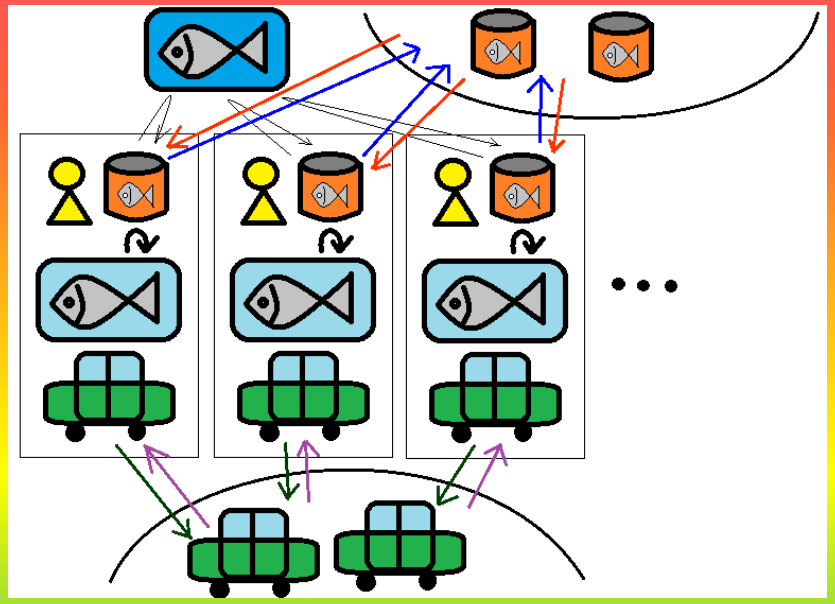
Non-Cooperative Decision of Fishery Amounts in Integrated Markets: Generalized Version



http://urx3.nu/L87t

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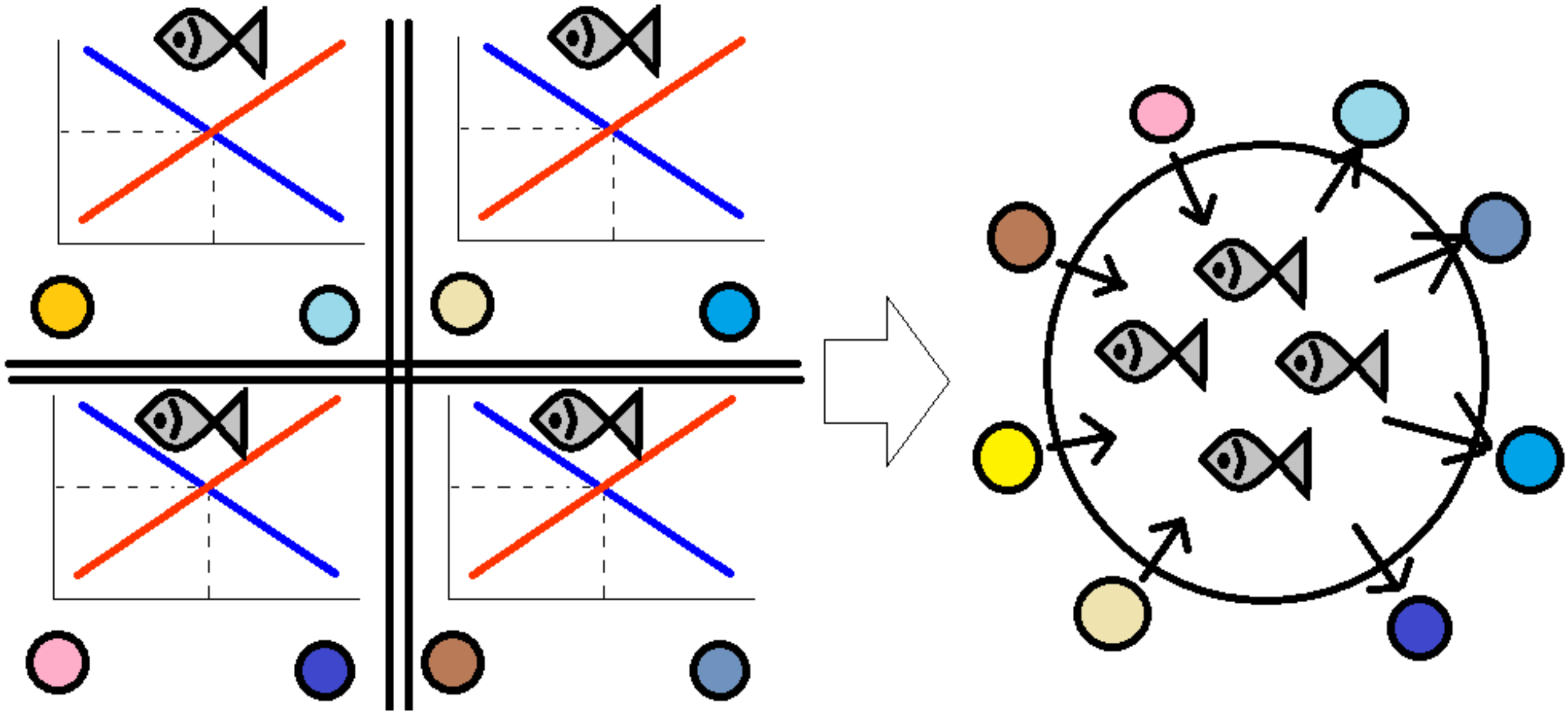
Introduction: Is market integrating in the world?

- In the long term:**Globalization** has became after many twists and turns.
  - ➢ **Transportation cost** has become down
  - ➢ Technology to move fishery products far away has grown up.
- Short term: Several movements of **mega-sized FTA/EPA** surround protectionism countries, where parts of countries must change policies.
- **Recognition of IUU (illegal, unregurated, unreported)** fishery internationally and **forming RFMOs**: both have effects of integration.
  - ➢ +Spill-over effect of price from big market

● Fish market has also become **integrated** at least partially in the world.



Framework of Non-Cooperation

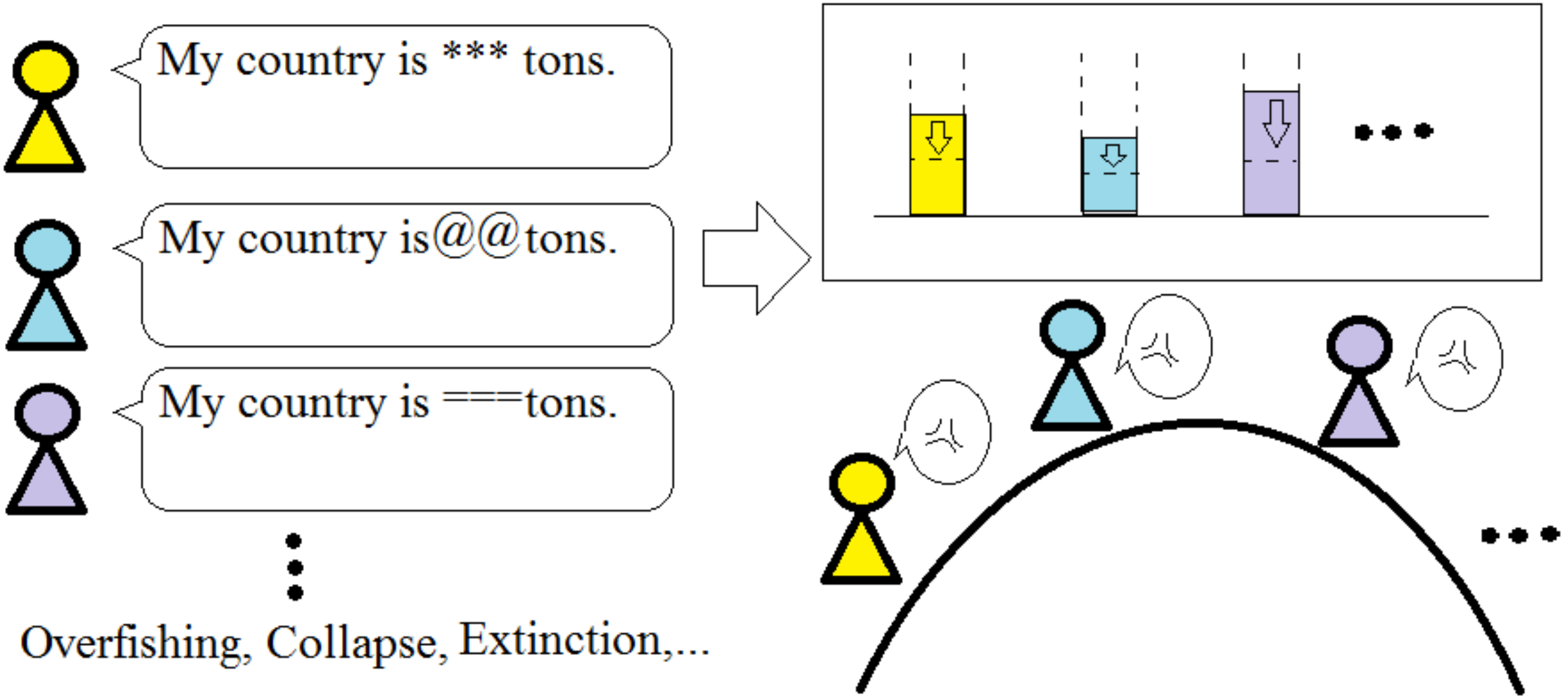
- Each country's non-cooperative movement has several meanings in also integrated market.

1. **Benchmark for cooperation**: For example, to derive international Nash-bargaining solution for cooperation, non-cooperation framework has a role of reservation for breaking point.

⇒For nontransferable quotas internationally (usual in the transboundary)

2. International extension of IUU and control: Each country's seriousness has **difference**.

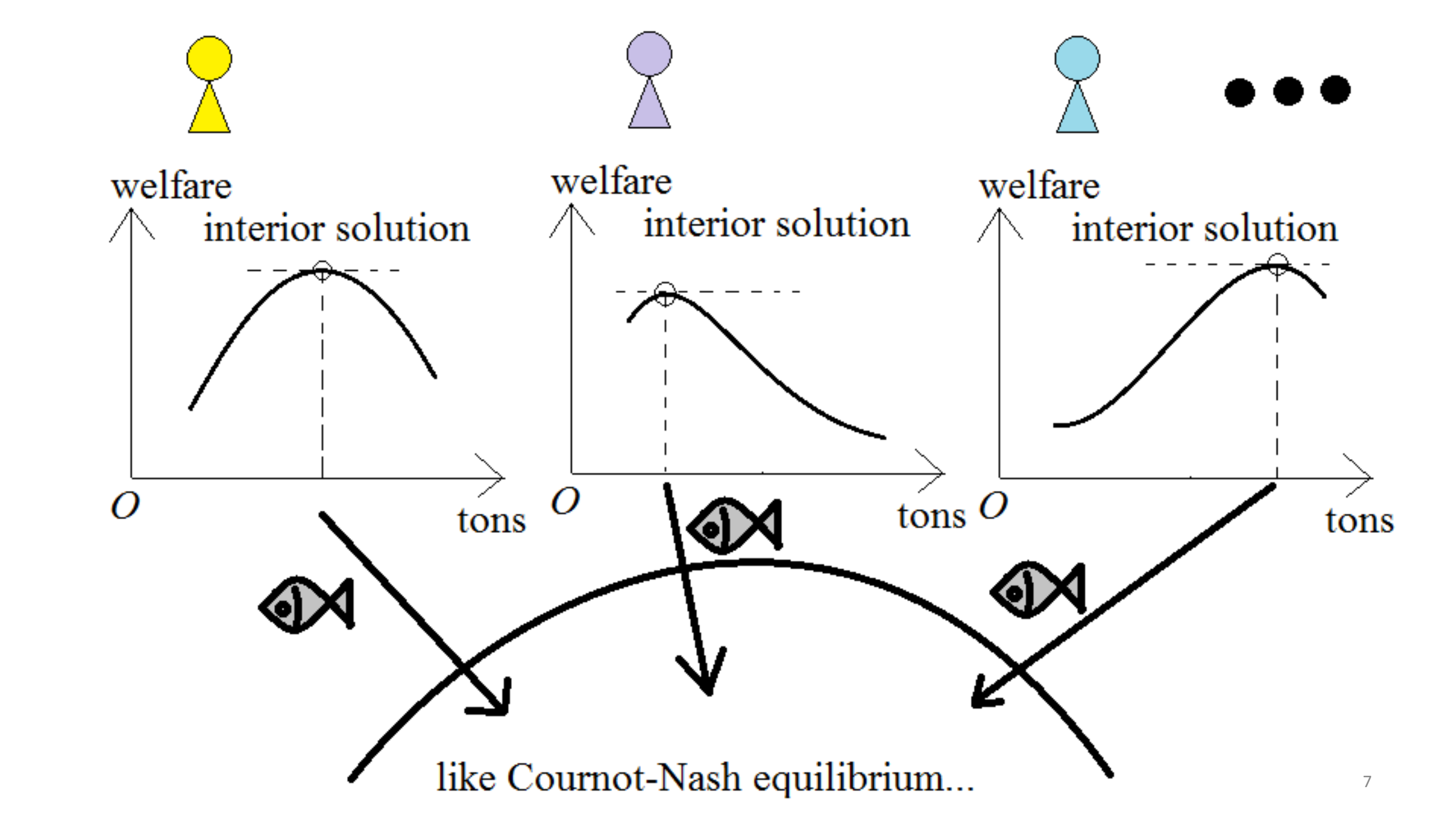
➢ Especially, **theoretical framework with general equilibrium** (not partial equilibrium) is focused in this research.


My country is *** tons.
My country is@@tons.
My country is ===tons.
Overfishing, Collapse, Extinction,...

Nothing Special Common Sense (but not Right)

- If each country non-cooperatively maximizes each country's welfare, each country decides the amount of catching fishery products with interior solutions ***without anything of doubt***, like Cournot equilibrium.

- Segmented market: **Yes**.
- Without considering price movement: **Yes**, but unrealistic in fishery.
- Partial equilibrium (without considering other markets): **Yes**.
- Non-Fresh goods which can be stocked: **Yes**, but unrealistic in fishery because many developing countries (including LDC) also exports.
- Another purpose from the country's welfare maximization: **Yes**.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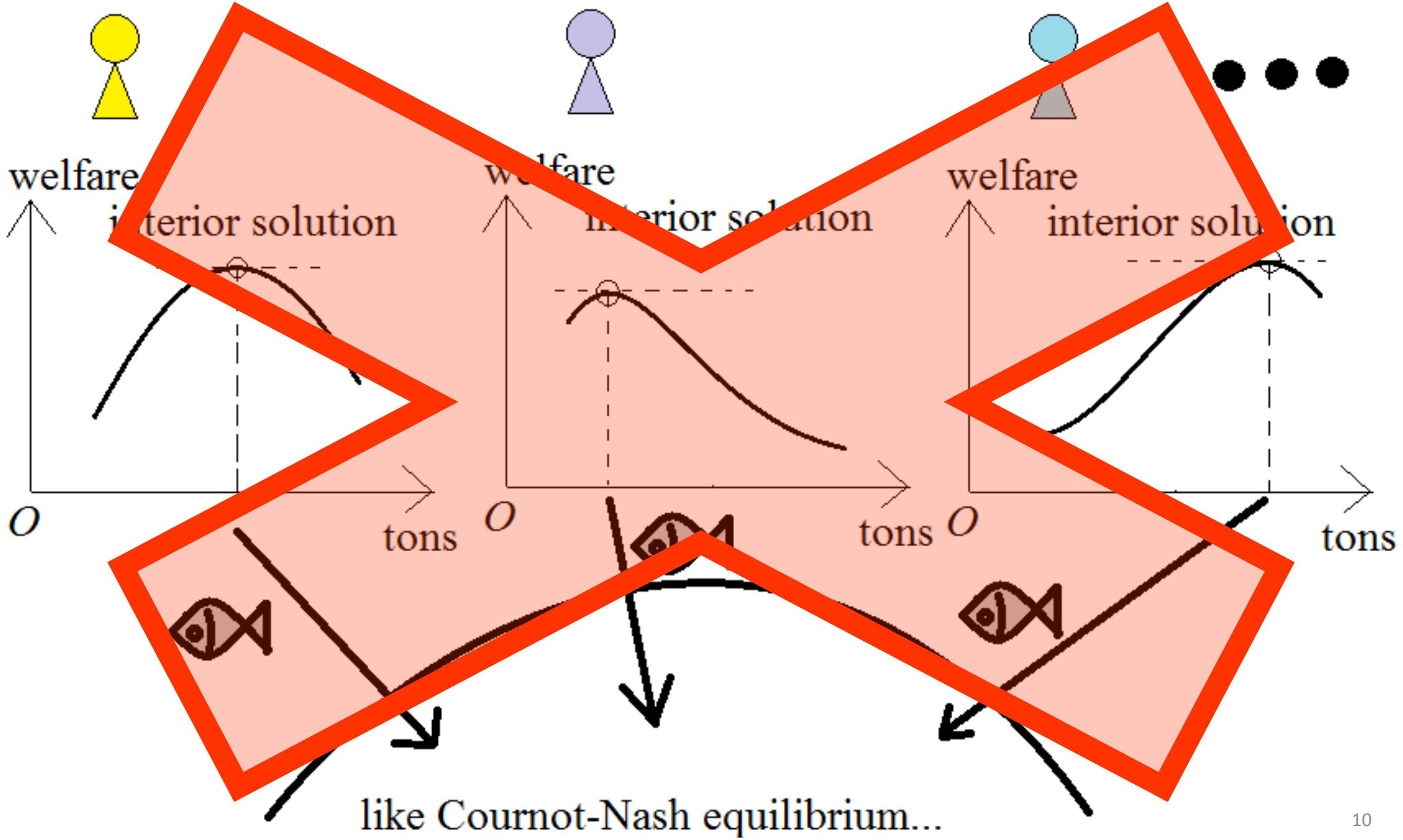
➢ Fresh fish with considering fish price movement like control variables under internationally integrated market in general equilibrium: **NO**.

The Purpose of this Research and Answer

- Purpose: The research wants to consider equilibriums where each country maximizes each country's welfare uncooperatively to choose each country's catching amount and fresh fish price **interiorly** under internationally integrated market with **general equilibrium**, ***if exists***.
- Caution: to derive international fish price from market clearing condition of fresh fish market and substitute, this is equivalent to the case of only catching amount as movements of fish price is a function.
- Answer: Interior equilibriums **cannot be existed**, with transition process. At least one country **must** specialize fishery or non fishery.
- Robustness: **Almost perfect in very general situation.**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Previous Researches with GE theoretically

- Brander and Taylor (1998, JIE): 2-country, 2-good (fishery and non-fishery), 1-factor (labor) trade with open access (not welfare maximization); **separated resources but integrated markets**.

cf. Brander and Taylor (1997, REE): welfare max. with only one country

- Ogawa (2014, SSRN WP): 2-country, 2-good (fishery and non-fishery), 1-factor (labor) trade with technical regulation; separated resources and separated markets (with product location's difference to consumers).

cf. Stöven(2014) et al.: continuous infinite kinds of resources

- Yanase and Li (mimeo): for integration theory between resource and environment; **separated resources but integrated market**

cf. Gozlan and Benonnier (mimeo): cross-sectoral pollution externality

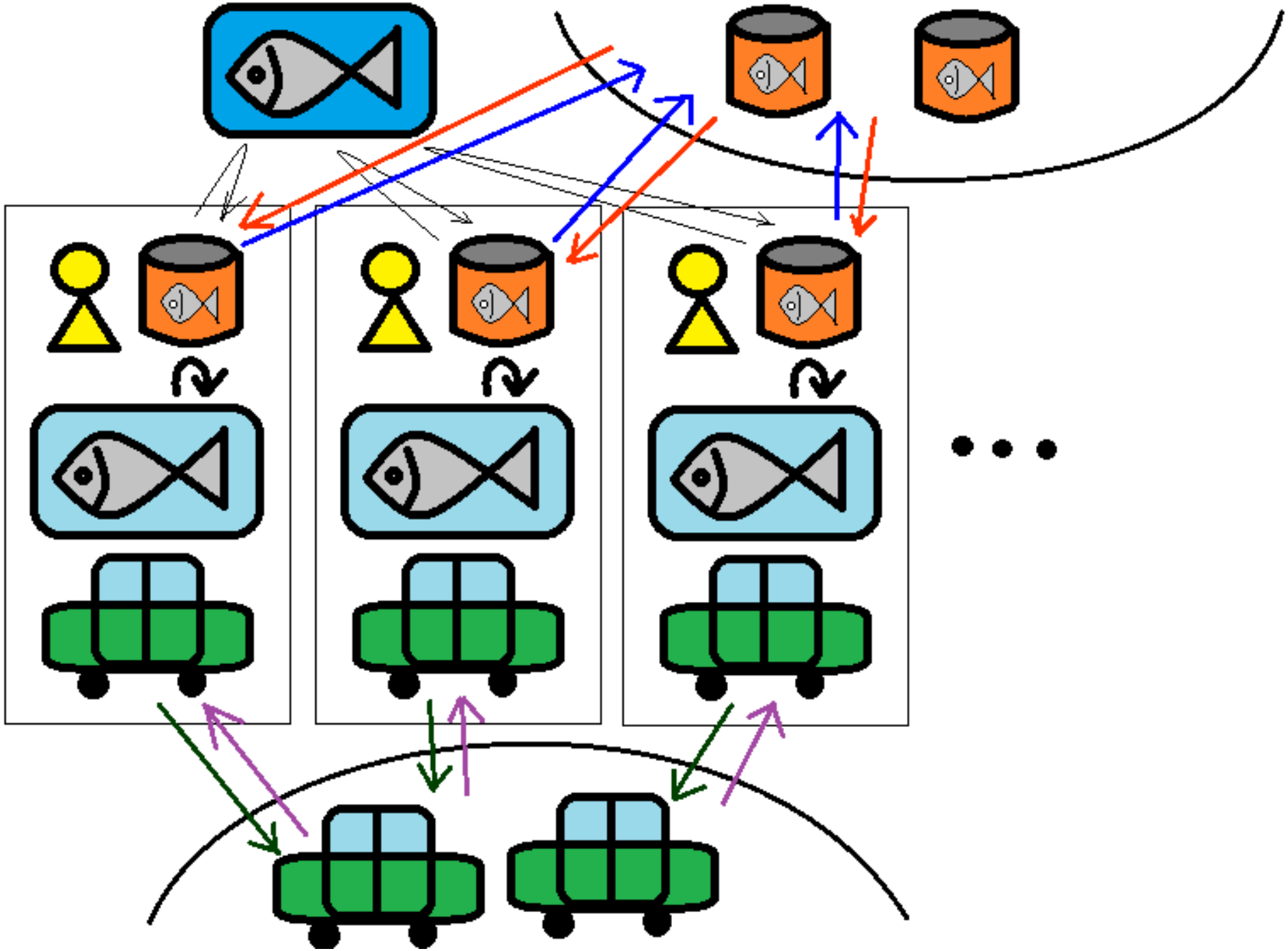
➢ ***Common resource is not necessary condition for integrated market.***

Previous Researches with GE theoretically (Cont.)

- Takarada et al. (2013, RIE): 2-country, 2-good (fishery and non-fishery), 1-factor (labor) trade with open access (not welfare maximization); **common resources and integrated markets**.

  cf. Rus(2012, ERE): partially-shared resources
- Takarada (2010, RIETI DP): 2-country, 2-good (fishery and non-fishery), 1-factor (labor) trade with technical regulations (limited welfare maximization); **common resources and integrated markets**.
- Takarada et al. (2012, Nanzan WP): 2-country, 2-good (fishery and non-fishery), 1-factor (labor) **Ricardian-type based** trade with excise tax regulations; **common resources and integrated markets**.

➢ ***Without considering both countries' incomplete specialization***



Model: General Equilibrium with Trade

- *n*-country (*i*=1,2,…,*n*), 2-good (fishery [H]: relative **common** price [*p*] and non-fishery numeraire [M]), 1-factor (labor endowment vector: ***L***) GE model with resource stock (**vector with generalized case**) ***S***.
- Discrete time *t* (from 0): But it can be ***applied with differential games***.
- ***c***: trade costs for each country and time (e.g. tariff, transportation cost)
- ***I***: income for each country & time (***including*** benefit from production)
- ***U(h,m)***: utility function from consumption of fishery and numeraire: utility function **can be allowed to be different** with country and time.
- Each country's consumer maximizes each country's utility with budget constraint in each period: *v* (indirect utility func. for ***Roy's identity***)

$$v_t^i\left(p_t + c_t^i, I_t^i\right) := \max_{h_t^i>0, m_t^i>0} \left\{ U_t^i\left(h_t^i, m_t^i\right) \in \mathbb{R} \middle| \left(p_t + c_t^i\right) h_t^i + m_t^i \leq I_t^i \right\}.$$

Model: Production and Market Clearing Conditions

- Labor constraints: fish catch effort + numeraire labor: $L_{Ht}^i + L_{Mt}^i = L_t^i$
- ***H***: fish catch amount function ***for each country & time*** with resources

$$H_t^i\left(L_{Ht}^i;\mathbf{S}_t\right)(\geq 0):\ H_t^{i\prime} > 0,\ H_{\mathbf{S}t}^i \geqq \mathbf{0},\ L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right) := H_t^{i,-1},$$

- ***M***: non-fishery numeraire production func. ***for each country and time***

$$M_t^i\left(L_{Mt}^i\right)(\geq 0): M_t^i > 0,$$

- Each country's income: $I_t^i := \left(p_t + c_t^i\right) H_t^i + M_t^i\left[L_t^i - L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right)\right]$
- Demand & supply equil. (***original types***) condition for fresh H:

$$\sum_{i=1}^{n} h_t^i\left\langle p_t + c_t^i, \left(p_t + c_t^i\right) H_t^i + M_t^i\left[L_t^i - L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right)\right]\right\rangle \leq \sum_{i=1}^{n} H_t^i$$

- This market clearing condition can be hold as equation (p_t: positive):

➢ ***There is a pair where the sign of net import of fresh fish is different.***

Resource Stock Movement and Welfare max.

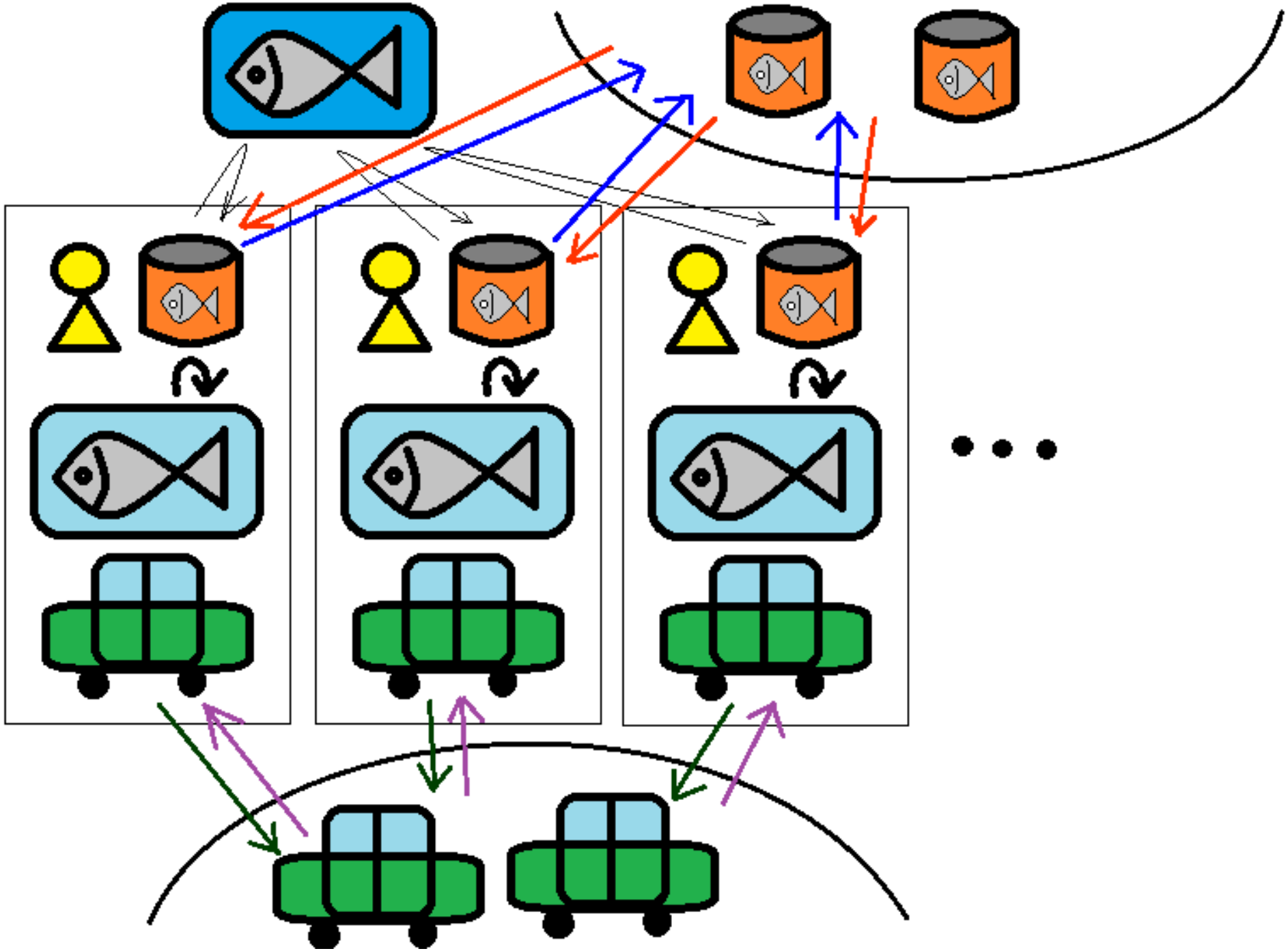
- Dynamic equation of resource stock vector is **very generalized**.
- $\mathbf{S}_{t+1} = \mathbf{F}_t\left(\mathbf{S}_t, \mathbf{H}_t, M_t^i, \mathbf{M}_t^{-i}\right)\left(\geqq \mathbf{0}\right), \lim_{t\to+\infty} \mathbf{S}_t \leqq \mathbf{C}$.(carrying capacity)
- $\beta^i \in (0,1)$:discount rate for each country i(=1,2,…,n)
- Each country's each period's welfare max. **with non-cooperation**:

$$\max_{0\leq H_t^i \leq H_t^i\left(L_t^i;\mathbf{S}_t\right), p_t>0} \sum_{t=0}^{+\infty} \left(\beta^i\right)^t \cdot v_t^i\left\langle p_t + c_t^i, \left(p_t + c_t^i\right) H_t^i + M_t^i\left[L_t^i - L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right)\right]\right\rangle$$

$$\text{s.t.} \quad \mathbf{S}_{t+1} = \mathbf{F}_t\left(\mathbf{S}_t, \mathbf{H}_t, M_t^i\left[L_t^i - L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right)\right], \mathbf{M}_t^{-i}\left(\mathbf{S}_t\right)\right), \quad \mathbf{S}_0(\gg \mathbf{0}) : \text{given},$$

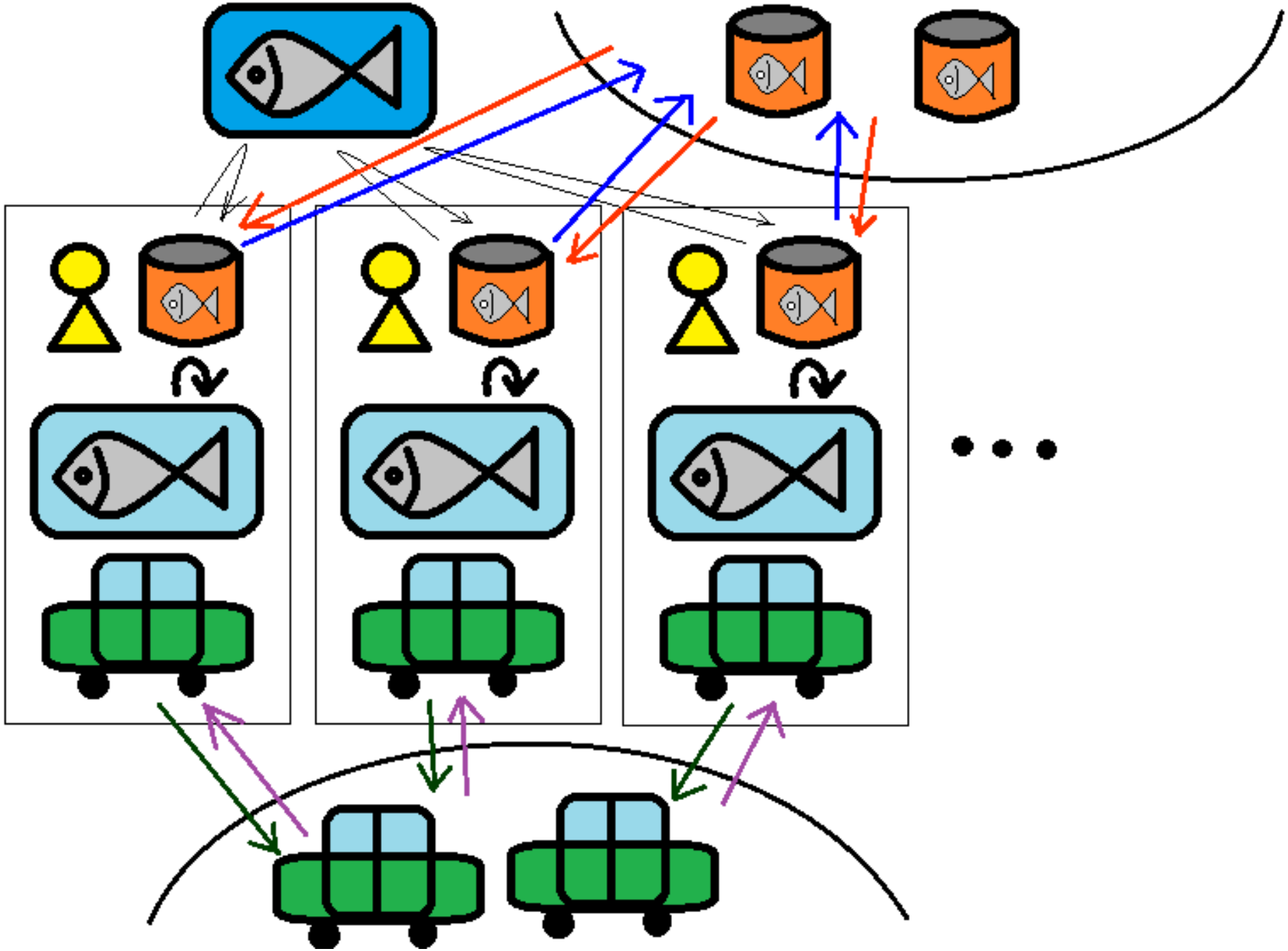
$$\sum_{i=1}^{n} h_t^i\left\langle p_t + c_t^i, \left(p_t + c_t^i\right) H_t^i + M_t^i\left[L_t^i - L_{Ht}^i\left(H_t^i;\mathbf{S}_t\right)\right]\right\rangle \leq \sum_{i=1}^{n} H_t^i,$$

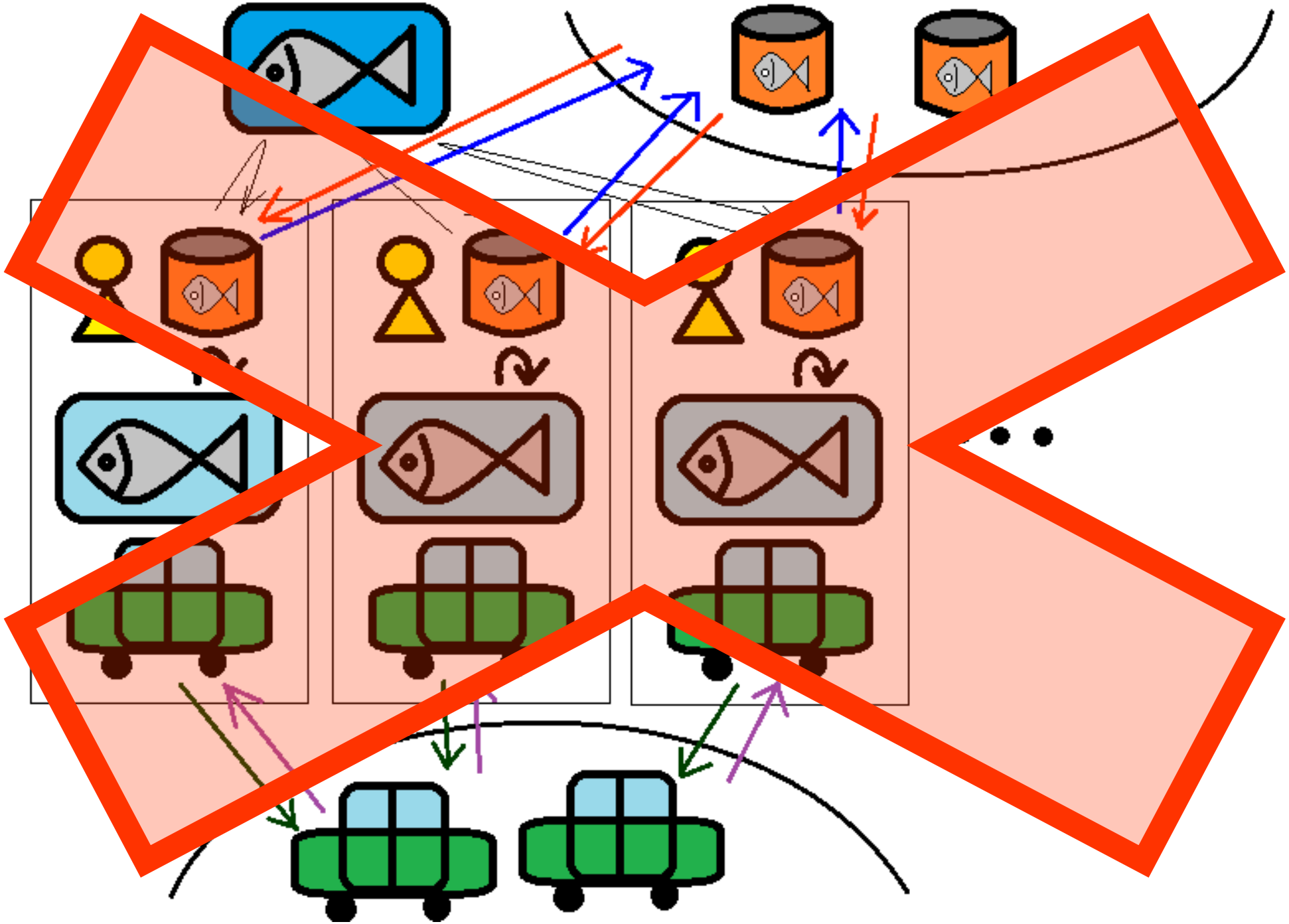
➢ Important point: Each country's fish catch amount has **no warranties to be interiors**, but **it cannot be assumed as interior solutions in all countries**. cf. Fish price's movement changes market clearing condition.



Proposition

- Proposition: Consider each country's welfare maximization using fish catch amount **non-cooperatively** when each country considers **international common market's** fish price movement as fish price is a control variable under fish price's market clearing condition.
- Trade of fish amount is assumed not to be 0 in all countries.
- Fish price's movement is supposed to move world equilibrium of fish.
- There is **NO** equilibrium where **all countries** (including fish-import countries and fish-export countries) **decide fish amounts as interior solutions** including any transition process.
- This result has robustness for each country's price movement part like transportation cost, import tariff, and so on.
- Moreover, the result has ***very general robustness***.





Sketch of Proof and Meaning

- Gimmick: the market clearing condition is original form to determine **the sign of multiplier** of the equilibrium condition to be positive.
- Using Roy's identity, the first-order partial derivatives of *p* to Lagrange (Hamilton with statistic formulation) function can be arranged **the same sign part and different sign part from fish's net exports' sign**.
- Therefore, there is a country which the condition cannot be zero; which means that price tends to become zero or infinity; the former implies that the country specializes non-fishery numeraire; otherwise, the latter implies that the country specializes fishery. Therefore, there is no equilibrium where any country determines interior fish catch output.
- The formation of results have meanings: (1) ***the formulation which Ricardian types of model can be justified*** (like Takarada et al. (2012))

Implication of the result for non-transferable quota (1)

- Like Nash Bargaining, if each country's fishing quota is determined as optimal, the reservation for breaking point is needed to start discussion.
- Moreover, **non-transferable quota is important** for transboundary framework (cf. ITQ is widely recognized in **only domestic** terms.) because the adjustment cannot to be done after determining the quota.
- However, if all countries have interior solutions as reservation points, there is a country which **doesn't maximize the country's welfare** non-cooperatively considering price movement, but it's not usual case. At least, it **requires a reason** why the choice is done for nation people.
- In the usual case, at least one country must specialize fishery or non-fishery, but if the specialization is fishery, the negotiation has difficult because non-fishery industry tends to **comparative *dis*advantage**.

Implication of the result for non-transferable quota (2)

- This country has a difficulty only to decrease the fish catch amount.
- Even if the fish price increases enough for this consensus, the country may take part in the consensus, but in the usual case, the country has gains of rents from fishery industry in the reservation points.
- At least, if the “reservation” points start **without** justifying points (welfare max.), the final result **also differs** from the justifying result.

➢ If international transferable quota, the quota is concentrated efficiency.

- Therefore, the important policy implication is as follows (***new***):

● If ***distribution of non-transferable quota*** including each country’s reduction should be justifying in the orthodox economy, at least one country which ***does NOT catch fish*** (only consuming) is needed in the negotiation. cf. Consensus may change the country’s welfare.

Conclusion

- This presentation focused on integrated fresh fish market in the general equilibrium. If each country maximizes each country's welfare non-cooperatively (which is based on the reservation points), **at least one country must specialize**.
- The result has **very robustness in the general formulation**.
- This result is from only the character of general equilibrium, so it is obvious in the trade area, but the result has important policy implication for resource economics, especially **non-transferable quota's justification** with orthodox economics.

- ***Thank you very much to listen to the presentation.***