

# Final Report –

## Evaluating Merger Simulation: Uncertainty, Economic Assumptions and Practical Implementation

Jonas Björnerstedt and Frank Verboven

In June 2013, the Swedish Competition Authority granted funding for a one year project in the methodology and practical implication of merger simulation. Due to administrative delays, the project started October 1, 2013, and ended November 30, 2014. The results of the project are summarized below.

### Project goals

The project aims were to evaluate the merger simulation approach as one of the empirical tools in assessing mergers. In particular, the aims were to:

- (1) incorporate the role of uncertainty on a systematic basis;
- (2) make the economic assumptions more realistic (regarding demand, conduct, entry);
- (3) build a user-friendly, freely available package for merger simulation.

The application of our work has been on the market for non-prescription pharmaceuticals, with a particular focus on the market for painkillers.

### Project results

The project has resulted in the following work:

- Björnerstedt & Verboven (2012) has been extensively revised which has led to a revise and re-submit. After further revisions, the paper now also includes analysis using random coefficient demand<sup>1</sup> and has confidence intervals for the merger results. See Björnerstedt & Verboven (2015a)<sup>2</sup>.
- The Stata package `mergersim` is freely available, documented in the Stata Journal article Björnerstedt & Verboven (2014) and an example do file<sup>3</sup>.
- A version 2 of `mergersim` in Stata is nearing completion, with changes documented in Björnerstedt & Verboven (2015b) and an updated example do file<sup>4</sup>.
- A Matlab package has been developed for random coefficients estimation and simulation with confidence intervals, Monte-Carlo studies and non-linear discrete choice models.
- Work on the analysis of uncertainty and confidence intervals in merger simulation continues under 2015.

---

<sup>1</sup> Berry, S., J. Levinsohn and A. Pakes, "Automobile prices in market equilibrium", *Econometrica*, Vol 63:4, 1995.

<sup>2</sup> Björnerstedt, J. and F. Verboven, "Predicting the price effects of horizontal mergers - An application to the market for painkillers in Sweden", 2015a

<sup>3</sup> Björnerstedt, J. and F. Verboven, "Merger analysis with `mergersim`", *Stata Journal* 2014, Volume 14 Number 3: pp. 511-540.

<sup>4</sup> Björnerstedt, J. and F. Verboven, "Market analysis with `mergersim 2`", 2015b, mimeo.

From a methodological perspective the innovation of the analysis has been the inclusion of uncertainty in merger simulation. The methods have been incorporated and documented in the revised version of Björnerstedt & Verboven for the market for painkillers, in a revise and resubmit to the American Economic Journal: Applied Economics. Confidence intervals for both the nested logit and random coefficient logit models have been calculated using the Stata and Matlab packages, respectively. The revised paper also includes additional economic interpretation on how well merger simulation predicted the actual price effects in this case, including the role of cost increases due to the package size reduction of several brands.

The second aim of the project was to make the economic assumptions of the simulation model more realistic, as compared with the model of Björnerstedt and Verboven (2012a)<sup>5</sup>, by extending the demand model to the random coefficients logit model of Berry, Levinsohn and Pakes (1995). Mergersim now also includes the PCAIDS demand model of Epstein & Rubinfeld (2002)<sup>6</sup>.

The project has also resulted in the creation a package that can be downloaded and used by anyone, free of charge. The article describing the package has been published in the Stata Journal, and version 1 of the program is available from the journal's site.

A second version of the program mergersim is nearing completion. It has been extended beyond the estimation of nested logit demand and merger simulation to incorporate

- simpler tests multi-product UPP, SSNIP-test
- calculation of consumer surplus
- incorporation of demand side efficiencies (in addition to cost efficiencies) and new product introduction
- calibration of demand from outside information on elasticities
- confidence intervals (using parametric bootstrap)

## **WORK IN PROGRESS**

Some of the research issues of the project have not been completed. Work will continue in the period January-August 2015 to complete the analysis of the following.

A major update of the merger simulation package mergersim is nearing completion. A preliminary version of the document describing this package is included in the final report: Björnerstedt & Verboven (2015), "Market analysis with mergersim 2".

The analysis of uncertainty in merger simulation has taken more time than expected due to a couple of technical difficulties. The method to analyze uncertainty entails studying the effect of a merger on prices under various conditions, varying the uncertain parameters. The routines for finding equilibria in Stata were unfortunately not stable or fast enough to do this in a reliable way. In about 5-10 percent of the cases, the equilibrium outcome was not found, making the analysis of uncertainty difficult. In part to address this difficulty, a new package was created in Matlab. With this new package, the convergence issues seem to have been solved. The analysis of uncertainty will continue under 2015, with a goal of completing a first version of a working paper before September.

---

<sup>5</sup> Björnerstedt, J. and F. Verboven, "Predicting the price effects of horizontal mergers - An application to the market for painkillers in Sweden", (2012), CEPR Discussion Paper No. DP9027.

<sup>6</sup> Epstein, Roy J. and Daniel L. Rubinfeld (2002), "Merger Simulation: A Simplified Approach with New Applications", 69 Antitrust Law Journal 883-919.