

## **Finding Non-Linear Production-Consumption Equilibrium.**

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We introduce and study non-linear production-consumption equilibrium (NPCE), which is a combination and generalization of both classical linear programming (LP) and classical input – output (IO) models.

The NPCE is also a generalization of Walras-Leontief's equilibrium introduced by Michio Morishima more than 50 years ago.

In contrast to both LP and IO, in the NPCE production cost, consumption and factor vectors are not fixed. Instead, they are functions of the production output, prices for goods and prices for factors.

The NPCE is such state of the economy that the total production cost reaches its minimum and the total consumption reaches its maximum, while the production prices are consistent with the production output, the consumption is consistent with the prices for goods and the factors availability is consistent with the prices for factors.

We show that finding NPCE is equivalent to solving a variational inequality with a particular operator and a very simple feasible set, projection on which is a low cost operation. Therefore, we consider two methods for finding NPCE that projection on the feasible set is the main operation per step.

Conditions on production, consumption and factors operators under which NPCE exists and is unique are considered. Convergence, rate of convergence and complexity of the methods under these conditions were established. Both methods are pricing mechanisms for finding NPCE.