



Multi-Product Supply Function Equilibria

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This paper demonstrates how appropriate bundling of goods simplifies the analysis of multi-product markets, where producers supply multiple types of goods. Appropriate bundling may also facilitate trade. We study pricing, welfare, and how these outcomes are shaped by competition. Our theoretical framework is particularly relevant for electricity markets.

In many markets, firms supply not just one product but several. On the electricity exchange, for example, a producer offers electricity in different hours, which can be regarded as distinct products. To account for start-up and shut-down costs in production, a producer may wish to condition its supply decision for a given hour on prices across several hours. Several electricity exchanges, allow this to some extent. Certain financial markets—especially those specialising in options trading—also provide such opportunities.

However, traditional models used to analyse competition in electricity and financial markets have primarily focused on trade of a single product. Our theoretical study extends these models to multi-product markets in which each producer commits to a supply function at the trading venue, and where the supply of each product may depend on several different prices.

A problem with trading platforms that permit bids to be contingent on several different prices is that trade becomes more complex, both for participants and for the market operator. We show that trade in these products can be simplified if they are bundled in a suitable way. By ‘appropriate bundling’ we mean that each bundle contains a carefully selected composition of the underlying products. This eliminates the need for producers to condition the sale of one bundle on the prices of others. This bundling solution also makes market analysis more tractable: multi-product markets can be analysed as if they were a set of independent single-product markets.

The concept of cost pass-through is often used in competition and welfare analysis to describe how markets respond to changes in costs and taxation. It measures the extent to which market prices rise when costs increase. In a multi-product market, higher costs for one good also affect the prices of other goods.

A particularly relevant measure for our analysis is the degree of cost pass-through relative to the pass-through that would prevail if all goods and bundles were supplied at marginal cost, as under perfect competition. We show that it is largely this relative pass-through that determines how much sales decline due to market power and how large the resulting welfare losses are.



Our theoretical analysis focuses on markets with symmetric producers with identical cost functions. For any given number of producers, it is possible to derive a worst-case scenario that maximises the welfare loss relative to the welfare level under perfect competition. This provides an upper bound on welfare losses in multi-product markets. We find that the relative welfare losses are always below 1 percent provided there are at least four producers in the market.