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Merger simulation with Stata

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Introduction

The presentation is based on the academic article *Björnerstedt-Verboven, **Merger Simulation with Nested Logit Demand – Implementation using Stata**, April 2013, Konkurrensverket Working Paper Series*

- Economics of merger (simulation)
- **mergersim** command in Stata
- How and when to apply the program

Economics of merger (simulation)

Product substitution matters

- Two main concepts of merger investigations:
  - Unilateral effects: unilateral incentive to increase prices
  - Coordinated effects: coordination more likely after merger → higher prices
- Differentiated products: diversion of sales from Company A to Company B is internalized as a result of the merger → looking at cross-price elasticities of products of Company A and Company B
- Merger simulation:
  - Applies a model on the industry and the competition
  - Calibrates pre-merger prices
  - Calibrates post-merger prices (which, in the absence of efficiencies, is always higher in markets of substitute products)
  - Firms compete by setting prices
  - Nash-equilibrium: each firm maximises profits given prices set by others
  - Need an assumption on demand function → strongest

Björnerstedt-Verboven model

Merger simulation with nested logit demand

- Demand is modelled with logit approximation: calculating choice probabilities of consumers for each choice available.
- Nested: consumer selects a product group first, then a specific product. This allows the model to calculate with cross-price elasticities greater between products of the same group (closer to reality)
- The model derives consumer choices based on random utility maximization then calculates the aggregate demand system for all products.

Merger simulation with Stata

Merger simulation with nested logit demand

1. mergersim init

run regression estimation (nested logit)

2. mergersim market (post-estimation command)

3. mergersim simulate (post-estimation command)

Merger simulation I. (initialization)

Three steps of merger simulation (1 of 3)

mergersim **init** [if] [in], marketsize(varname) {quantity(varname) | price(varname) | revenue(varname)} [init_options]

→ nests(varlist) firm(varname) unitdemand / cesdemand

```
. mergersim init, nests(segment domestic) price(princ) quantity(qu) marketsize(MSIZE) firm(firm)
```

```
MERGERSIM: Merger Simulation Program
Version 1.0, Revision: 218
```

```
Unit demand two-level nested logit

                Depvar              Price               Group shares
                ------------------------------------------------------
                M_ls                princ               M_lsjh M_lshg
```

```
Variables generated: M_ls M_lsjh M_lshg
```

Merger simulation I. (initialization)

Three steps of merger simulation (1 of 3)

- Estimate nested logit model

```
. xtreg M_ls princ M_lsjh M_lshg horsepower fuel width height domestic year country2-country5, fe

Fixed-effects (within) regression               Number of obs      =     11,483
Group variable: co                              Number of groups   =        351

R-sq:                                           Obs per group:
     within  = 0.9001                                         min =          1
     between = 0.7692                                         avg =       32.7
     overall = 0.8512                                         max =        146

                                                F(13,11119)        =    7706.68
corr(u_i, Xb)  = -0.0100                        Prob > F           =     0.0000
```

M_ls	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
princ	-1.171301	.0264398	-44.30	0.000	-1.223127	-1.119474
M_lsjh	.9081198	.0040417	224.69	0.000	.9001973	.9160423
M_lshg	.580436	.0083036	69.90	0.000	.5641596	.5967125

Merger simulation II. (market specification)

Three steps of merger simulation (2 of 3)

mergersim **market** [if] [in], [market_options] → conduct(#)

```
. mergersim market if year == 1999
-------------------------------------------------------------------------------

Supply: Bertrand competition
Demand: Unit demand two-level nested logit
-------------------------------------------------------------------------------

Demand estimate
xtreg M_ls princ M_lsjh M_lshg horsepower fuel width height domestic year country2-country5, fe
Dependent variable: M_ls
-------------------------------------------------------------------------------


Parameters

alpha = -1.171
sigma1 = 0.908
sigma2 = 0.580
-------------------------------------------------------------------------------

Own- and Cross-Price Elasticities:  unweighted market averages

    variable |      mean        sd       min       max
-------------+--------------------------------------------
       M_ejj |    -8.527     4.329   -39.684    -2.069
       M_ejk |     0.855     1.486     0.002    10.354
       M_ejl |     0.076     0.133     0.000     0.781
       M_ejm |     0.001     0.002     0.000     0.010
-------------------------------------------------------------------------------
```

Own-price elasticity

Cross-price elasticities

Merger simulation II. (market specification)

Three steps of merger simulation (2 of 3)

mergersim **market** [if] [in], [market_options] → conduct(#)

Pre-merger Market Conditions
Unweighted averages by firm

firm code	princ	Marginal costs	Pre-merger Lerner
BMW	0.888	0.784	0.130
Fiat	0.770	0.591	0.278
Ford	0.791	0.694	0.149
Honda	0.663	0.580	0.134
Hyundai	0.562	0.483	0.159
Kia	0.472	0.393	0.185
Mazda	0.695	0.614	0.132
Mercedes	1.035	0.898	0.144
Mitsubishi	0.694	0.613	0.126
Nissan	0.658	0.576	0.142
GM	0.915	0.820	0.123
PSA	0.670	0.561	0.189
Renault	0.684	0.582	0.177
Suzuki	0.448	0.368	0.185
Toyota	0.611	0.529	0.156
VW	0.804	0.701	0.167
Daewoo	0.537	0.457	0.168

Merger simulation III. (merger simulation)

Three steps of merger simulation (3 of 3), unilateral effects

mergersim **simulate** [if] [in], firm(varname) {buyer(#) seller(#) | newfirm(varname)} [simulate_options]
→ newconduct(#) buyereff(#) sellereff(#) method(fixedpoint | newton)

```
. mergersim simulate if year == 1999 , seller(5) buyer(15) detail // Ford merges w GM
```

Prices
Unweighted averages by firm

firm code	Pre-merger	Post-merger	Relative change
BMW	0.888	0.890	0.002
Fiat	0.770	0.770	0.001
Ford	0.791	0.820	0.045
Honda	0.663	0.663	0.000
Hyundai	0.562	0.562	0.000
Kia	0.472	0.472	0.000
Mazda	0.695	0.695	0.000
Mercedes	1.035	1.035	0.001
Mitsubishi	0.694	0.694	0.000
Nissan	0.658	0.658	0.000
GM	0.915	0.944	0.041
PSA	0.670	0.670	0.001
Renault	0.684	0.684	0.000
Suzuki	0.448	0.448	0.000
Toyota	0.611	0.611	0.000
VW	0.804	0.806	0.003
Daewoo	0.537	0.537	0.000

Merger simulation III. (merger simulation)

Three steps of merger simulation (3 of 3), unilateral effects with efficiencies

mergersim **simulate** [if] [in], firm(varname) {buyer(#) seller(#) | newfirm(varname)} [simulate_options]
newconduct(#) buyereff(#) sellereff(#) method(fixedpoint | newton)

```
. mergersim simulate if year == 1999, seller(5) buyer(15) buyereff(0.1) sellereff(0.1) detail method(fixedpoint) // Ford merges w GM w eff
```

Prices
Unweighted averages by firm

firm code	Pre-merger	Post-merger	Relative change
BMW	0.888	0.883	-0.005
Fiat	0.770	0.768	-0.002
Ford	0.791	0.767	-0.018
Honda	0.663	0.662	-0.001
Hyundai	0.562	0.562	-0.000
Kia	0.472	0.472	-0.000
Mazda	0.695	0.695	-0.000
Mercedes	1.035	1.024	-0.008
Mitsubishi	0.694	0.693	-0.000
Nissan	0.658	0.658	-0.000
GM	0.915	0.880	-0.026
PSA	0.670	0.669	-0.001
Renault	0.684	0.683	-0.001
Suzuki	0.448	0.448	-0.000
Toyota	0.611	0.610	-0.000
VW	0.804	0.802	-0.003
Daewoo	0.537	0.537	-0.000

Merger simulation III. (merger simulation)

Three steps of merger simulation (3 of 3), unilateral & coordinated effects

mergersim **simulate** [if] [in], firm(varname) {buyer(#) seller(#) | newfirm(varname)} [simulate_options]
newconduct(#) buyereff(#) sellereff(#) method(fixedpoint | newton)

```
. mergersim simulate if year == 1999 , seller(5) buyer(15) newconduct(0.2) detail // Ford merges w GM w coordinated effects
```

Prices
Unweighted averages by firm

firm code	Pre-merger	Post-merger	Relative change
BMW	0.888	0.917	0.037
Fiat	0.770	0.793	0.036
Ford	0.791	0.845	0.084
Honda	0.663	0.687	0.039
Hyundai	0.562	0.585	0.046
Kia	0.472	0.495	0.052
Mazda	0.695	0.718	0.037
Mercedes	1.035	1.063	0.033
Mitsubishi	0.694	0.717	0.035
Nissan	0.658	0.682	0.041
GM	0.915	0.970	0.074
PSA	0.670	0.695	0.043
Renault	0.684	0.708	0.042
Suzuki	0.448	0.471	0.054
Toyota	0.611	0.634	0.044
VW	0.804	0.830	0.040
Daewoo	0.537	0.561	0.049

Conclusion

How and when to apply “mergersim”?

- “Mergersim” is easy to apply, estimates are clear
- The “mergersim” Stata program is useful given the followings:
  - The user understands the underlying model
  - The model describes well the competition in the market
  - Sufficient data are available
- To-dos with “mergersim”
  - Use as an initial/additional screen in a more comprehensive merger assessment
  - Run sense-checks of the initial results
- Not to-dos with “mergersim”
  - Use as a single decision tool in merger assessments (Type I error is very problematic)
  - Do not place too much emphasis on results if many assumptions are made
  - Use as a sole predictor of coordinated effects

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