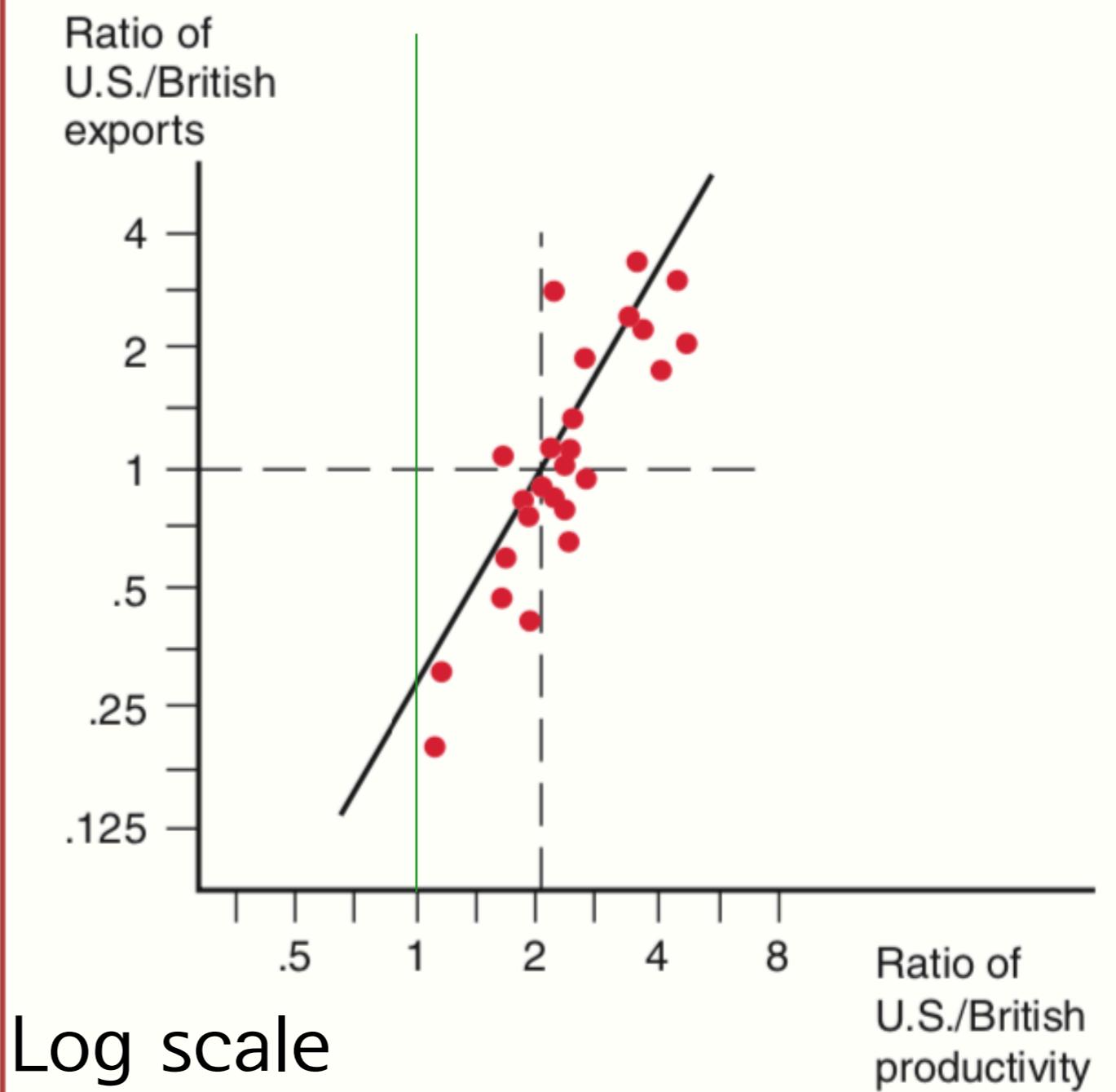
- Predicts an extreme degree of specialization
- Does not explain the redistribution of income within countries from international trade
- Does not count the differences in resources among countries
- Neglects the economies of scale

Empirical Test

FIGURE 3-6

Productivity and Exports

A comparative study showed that U.S. exports were high relative to British exports in industries in which the United States had high relative labor productivity. Each dot represents a different industry.



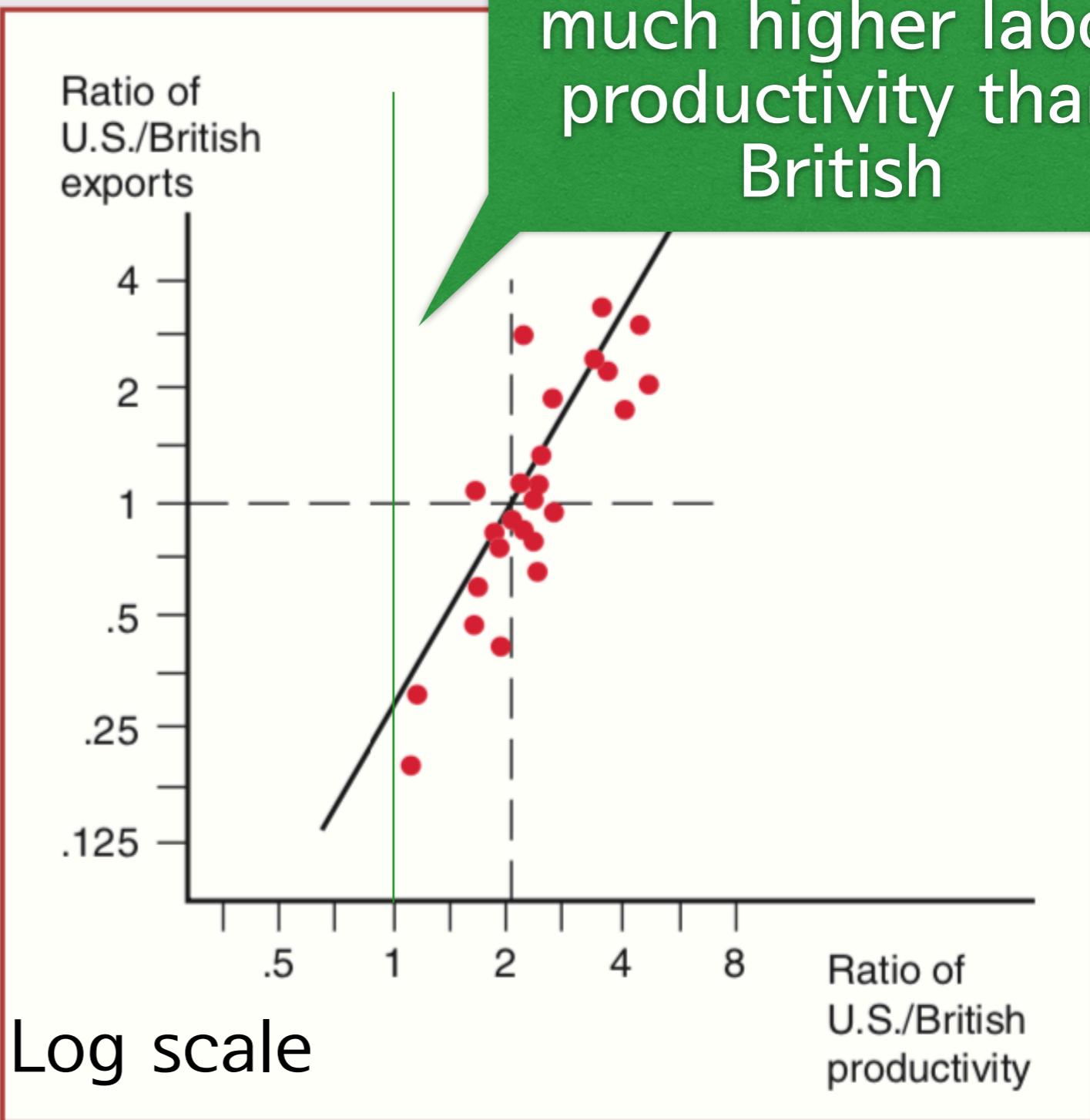
Empirical Test

FIGURE 3-6

Productivity and Exports

A comparative study showed that U.S. exports were high relative to British exports in industries in which the United States had high relative labor productivity. Each dot represents a different industry.

$x > 1$ implies US has much higher labor productivity than British



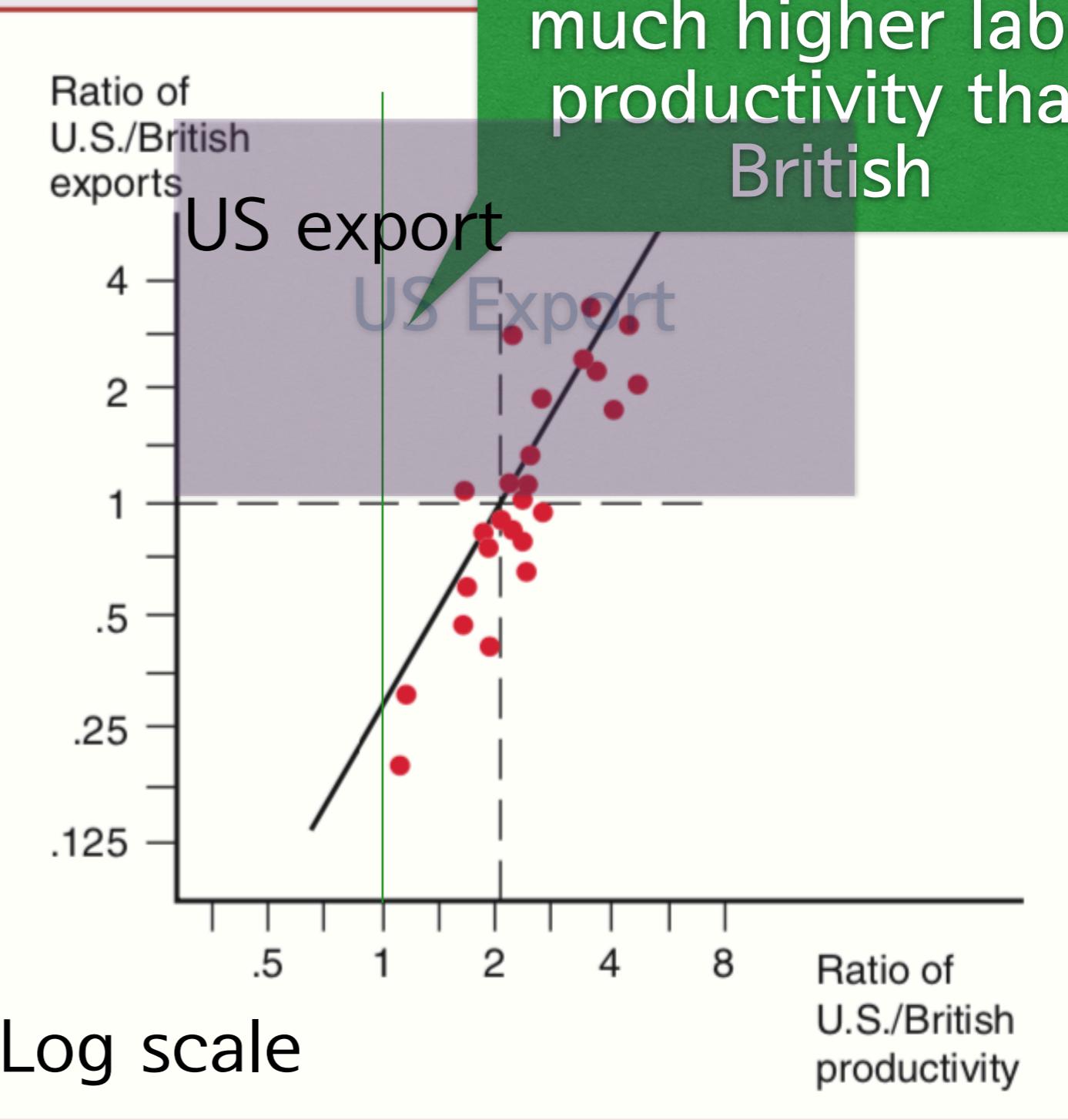
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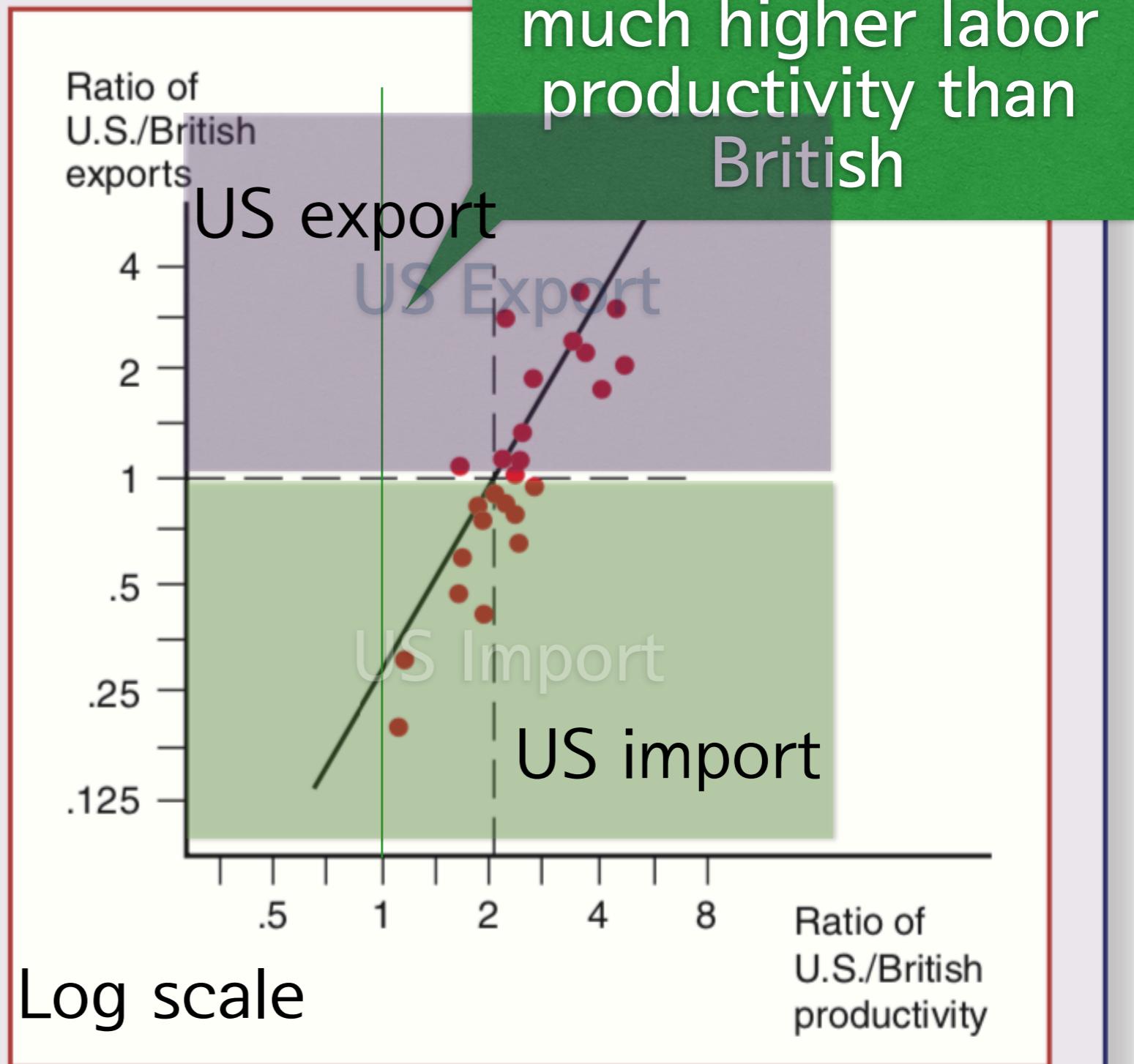


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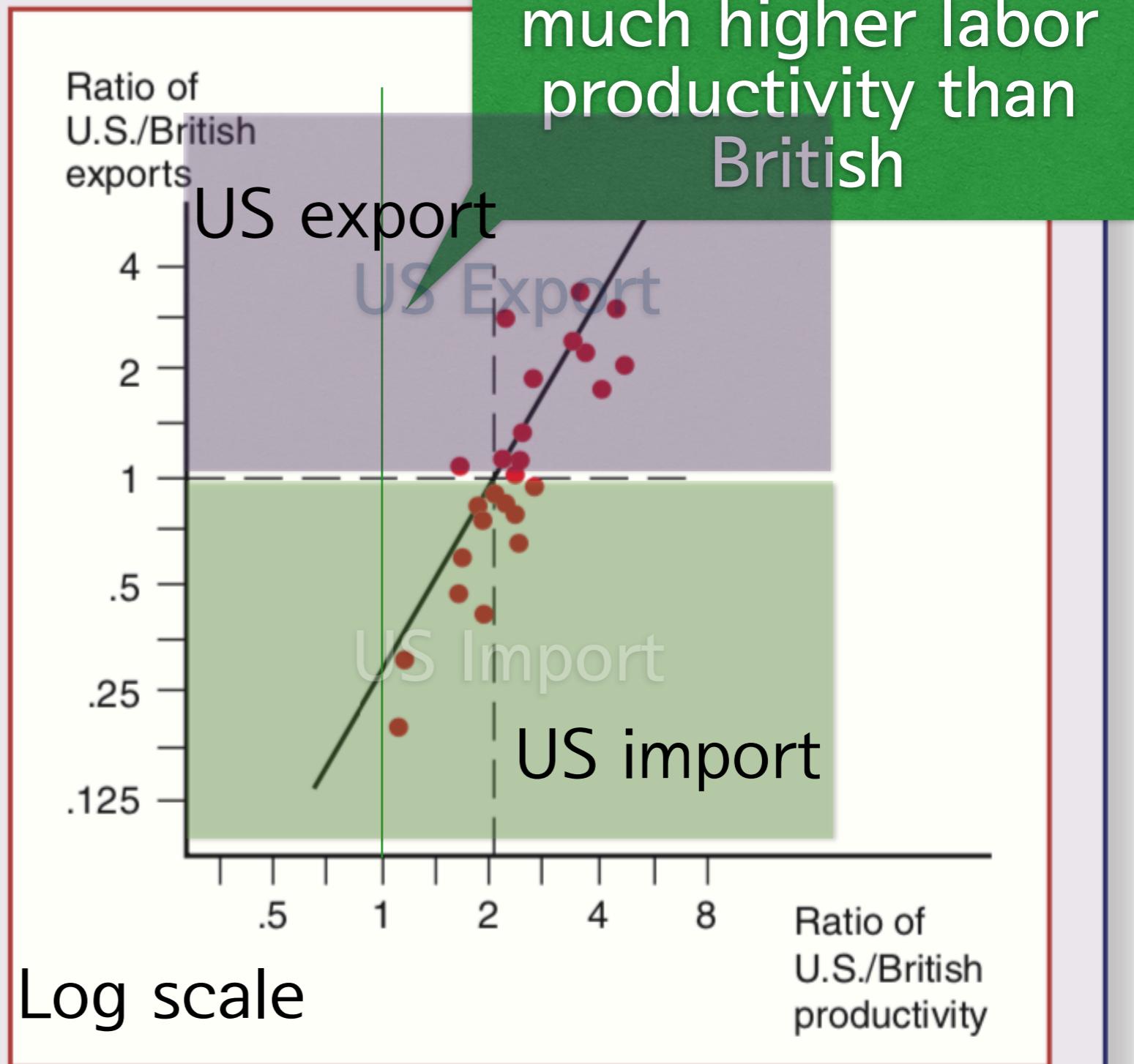
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Productivity and Exports

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Trade depends on comparative, not absolute advantage



Conclusion

- Productivity differences is very important in international trade
- Comparative advantage is more important than absolute advantage

Next Topic

- Specific Factors and Income Distribution
- Chapter 4

Thank you!

