Economic analysis of mergers

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Restraining competition: Horizontal integration

- Horizontal integration: Combination of two entities, in the same or similar businesses, under common ownership.

- Horizontal integration:
  - Reduction in quantity supplied.
  - Change of products offered.
  - Rise in market price.
  - Higher profit.

Competition policy

- Prohibit collusion on price or other means.
- Prohibit monopolies or monopsonies from abusing market power.
- Prohibit mergers or acquisitions that would substantially lessen competition in the market.

Restraining competition: merger analysis in competition policy

- Mergers: Key question what will happen if the merger allowed or not allowed?
- Earlier: Competition policy relied on static measures.
- Good: simple and transparent.
- Bad: not very accurate.
- Hirschman-Herfindahl-index.

Restraining competition: merger analysis in competition policy

Post-merger HHI	Increase in HHI		
	0 - 50	50 - 100	> 100
> 1,800	safe	suspect	suspect
1,000 – 1,800	safe	safe	suspect
0 – 1,000	safe	safe	safe

Modern approach

- Currently, competition authorities, regulators and economic consultancies use increasingly sophisticated tools:

- Theory-based;
- Advanced econometric /statistical tools.

Econometrics

”A branch of economics in which **economic theory** and **statistical methods** are fused in **the analysis of numerical** and **institutional data**” Hood and Koopmans (1953, pp. xv.).

Hood, W. C., and T. C. Koopmans (eds.), 1953, Studies in Econometric Method, Wiley.

Restraining competition: merger analysis in competition policy

- Case: Swedish painkiller market 2008 - .
- Two firms providing competing (paracetamol) products merged.
- Does Merger Simulation Work? Evidence from the Swedish Analgesics Market, Jonas Björnerstedt and Frank Verboven, American Economic Journal: Applied Economics, 2016.

Restraining competition: merger analysis in competition policy

- Why allow?

- Efficiency defense.
- Brand versus substance.
- Upcoming deregulation.

- Why not? Increase in market power.

- How to answer: Ex-ante merger analysis.

Ingredients of any market model

- Demand
- Supply
- Level of competition
- Institutional features

The products

- 3 “active” ingredients:

1. Paracetamol
2. Ibuprofen
3. Aspirin
4. + two less important ones.

The products

- Different forms of the product:

- Tablets
- Fizzy tablets
- Liquid
- Suppository
- Powder

- No product under patent.

Market shares

Table 1: Market shares in 2008, by form and active substance

Form	Paracetamol	Ibuprofen	ASA	Total
Tablet	36.1	29.0	2.6	67.7
Fizzy tablet	6.0		26.3	32.3
Total	42.1	29.0	28.9	100

Note: This table shows the market shares of the main administrative forms and active substances, according to the total value of sales in 2008. Paracetamol is known as acetaminophen in the U.S.

Table 2: Market shares in 2008, by brand and active substance

Firm	Brand	Paracet.	Ibupr.	ASA	Total
AZT	Alvedon	29.3			31.5
	Reliv	2.2			
GSK	Panodil	10.6			10.6
McNeil	Ipren		19.1		44.7
	Treo			22.5	
	Magnecyl			3.1	
Nycomed	Ibumetin		9.2		9.2
Meda (Ellem)	Alindrin		0.7		3.4
	Bamyl			2.7	
Bayer	Aspirin			0.4	0.6
	Alka-selzer			0.0	
	Albyl			0.2	
Total		42.1	29.0	28.9	100

Note: This table shows the market shares of the main firms and brands and active substances, according to the total value of sales in 2008. Paracetamol is known as acetaminophen in the U.S.

Consumer decision-making

- Active ingredient.
- Brand (heavy advertising)
- Distribution:

1. Up to 2009, through state monopoly pharmacy with 850 pharmacies. Fixed mark-up rule.
2. From 2009, (many) pharmacies privatized + non-pharmacy retailing allowed.

The merger

- 22.12.2008 GSK notified that it wants to acquire AZT’s painkiller brands.

- Swedish competition authority cleared the merger 3.4.2009.

Deregulation would mean that **players other than Apoteket** would be able to provide OTC pharmaceuticals and at the same time **pharmaceutical companies would no longer be able to determine prices** for customers. Deregulation would also enable **new pharmaceutical stakeholders** to enter the Swedish self-care market **with their brands**; for example including the paracetamol substance. In this way, the buying power of pharmacies and retailers would improve, which could possibly result in improved price competition between the different products available in the self-care market.

Ex ante analysis

- How to answer the question?
- Need data on the market.
- Need a model of competition in the market.
- Estimate demand and supply.
- “Simulate” the merger outcome.

Data

- Sales data covers, at monthly level, sales of all painkillers between 1/1995 – 5/2011.
- Data at product level.
- Product: brand, form, package size, dose.
- Data on marketing expenditures (brand, month)
- Fraction on sick leave, GDP, population.

What is the unit of consumption?

1. Tablet

2. Daily dosage (DD).

3. “normal dose”.

- These will yield a quantity measure (q) and
- a price p

Modeling demand

- Why do different looking consumers choose different products?
- Why do different looking consumers choose the same product?
- Why do similar looking consumers choose different products?

Modeling demand

- So-called nested logit demand:

1. First consumer chooses between groups of products.

2. Second, consumer chooses a product from those in the group she chose.

- Here, groups defined by active ingredient & administrative form (tablet, fizzy tablet).

Modeling demand

Utility There are L consumers, $i = 1, \dots, L$. Each consumer chooses one out of $J + 1$ differentiated products, $j = 0, \dots, J$; good 0 is the outside good or no-purchase alternative. Suppose consumer i has the following conditional indirect utility for good $j = 0, \dots, J$:

$$u_{ij} = \mathbf{x}_j \boldsymbol{\beta} + \xi_j + \alpha f(y_i, p_j) + \varepsilon_{ij}, \tag{2}$$

where $\mathbf{x}_j$ is a vector of observed product characteristics of product j, p_j is price, ξ_j captures unobserved product characteristics, y_i is income of individual i, $\boldsymbol{\beta}$ and α are utility parameters, and ε_{ij} is a random utility term or an individual-specific taste parameter for good j.

Conditional on buying product j, a consumer i's demand for product j follows from Roy's identity, $d_j(y_i) = -(\partial f / \partial p_j) / (\partial f / \partial y_i)$. We consider the following two specifications for $f(y_i, p_j)$:

$$\begin{array}{llcll} \text{Unit demand} & f(y_i, p_j) & = & y_i - p_j & \Rightarrow \quad d_j(y_i) = 1 \\ \text{Constant expenditures} & f(y_i, p_j) & = & \gamma^{-1} \ln y_i - \ln p_j & \Rightarrow \quad d_j(y_i) = \gamma \frac{y_i}{p_j} \end{array} \tag{3}$$

Choice probabilities Each consumer i chooses the product j that maximizes her random utility u_{ij}. Assume that the random utility terms follow the extreme value distributional assumptions of a two-level nested logit model. Partition the set of products into G groups, $g = 0, \ldots, G$ (where group 0 consists of the outside good 0) and further partition each group g into H_g subgroups, $h = 1, \ldots, H_g$. Each subgroup h of group g contains J_{hg} products, so that $\sum_{g=1}^{G} \sum_{h=1}^{H_g} J_{hg} = J$.

Given random utility maximization, the probability that a consumer i chooses product $j = 1, \ldots, J$ takes the following well-known form:

$$s_j = s_j(\boldsymbol{\delta}, \sigma) \equiv \frac{\exp(\delta_j/(1-\sigma_1))}{\exp(I_{hg}/(1-\sigma_1))} \frac{\exp(I_{hg}/(1-\sigma_2))}{\exp(I_g/(1-\sigma_2))} \frac{\exp(I_g)}{\exp(I)}, \tag{5}$$

where I_{hg}, I_g, and I, are the inclusive values or "log sum" formulas (see Appendix), $\boldsymbol{\delta}$ is a $J \times 1$ vector containing the mean utilities δ_j, and $\sigma = (\sigma_1, \sigma_2)$ are the nesting parameters associated with the nested logit distribution. Note that the separable terms K_i cancel out from the choice probabilities (5).

total income of all consumers. Substituting and rearranging then gives expressions for the choice probabilities in terms of observables:

$$\begin{aligned} &\text{Unit demand} && \tfrac{q_j}{L} = s_j\left(\boldsymbol{\delta}, \sigma\right) \\ &\text{Constant expenditures} && \tfrac{p_j q_j}{B} = s_j\left(\boldsymbol{\delta}, \sigma\right) \end{aligned} \tag{6}$$

where we define $B = \gamma Y$ as the total potential budget allocated to the differentiated products in the economy, a constant fraction γ of total income of all consumers Y. Hence, the choice probabilities are equal to the market shares in volume terms for the familiar unit demand specification, whereas they are equal to market shares in value terms for the constant expenditures specification.

solve for the mean utilities $\delta_j = \delta_j(\mathbf{s}, \sigma)$. Following Berry (1994) for the one-level nested logit and Verboven (1996) for the two-level nested logit, we obtain an analytical solution for the inverted choice probability system:

$$\ln(s_j/s_0) = \sigma_1 \ln(s_{j|hg}) + \sigma_2 \ln(s_{h|g}) + \delta_j, \tag{7}$$

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$$\delta_j \equiv \mathbf{x}_j \boldsymbol{\beta} - \alpha \ln p_j + \xi_j$$

Supply model

- An oligopolistic market with few firms.
- Each firm may have several products.
- Products are heterogenous.
- Demand over products varies.
- Static model.

Supply model

now written as a function of the $J \times 1$ price vector $\mathbf{p}$. The profit-maximizing price of each product $j = 1, \ldots, J$ should satisfy the following first-order condition:

$$q_j(\mathbf{p}) + \sum_{k \in F_f} (p_k - c_k) \frac{\partial q_k(\mathbf{p})}{\partial p_j} = 0. \tag{9}$$

A price increase affects profits through three channels. First, it directly raises profits, proportional to current demand $q_j(\mathbf{p})$. Second, it lowers the product's own demand, which lowers profits proportional to the current markup. Third, it raises the demand of the other products in the firm's portfolio, which partially compensates for the reduced demand of the own product. If the first-order conditions (9) hold for all products $j = 1 \cdots J$, a multiproduct Bertrand-Nash equilibrium obtains.

Estimation results

- Simulation = ask how prices of ALL firms would change if GSK and AZT were allowed to merge.
- Case #1. no efficiencies.
- Case #2. how large should efficiencies be for the society to benefit? Are these realistic?

Estimation results

Table 5: Demand parameter estimates

	Nested logit		Random coefficient logit	
	Const Exp	Unit	Const Exp	Unit
constant	-6.941	-5.054	-31.682	-33.909
	(1.247)	(0.786)	(6.481)	(7.086)
price ($-\alpha$)	-0.289	-2.041	-1.616	-11.838
	(0.089)	(0.149)	(0.228)	(1.778)
marketing expenditures	13.384	8.905	92.304	113.806
	(2.456)	(1.782)	(11.189)	(22.373)
log(dosage)	0.757	0.813	3.540	5.067
	(0.195)	(0.123)	(1.015)	(1.110)
log(package size)	-0.025	-0.184	0.132	-0.397
	(0.082)	(0.051)	(0.425)	(0.464)
fizzy	-0.024	-0.277	-1.408	-4.931
	(0.097)	(0.061)	(0.503)	(0.550)
paracetamol	0.323	0.118	0.911	0.766
	(0.128)	(0.081)	(0.668)	(0.730)
ibuprofen	0.585	0.671	2.496	3.819
	(0.174)	(0.109)	(0.902)	(0.986)
branded	0.533	0.381	3.286	2.795
	(0.122)	(0.077)	(0.632)	(0.691)

Merger simulation

- Simulation = ask how prices of ALL firms would change if GSK and AZT were allowed to merge.

Table 6: Price elasticties, markups, predicted price effects

	Nested logit		Random coefficients logit	
	Const Exp	Unit	Const Exp	Unit
	Brand-level price elasticities			
Own	-2.43	-8.84	-2.05	-3.61
Own (range)	(-3.05 ; -2.00)	(-15.45 ; -5.16)	(-2.61 ; -1.51)	(-6.52 ; -1.99)
Cross - same substance	0.30	2.12	0.12	0.36
Cross - different substance	0.05	0.28	0.05	0.19
	Markups (percent)			
Paracetamol	48.5	17.3	59.0	44.7
Ibuprofen	45.0	11.8	55.7	32.3
ASA	59.1	22.9	66.5	44.5
	Basic predicted price effects (percent)			
Paracetamol	41.1	15.9	21.29	9.34
Ibuprofen	1.2	0.5	0.75	0.76
ASA	1.5	0.6	0.81	0.45

Notes: All numbers are averages across products for December 2008, except for the numbers in parentheses, which refer to the range.

Could changes in MC explain price changes?

- Several producers changed package size(s) after the merger.
- This was the way to implement the price changes.
- Could this have lead to higher MC?
- Data (see paper) suggests this may be the case.

Could level of competition explain the price effects?

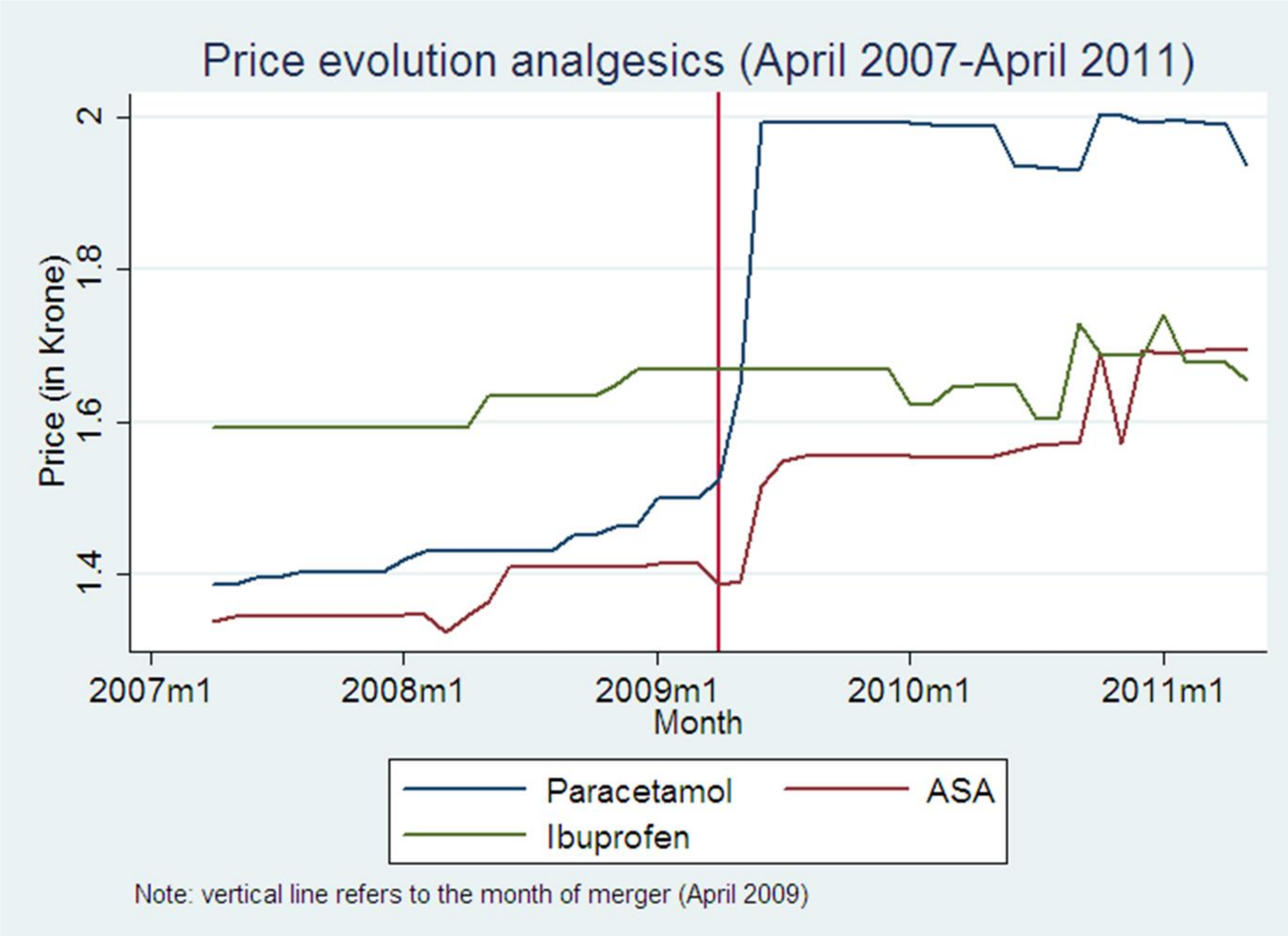
- What if instead of competing Bertrand-Nash in prices, there is tacit collusion?
- Approach: assume a level of tacit collusion, same before and after merger.
- Redo analysis.

Table 8: Predicted price effects - role of supply side

	Cost Increase			Cost Increase + Part. Coord.		
	Mean	10% CI	90% CI	Mean	10% CI	90% CI
	Nested logit					
Paracetamol	57.8	49.8	67.4	48.5	43.1	54.8
AstraZeneca	46.0	40.5	52.5	41.4	37.3	46.0
GSK	93.6	77.4	113.6	70.0	60.0	82.5
Ibuprofen	1.5	1.4	1.7	4.4	4.0	4.9
McNeil	2.0	1.8	2.2	4.8	4.4	5.3
Meda	0.1	0.1	0.1	2.9	2.5	3.3
Nycomed	0.7	0.6	0.8	3.8	3.2	4.2
ASA	6.6	6.3	6.9	7.5	6.7	8.5
McNeil	6.6	6.2	6.9	7.3	6.4	8.3
Meda	8.1	8.0	8.2	9.9	9.4	10.7
Bayer	0.1	0.1	0.1	3.0	2.5	3.4

So what actually happened?

- Unlike a CA before the merger, the researchers could do a before-after analysis.


Price evolution analgesics (April 2007-April 2011)
Price (in Krone)
2
1.8
1.6
1.4
2007m1
2008m1
2009m1
2010m1
2011m1
Month
Paracetamol
ASA
Ibuprofen
Note: vertical line refers to the month of merger (April 2009)

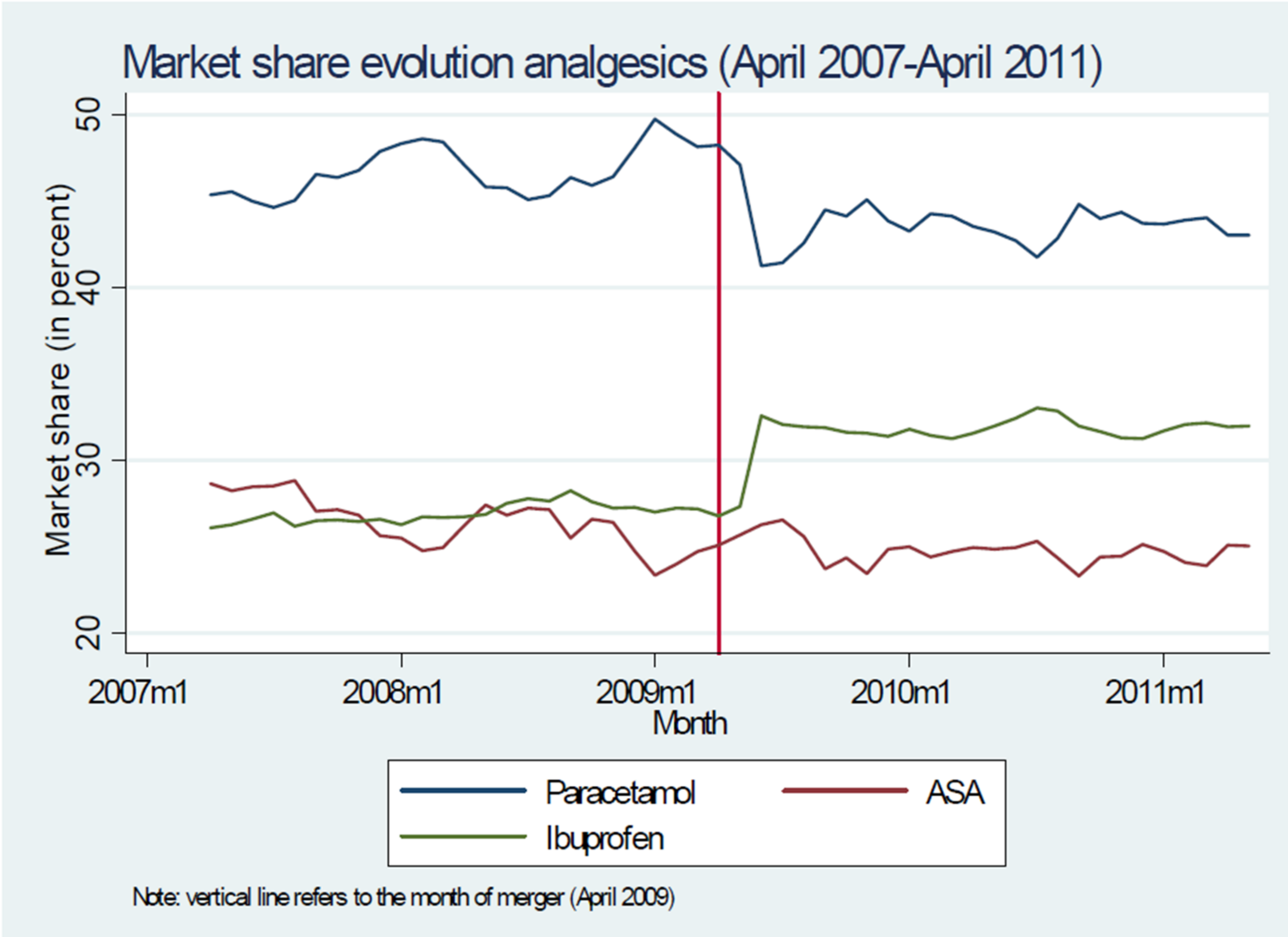


Figure 2: Market share evolution analgescis (April 2007 - April 2011)

Table 4: Actual price and market share effects, two year window

	Price (% change)		Market share (%)	(% point change)	
	Coeff	St. Err	Before	Coeff	St Err
Regressions at the level of the substance					
substance fixed effects	yes			yes	
Paracetamol×merger	39.7	(1.0)	47.0	-3.6	(0.6)
Ibuprofen×merger	0.1	(1.7)	27.3	4.3	(0.2)
ASA×merger	13.3	(4.7)	25.8	-0.8	(0.5)
R^2	.969			.986	
Regressions at the level of the firm × substance					
firm×substance fixed effects	yes			yes	
Paracetamol					
AZT×merger	39.2	(1.2)	34.2	-3.6	(0.4)
GSK×merger	40.9	(2.1)	12.7	0.0	(0.3)
Ibuprofen					
McNeil×merger	0.4	(1.1)	17.1	2.0	(0.2)
Meda×merger	0.0	(0.1)	0.7	0.0	(0.1)
Nycomed×merger	0.9	(1.1)	9.5	1.5	(0.2)
ASA					
McNeil×merger	17.9	(4.8)	21.4	-2.3	(0.4)
Meda×merger	8.9	(5.4)	3.7	1.1	(0.2)
Bayer×merger	6.8	(1.0)	0.6	0.4	(0.1)

How well did the modeling do?

- It predicts the kind of large price effects observed. But

1. it incorrectly predicted a larger effect for the smaller merger partner.

2. It incorrectly predicted only a small rival response, whereas there was a relatively large one.

How well did the modeling do?

- Allowing for changes in MC improved predictions.
- Allowing for tacit collusion improved predictions.
- Problem: How to deal with such effects in a real merger case & ex ante analysis?