Existence and uniqueness of conjectured supply function equilibria

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Abstract— Supply Function Equilibrium (SFE) and Conjectured Supply Function Equilibrium (CSFE) are some of the approaches most used to model electricity markets in the medium and long term.

SFE represents the generators' strategies with functions that link prices and quantities, but leads to systems of differential equations hard to solve, unless linearity is assumed (Linear Supply Function Equilibrium, LSFE). CSFE also assumes linearity of the supply functions but only around the equilibrium point, also avoiding the system of differential equations.

This paper analyzes the existence and uniqueness of G-CSFE (a CSFE previously proposed by the Authors) for both elastic and inelastic demands. In addition, it also proves that the iterative algorithm proposed to compute G-CSFE has a fixed point structure and is convergent, and that LSFE is a particular case of G-CSFE when demand and marginal costs are linear. Selected examples show the performance of G-CSFE and how it can be applied to market power analysis with meaningful results.

Index Terms— Conjectured supply function, supply function, inelastic demand, electricity market equilibrium, equilibrium existence and uniqueness.