Research Activities

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[Backgrounds of the research]

Trade theory is one of the oldest research subjects in economics. Ricardo's comparative cost theory is the oldest and most cited among various approaches. A modern formal investigation started in the first half of the 20th century and came to a certain maturity in 1950's. It was believed that a culmination was achieved by Ronald Jones's paper in 1961. In 1999 Ethier wrote: "[Jones's] contribution was so definitive that the Ricardian model has since been used almost entirely as a tool of other purposes and not as a subject of research in its own right." It was untrue, because a most important and difficult problem was left. It was the study of economies with input trade. In the course of my research in Ricardo-Sraffa trade economy, I found by chance that Ricardo trade economy (without input trade) contains an interesting mathematical structure.

Min-times or max-times semi-rings are two variants of tropical algebra. As standard tropical algebra is based on max-plus semi-ring, I named these algebras subtropical. Ricardian trade theory is composed of two entities: international values and production set. The knowledge of tropical mathematics gives a good guidance on the investigation of international values. For example, the set of all competitive types form a tropical oriented matroid when the labor input coefficient matrix A is in a general position. This tropical oriented matroid corresponds to maximal frontier of the world production possibility set, which is defined as the Minkowski sum of simplices. Research in Ricardian trade economy can bee interpreted as a study of subtropical convex geometry. Although this method applies only to Ricardo trade economy and not to Ricardo-Sraffa economy, subtropical view point guides us to new research projects.

[Results obtained]

An article titled “Subtropical convex geometry as Ricardian theory of international trade” was written. This is intended to be a comprehensive report. As the research is still developing, it remains in a form of draft paper. A short summery was published under the title “International trade theory and exotic algebras” in *Evol. Inst. Econ. Rev.* (June 2015).

[References]

Jones, R. 1961 Comparative Advantage and the Theory of Tariffs: A Multi-country, Multi-commodity Model. *Review of Economic Studies* **28**(3): 161-175.

Ethier, W. J. 1999 Profile : Jones and Trade Theory. *Review of International Economics* **7**(4): 764-768.