Merger simulation models: Part 3

This is the third CCR out of a series of four. In previous CCRs, we discussed the purpose of MSM and their application to several merger cases settled by the European Commission.

In this CCR, we will touch upon the **practical implementation** of MSMs in merger control. In doing so, we will address the following questions: What assumptions are we making when running a MSM? What are the time and data requirements? What are the limitations of MSMs?

Design of MSM

▪ Competitive structures

The first assumption we make when building a MSM is about the form of competition that best describes the behavior of firms operating in the relevant market.

In the model of <u>perfect competition</u> firms charge their price at marginal costs. The conditions required to classify a market perfectly competitive is a mixture of several different notions. Perfect information about the market and price distribution should be available. Besides product homogeneity, the size of agents does not matter either: market participants can sell as much of the good as they wish at the equilibrium price but nothing at a higher price. The equilibrium or competitive price at marginal costs is reached when supply and demand are in equilibrium. Since equilibria happens before and after a merger, such models are inappropriate to estimate the unilateral effects of a merger.

<u>Oligopoly models</u>, instead, are more appropriate by applying game theory. Whereas in traditional economic analysis, a company takes as given its cost structure and the demand curve that it is facing, game theory suggests that most companies are smarter than this and realize that competitors will respond to whatever strategy they choose. Thus, modern game theory strives to formalize the theory and mathematics of decision making in a strategic environment by incorporating awareness of the consequences of strategic decisions. The consequences can be a response, such as matching a competitor's prices, or responses from consumers, such as lower future demand in response to quality issues with the company's product.

Oligopoly games have a <u>few players</u> which is generally taken to be somewhere between three and ten. Thus, economic games tend to have a manageable number of players, although sometimes games are constructed with a few players and then the remaining part of the industry represented as a competitive fringe meaning that those firms act as in perfect competition and do not practice strategic behavior.

<u>Repeated games</u> are when the same players repeat the same game, either a set number of times (called rounds) or an infinite number of times. A game in which the sum of all payoffs is constant is called a <u>constant game</u>; a non-constant game is one where the sum of payoffs varies depending on strategies chosen.

The <u>Nash equilibrium</u> is a solution concept of a non-cooperative game involving two or more players, in which each player is assumed to know the equilibrium strategies of the other players, and no player has anything to gain by changing only their own strategy. If each player has chosen a strategy and no player can benefit by changing strategies while the other players keep their unchanged, then the current set of strategy choices and the corresponding payoffs constitute a Nash equilibrium.

Modern oligopoly theory is predominantly built upon three standard models: (1) Cournot competition, (2) Bertrand competition, and (3) Auction theory.

(1) <u>Cournot competition</u> applies to markets with homogenous goods i.e. perfect substitutes, where firms compete in quantities. MSMs are rarely applied to Cournot competition because it is somehow counterintuitive to estimate unilateral effects caused by price changes when quantities (not prices) are the strategic parameters.

(2) <u>Bertrand competition</u> is the common framework adopted to evaluate horizontal mergers in differentiated products industries. In this model, firms compete in prices. More specifically, a firm sets its optimal price as a function of marginal cost, own-price elasticity, and the prices of its competitors. The <u>Bertrand paradox</u> describes a situation in which two players (firms) reach a state of Nash equilibrium where both firms charge a price equal to marginal cost. Bertrand's result is paradoxical because if the number of firms goes from one to two, the price decreases from the monopoly price to the competitive price and stays at the same level as the number of firms increases further. The outcome would be the same as under perfect competition.

For merger simulation purposes, the Bertrand model is useful. A horizontal merger between two firms will give a strong incentive to the merged entity to raise its price due to the <u>internalization</u> of the competition between the merging parties. A MSM based on a Bertrand model is able to illustrate these price movements.

(3) In some markets, products are traded at <u>auctions</u>. The assessment of unilateral effects arising in such context as a result of a merger between two bidding firms can be performed through MSM using auction theory. Auction theory studies the efficiency of a given auction design, optimal and equilibrium bidding strategies, and revenue comparison.

- **Functional form of demand**

The quality of a MSM highly depends on the specification of the demand for the good or service in question. This is because demand entails information about own- and cross-price elasticities which are important parameters used to estimate unilateral effects. Therefore, the choice of a functional form of demand heavily influences the results of MSMs.

There exist four functional forms of demand: (1) linear and log-linear demand, (2) discrete choice demand, (3) Almost Ideal Demand System (AIDS) and Proportionality Calibrated AIDS (PCAIDS), and (4) multi-level demand estimation.

(1) Linear and log-linear demand specifications are scarcely used due to the underlying assumption that own- and cross-price elasticities remain constant after the merger. Moreover, they require information on product prices, quantities and demand shift variables. Nevertheless, these specifications are convenient for their simplicity. Just about 2 weeks are necessary to collect the required data.

(2) Discrete choice demand representation (or logit models) is the most common functional form used in MSM. In that case, demand takes the form of a consumer utility function which is influenced by quantities, prices and other product characteristics. Logit models are more demanding. However they also allow concrete effects based analyses. Time requirement is about 4-6 weeks.

(3) AIDS and PCAIDS models allow for a flexible representation of own- and cross-price elasticities determined by the data. They only require information on the products' market shares and

prices. Data requirement is straightforward and simple. Time horizon for analysis is about 2-4 weeks.

(4) Finally, multi-level demand specification consists of dividing the demand system into the overall demand in the market and competition between brands. Such specification is not often used due to the requirement of detailed product level data. About 4 weeks are necessary to collect the appropriate data set.

▪ **Merger efficiencies**

Another issue that deserves particular attention is the assumption concerning the efficiency gains resulting from a merger. In fact, efficiency gains or synergies may occur from the fact that marginal costs of the merging firms both decrease as a result of the merger. The existence of these merger efficiencies may mitigate the effects of an increase in post-merger prices by increasing overall welfare through economies of scale. Merger efficiencies are an integral part in any MSM.

▪ **Calibration of data and market simulation**

As already explored in the previous CCRs, own- and cross-price elasticities can either be estimated econometrically when detailed market data are available, or calibrated to real market conditions. MSMs use calibration strategies because they require limited market data and can be quickly implemented.

In the case of logit demand models, for instance, the own- and cross-price elasticities of demand for a particular good can be calculated directly from the regression of the product´s market share on observed product characteristics (e.g. size, quality) and the price. In other words, calibration means that elasticities are inferred from market shares data: products that have a large market share face a less elastic demand compared to products with a lower market share, ceteris paribus.

Once own- and cross-price elasticities have been estimated, the last step to estimate unilateral effects is to simulate the post-merger equilibrium price derived from the First-Order Conditions (FOCs) of the merged entity´s profit maximization problem. In particular, the post-merger equilibrium price is calculated as the price that maximizes profits for the merged entity whereby the profit function of the merged entity is derived from the pre-merger demand and cost structure specifications. The last CCR 2013 will provide a concrete example.