MAKING EUROPEAN MERGER REMEDIES MORE PREDICTABLE :
AN ORDERED DISCRETE CHOICE ANALYSIS

Béatrice Dumont
University of Rennes I CREM-CNRS & College of Europe
7 Place Hoche
F-35065 Rennes cedex
Email : beatrice.dumont@univ-rennes1.fr

Abstract :

Since its entry into force in 1990, the European merger control has provided that the parties to a merger may modify their proposed concentration by offering commitments to remove the competition concerns identified by the Commission in its investigation. But little is known about the merging firms' characteristics that led DG Competition to decide whether to require conditional acceptance and about the different types of remedies associated to these characteristics.

This paper tries to fill this gap by building and empirically evaluating an ordered discrete choice model of merger remedies as a basis for policy analysis. Our database consists of a sample of all merger cases accepted with conditions in Phase I of the European merger process between 1990 and 2007. The model is built on the following idea: to be Pareto-improving, a merger increasing social welfare must lead to a transfer from firms to consumers. In practice, antitrust authorities do not impose directly the amount of this compensation (transfer) but require some conditions (remedies) to be implemented instead. This is done in such a way that the transfer lies in a reasonable range of values compared to the compensation looked after. The compensation (a function of the observed and non-observed –i.e. stochastic- characteristics of the different cases) is therefore the latent variable of an ordered discrete choice model for the remedies. By estimating this model by maximum likelihood, it is possible to forecast the choice of remedies depending on the cases (and of their characteristics). We are thus able to deduce the "doctrine" of DG Competition as revealed by the observation of its decisions.

Key words : merger remedies-ordered discrete choice model
JEL Classification : K21, L40

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very preliminary version (March, 2008)

I-Introduction

Since its entry into force in 1990, the European Merger Control has provided that the parties to a merger or the acquirer(s) and the target of an acquisition may modify their proposed concentration by offering commitments to remove the competition concerns identified by the European Commission's Directorate General for Competition ("DG Comp") in its investigation. The European Commission (henceforth, EC) is entitled to accept commitments from merging parties on condition that they are proportionate to the competition concerns they are solving and they eliminate it[1]. Without such remedies, merger decisions would in fact be binary (clearance/prohibition). Remedies therefore constitute an additional tool in the hand of competition authorities, aimed at "fixing" a competition problem generated by a merger while at the same time preserving its economic rationale. Getting it right is therefore particularly important. Indeed, a remedy that is ill-adapted will fail to achieve either or both objectives, imposing an unduly high cost on the merging parties and/or harm on consumers.

Besides information asymmetries, the design of remedies is rather complex and may encompass many drawbacks (FTC, 1999 & EC, 2005). This is notably due to the fact that strict time-limits, especially in phase I, allow limited opportunity for precise tailoring of remedies and may lead to over or under-fixing. Against this background, it is important to evaluate what factors have historically led the EC to ask for remedies in the first place and then what determines the choice between structural and behavioural remedies or a mix of both. This paper tries to fill this gap by building and empirically evaluating an ordered discrete choice model of merger remedies as a basis for policy analysis. Our database consists of a sample of all merger cases accepted with conditions in Phase I of the European merger process between 1990 and 2007. The model is built on the following idea: to be Pareto-improving, a merger increasing social welfare must lead to a transfer from firms to consumers. In practice, antitrust authorities do not impose directly the amount of this compensation (transfer) but require some conditions (remedies) to be implemented instead. This is done in such a way that the transfer lies in a reasonable range of values compared to the compensation looked after. The compensation (a function of the observed and non-observed –i.e. stochastic- characteristics of the different cases) is therefore the latent variable of an ordered discrete choice model for the remedies. By estimating this model by maximum likelihood, it is possible to forecast the choice of remedies depending on the cases (and of their characteristics). We are thus able to deduce the "doctrine" of DG Competition (i.e. the conclusions of the Commission on the commitments offered and the modifications required to get a clearance) as revealed by the analysis of its decisions.

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[1] Commission Regulation 139/2004 on the control of concentration between undertakings, OJ L24/1, Arts 6(2) and 8(2), recital 30.

This paper starts in section II with in a review of the Commission Notice on merger remedies and a brief presentation of different types of remedies available to rule out "serious doubts". Section III presents the findings of earlier economics literature on mergers. Section IV introduces the model. Section V explains the key explanatory variables used in this study. Section V presents the results. Finally, section VI offers a few conclusions and isolate several stylized facts with a view to making realistic policy recommendations about how to improve the merger remedy process.

II-The Commission Notice on remedies

The main legislative texts for merger decisions are the Council Regulation (EC) No 139/2004 on the control of concentrations between undertakings (the "Merger Regulation") and the Merger Implementing Regulation (Commission Regulation (EC) No 802/2004 of 7 April 2004). The Merger Regulation contains the main rules for the assessment of concentrations, whereas the Implementing Regulation concerns procedural issues (notification, deadlines, right to be heard, etc...).

On 21st December 2000, the EC adopted a Notice on merger remedies[2]. This Notice, currently under review[3], is intended to provide guidance to companies on modifications to concentrations to restore conditions for effective competition. Such modifications are more commonly described as "remedies" since their object is to eliminate competition concerns identified by the Commission. The Notice sets both the substantial and procedural requirements that merging parties must fulfill when proposing remedies. As stated in the Notice, the allocation of responsibilities is well specified. DG Comp informs the parties of the competition concerns identified by sending a statement of objections. It is for the parties to propose remedies[4]. The role of DG Comp is then to assess the effects of the operation, as modified by the remedies. The assessment standards require certainty as to the implementation and probability as to the assessment of the operation ("*more likely than not that the operation modified significantly impedes effective competition*")[5]. It is also based on a principle of proportionality, i.e. that parties do not need to submit remedies that go further than what is necessary to remove competition concerns. If they do so, however, Commission cannot reject them and impose different ones.

The Notice also contains an overview of DG Comp's current thinking on remedies in merger control proceedings, assessing several types of remedies, but ultimately focusing on the divestment of businesses, in line with both statistics (where divestments account for the majority of remedies in the Commission's merger control decisions) and its explicit preference for such remedies.

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[2] http://ec.europa.eu/comm/competition/mergers/legislation/draft_remedies_notice.pdf

[3] The Draft revised Remedies Notice will, once finalized, replace its 2001 predecessor, the Commission Notice on remedies acceptable under Council Regulation (EEC) No 4064/89 and under Commission Regulation (EC) No 447/98 ("2001 Remedies Notice" Official Journal of the European Communities, No C 68).

[4] Given their complexity, merger remedies need to be analysed as early as possible. In fact, efficient counselling requires discussions of possible remedies as early as during the European Commission's informal guidance at the pre-notification stage. This is one of many aspects of merger control filings being 'front-loaded' in the European Union, whereas US filings are 'back-loaded'.

[5] In phase I, remedies have to rule out "serious doubts". They are only acceptable when competition problem is readily identifiable and can easily be identified. In phase II, remedies must remove competition concerns.

As already stated, the purpose of the commitments is to deal with a specific competition problem related to the completion of the transaction notified. The negotiating of commitments thus tries to find the arrangements which are the most suitable for each competition problem. Even though it is difficult to establish the different types of remedies since they are a question of each case, they can nevertheless be classified under two categories : structural and behavioural remedies[6] even if this traditional distinction sometimes turns out to be artificial (Motta & alii., 2002).

II.1-Structural remedies

Structural commitments are remedies aimed at immediately changing the market structure in a lasting way and not requiring medium or long term monitoring. These structural arrangements usually consist of a disposal or a sale of assets belonging to the parties. According to paragraph 14 of the Remedies Notice, divestitures must concern a viable business that acting independently will be able *to compete effectively with the merged entity on a lasting basis'*. Indeed, the scope of the divested business determines to a large extent whether this new operator will be viable, capable of being operated independently from the divesting parties ("stand-alone") and constitute in the hands of a suitable purchaser an effective and lasting competitive force vis-à-vis the parties and other competitors. As stressed in the merger remedy study (2005), such remedies can be divided into six groups :
- divestiture of a controlling stake in a company that was already a viable stand-alone business (*DIVEST1*)
- divestiture of a business unit that needed to be carved out extensively from a greater company structure (*DIVEST2*)
- divestiture of a package of assets that combine the assets of more than one of the parties (so-called mix-and-match") (*DIVEST3*)
- divestiture or grant of a long-term exclusive licence with indefinite duration or until expiration of patent protection (*DIVEST4*)
- transfer of personnel (*DIVEST5)*
- commitment to exit a JV (*DIVEST6*)

Generally speaking, structural commitments tend to be preferred by DG Comp (including for non horizontal concerns) because of their direct addressing of competition concerns, their lasting effects on market structure for which they are expected to restore competition and the fact that they do not require constant monitoring that would use up the authorities scarce resources. The preference for structural over behavioural remedies expressed by the Commission was partially confirmed by the Court of First Instance in the judgement *Gencor*[7] where the Court stated that the mere promise not to abuse a dominant position is not enough to restore competition. Nevertheless, the Court also underlined that in some cases behavioural undertakings as *'not to use a trademark for a certain period, or to grant access to essential facilities on non-discriminatory terms, may themselves also be capable of preventing the emergence or strengthening of a dominant position'* (para. 319). In *Tetra Laval*[8] The European Court of Justice, deciding on appeal made it clear that in *Gencor,* the CFI did not clearly eliminate a possibility of using behavioural remedies to eliminate competitive detriments (para. 86). The Court also criticized the Commission for not taking into account behavioural undertakings proposed by the parties *"The only promise that can categorically be*

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[6] Economists distinguish remedies on the basis of their impact on property rights, i.e. whether remedies can either reallocate or constrain the exercise of property rights.
[7] Case T-102/96 *Gencor v. Commission* [1999] ECR-II-759.
[8] Case C-12/03P, Judgement of 15 February 2005.

rejected would be a promise not to abuse a dominant position which was directly strengthened or created by the transaction. Such a promise, by its nature would undermine the goals of the ECMR".

II.2-Behavioural remedies

Apart from structural remedies, there is a range of behavioral remedies available as well. The objective of these remedies set constraints on the merging firms' property rights. As stressed by Parker & Balto (2000), these structural commitments can be divided into 4 groups :

- granting of non-discriminatory access to infrastructures, networks, technologies or other IPRs (*BCOMMIT1*)
- termination of exclusive vertical agreements (*BCOMMIT2*)
- withdrawing of a brand, transfer of permits, authorizations, customer lists or orders) (*BCOMMIT3*)
- firewall (*BCOMMIT4*)

However, competition authorities are usually reluctant to use behavioural remedies in order to clear mergers creating or strengthening a dominant position (or significantly lessening effective competition under the new 2004 test). In contrast with structural remedies, it is often emphasized that behavioural remedies are more complex and thus usually harder to enforce and require a regular monitoring to be effective, meaning Commission's or at least a trustee's involvement resulting in supplementary costs. Indeed, the parties may try to impede the effectiveness of such remedies and if it includes a cooperation of the merged entity with a third party, it may encourage collusion and at least information flows between rivals. What can also cause problems, notably with access remedies (*BCOMMIT1*), is the assessment of technical conditions of third parties and of technological changes. Similarly, in cases of re-branding, remedies may fall short of providing a satisfactory opportunity for the licensee to develop its own brand.

In spite of these potential difficulties, it is worth stressing the flexibility of behavioural remedies in comparison with structural ones, which by definition are irreversible. In particular, Recital 26 of Commission 2001 Remedies Notice states that in some cases, where competition concerns arising from a merger may not be solved by means of structural remedies, behavioural remedies are considered to be appropriate to eliminate competition risks in case of mergers including vertical factors where access to infrastructure or technology may create an obstacle to entry. They are therefore particularly useful in technology markets, emerging markets and network industries. Indeed, in some situations when obstacles to entry result from control over infrastructure or key intellectual property rights, an effective remedy can be to grant access to this technology or infrastructure to rivals. It may equally be required to conclude a licensing agreement, instead of divestiture of a technology (in particular through the granting an exclusive license), if divestiture could hinder efficient ongoing research.

Overall, it is possible to speak about the existence of a graduation or a hierarchy in the remedies with a "soft" version of commitments characterized by behavioural remedies (class 1), an "intermediate" version characterized by structural remedy (class 2) and a more "stringent" version characterized by a mix of both remedies (class 3).

III. Earlier literature

Clearances with conditions have received little attention in economic literature. While still an under-researched area of economics, some recent contributions may provide some further guidance about the guiding principles that should underpin merger remedies.

In October 2005, for instance, DG Competition published a detailed ex-post assessment of merger remedies adopted in 40 cleared mergers over the period 1996 to 2000[9]. The objective of this study was to review, with the benefit of hindsight, the design and implementation of commitments offered and accepted by the Commission in previous cases so as to identify areas where further improvements to the Commission's existing merger remedies policy and procedures may be necessary in future. More specifically, the focus of the study was to identify what factors and/or processes may have positively or negatively influenced the effective design and implementation of merger remedies. One of the interesting aspects of this study is that the usual distinction between structural and behaviour remedies is set aside. Instead, a form-based and wider classification is adopted : commitments to transfer of a market position, access remedies (access to infrastructure or technology, termination of exclusive agreements) and commitments to exit from a joint venture. This classification is somewhat unusual as it does not fit the current Notice on merger remedies nor does it fit the economic classification of remedies.

Among the findings of this study, there are some indications that access remedies related to technology or infrastructure or to termination of exclusive rights did not function properly in many cases. According to the Commission, it was primarily caused by problems with finding contractual terms (e.g. scope, price) guaranteeing effective access. More generally, the study pointed out that the difficulties were in mainly linked to market developments inconsistent with the anticipations made by the Commission. Indeed, in three out of four mergers where access to infrastructure was required as a remedy, the risk was related to competition foreclosure in related emerging markets. However, expected development of these emerging markets did not take place in reality making the commitments unnecessary[10]. Similarly to infrastructure remedies, inappropriately defined contractual terms for licensing were regarded as having a negative impact on the efficiency of such remedies[11].

A similar study, albeit solely related to divestitures, was conducted by the Federal Trade Commission (1999) in the United States. But despite the interest of both studies in assessing the effectiveness of merger remedies, little is known about the merging firms' characteristics that led DG Competition to decide whether to require conditional acceptance and about the different types of remedies associated to these characteristics. Indeed, the studies carried out by the FTC and the EC mainly deal with an ex-post evaluation of the design and implementation of remedies and are primarily based on interviews with purchasers of divested assets.

If we broaden our perspective to competition cases in general, Duso and *alii* (2006) study a sample of 167 mergers that were under the European Commission's scrutiny from 1990 to 2002. To do so, they use an event study methodology to identify the potential anticompetitive effects of mergers as well as the remedial provisions on these transactions. They first classify

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[9]   DG   Competition,   (2005),   « Merger   Remedies   Study »,   October,   available   at http://europa.eu.int/comm/competition/merger/others/remedies_study.pdf
[10] Merger Remedy Study, p. 115.
[11] Merger Remedy Study, p. 117.

mergers according to their effects on competition and then develop hypotheses on the effects that remedies are supposed to achieve depending on the merger's competitive outcome. Their results show that remedies were not always appropriately imposed and that the market seems to be able to predict remedies' effectiveness when applied in phase I.

If this economic analysis is worth stressing, force is to note that it is again mainly dealing with the effectiveness rather than the design of merger remedies. To our knowledge, only two studies really address the latter. First, Bergman and *alii* (2005) using a sample of 96 mergers notified to the EC evaluate what are the factors influencing merger decisions. They find no indication that the Commission allows political aspects to influence its decisions. They also find that the probability of a phase II investigation increases with the parties' market shares and when the EC finds high entry barriers or that a post-merger market conducive to collusion. Despite its interest, this study remains somewhat general and does not address clearances with commitments in particular. Second, Bougette & *alii* (2006) build and empirically evaluate a discrete choice model of merger remedies as a basis for policy analysis. Their database consists of 229 merger cases accepted in Phase I or Phase II of the European merger process between 1990 and 2005. The authors explore the determinant factors of the Commission's decisions with a neural network model differentiating cases accepted with or without remedies (either structural or behavioural) and then by implementing three multinomial logit models. They find that variables related to high market power lead more frequently to a remedy outcome, whatever the phase. But also that innovative industries such as energy, transportation and communications positively affect the probability of a behavioral remedy. Lastly, former Competition Commissioner Mario Monti's policy appears to be pro-remedy.

III-The empirical model

The goal of antitrust policy is to increase welfare. Although there is a debate on which criteria to take into account, antirust enforcers usually focus on consumer welfare. Figure 1 then helps synthesizing the decision of antitrust authorities as regards whether accepting a merger or not and, in the first case, whether to ask for remedies or not. It builds on a graphic commonly used to illustrate cost benefit analysis. The surplus of the merging parties is reported on the vertical axis whereas the surplus of consumers is reported on the horizontal axis. The pre-merger surplus for the parties and the consumers are respectively given by S_p^A and S_c^A. The set of points characterized by higher or at least equal surplus for both the merging parties and the consumers is the set of Pareto improving mergers.

The dashed line passing through point A associated with the pre-merger situation yields the combination of the parties' surplus and consumers' surplus whose sum is equal to a same amount of total surplus. Henceforth such lines are referred to as iso-total surplus lines. Any point that lies above the iso-total surplus line passing through point A increases the total surplus compared with the pre-merger situation. Nonetheless, it may be the case that the total surplus increases but at the cost of a drop in consumers' surplus. This is typically illustrated by point B. In order to make the merger Pareto-improving, it is then required to move point B down and to the right along the iso-total surplus line passing through B until point B' is reached. The drop y in the merging parties' surplus corresponds to an equivalent transfer to consumers. Such a transfer is not directly implemented by competition authorities but is indirectly enforced through remedies instead. In case of a merger that initially lies inside the set of Pareto improving situations, no transfer is required and the merger is accepted without

conditions. This situation is depicted by point C. Finally, any merger that leads to a point beside the dashed line passing through point B is rejected. Indeed, no monetary compensation of consumers is possible that lets the merger be profitable for the merging parties. A merger associated with point D for instance implies a switch down to point D' to let the consumers' surplus at least unchanged and then generates a net loss for the merging parties. An important underlying assumption in Figure 1 is that the rate of substitution of the parties' surplus in consumers' surplus amounts to one. Otherwise stated, there is no loss when implementing the monetary transfer. Though this assumption seems strong, it is not essential to the analysis. In case of a loss when implementing the monetary transfer, the sole modification to Figure 1 is that the slope of iso-total surplus is less than one.

Insert Figure 1

Figure 1 highlights that the monetary transfer y required to make a merger Pareto improving differs from a merger to another one. Since monetary transfers are indirectly enforced by the means of remedies, it implies that remedies have to be tailored. Nonetheless, a key difference between monetary transfers on the one hand and remedies (or classes of remedies) on the other hand is that the first are continuous variables while the last are discrete ordered variables. More precisely, as detailed in section II competition authorities are able to implement increasing monetary transfers in phase 1 by first enforcing behavioral remedies (class 1), then structural remedies (class 2) and finally both behavioral and structural remedies (class 3). Immediate acceptance of a merger (clearance) is associated with no need of transfer (class 0) while going to phase 2 (class 4) is assimilated with an even higher transfer. Each class of remedies corresponds to a discrete approximation of a targeted monetary transfer that, in turn, depends on some observed variables characterizing the merger and unobserved characteristics. Figure 2 illustrates this principle for the simplest case of one observed variable x and a random term ε capturing unobserved factors. A class k ($k \in \{1, 2, 3\}$) of remedies is bounded by an upper threshold $\bar{y}_k$ and a lower threshold $\bar{y}_{k-1}$ in terms of monetary transfer which in turn define a range of values $]\bar{x}_{k-1}, \bar{x}_k]$ in terms of the variable x as long as y increases (as shown in Figure 2) or decreases for all values of x. Conversely, the fact that the observed characteristic x lies in the interval $]\bar{x}_{k-1}, \bar{x}_k]$ implies that competition authorities asked for a remedy of class k.

Insert Figure 2

Of course, due to unobserved factors, the relationship between x and the class of remedies is not purely deterministic. A merger with an x that amounts to x_i and would normally require a remedy of class 2 as a counterpart for acceptance according to Figure 2, could actually be asked for a remedy of class 3 due to the additional unobserved factor ε_i. This is the basis for the econometric model. Indeed, assume the unobserved factor ε is a random term and let $cdf(\varepsilon)$ and $pdf(\varepsilon)$ respectively denote its cumulative partial distribution functions. Let the targeted monetary transfer y be a linear expression $X\beta + \varepsilon$ where X is a row vector of observed variables characterizing the merger and β is a column vector of parameters. Then the probability that a merger i belongs to the class k ($k \in \{1, 2, 3\}$) is given by the probability that y_i lies between the thresholds $\bar{y}_{k-1}$ and $\bar{y}_k$ or, equivalently by the probability that the random term ε_i lies between the thresholds $\bar{y}_{k-1} - X_i\beta$ and $\bar{y}_k - X_i\beta$.

$$\Pr[i \in class\ k] = cdf(\bar{y}_k - X_i\beta) - cdf(\bar{y}_{k-1} - X_i\beta) \tag{1}$$

This type of ordered discrete choice is well documented in the econometric literature. Greene (1997) or Cameron and Trivedi (2005) among others provide details on the estimation of such models. The latent variable of the model is the monetary transfer y, the observed rank is the class k of remedies and X is the vector of explanatory variables. However, our model slightly departs from the standard ordered discrete choice model depicted by equation (1). Indeed, we restrict the econometric study to those mergers that were accepted in phase 1 thus disregarding mergers accepted without condition (class 0) or accepted in phase 2 or rejected (class 4). Therefore the correct econometric specification is an ordered discrete choice model truncated on the left and on the right. What we estimate is the probability that a merger i belongs to the class k given that it does not belongs to classes 0 and 4:

$$\Pr[i \in class\ k / i \notin classes\ 0\ and\ 4] = \frac{cdf(\bar{y}_k - X_i\beta) - cdf(\bar{y}_{k-1} - X_i\beta)}{cdf(\bar{y}_3 - X_i\beta) - cdf(\bar{y}_0 - X_i\beta)} \tag{2}$$

Prior going further on the econometrics, it is worth noting two features. First, as one easily checks on Figure 2, normalizing $\bar{y}_0$ to zero has no incidence on the functional link between x and y except a corresponding adjustment of the intercept. Second, once $\bar{y}_0$ has been normalized to zero, it also appears that multiplying all remaining thresholds by a constant while multiplying the slope of the functional link between x and y let the intervals $]\bar{x}_{k-1}, \bar{x}_k]$ unchanged. Hence, there is one degree of liberty to determine the thresholds $\bar{y}_k$. This degree of liberty is used to arbitrarily fix $\bar{y}_3$ to three. We are then let with two unknown thresholds $\bar{y}_1$ and $\bar{y}_2$ along with the vector of parameters β and eventually parameters of the cumulative distribution function to be estimated. Note that we do not restrict the range of values for the latent variable y to be the same and thus the differences $\bar{y}_k - \bar{y}_{k-1}$ to be identical whatever the class k. We impose the restrictions $0 < \bar{y}_1 < \bar{y}_2 < 3$ by assuming that $\bar{y}_1 = \theta_1^2$ and $\bar{y}_1 = \theta_1^2 + \theta_2^2$ where the two parameters to be estimated are θ_1 and θ_2. The last step to fully specify the econometric model consists in the choice of a distribution function for the random term ε. It is usually assumed that this distribution has an expected value that amounts to zero and is symmetric to reflect the fact there are no systematic bias and *a priori* affecting the unobserved determinants of the rank. A standard choice is then the Gaussian distribution with zero as expected value and σ as standard deviation[12]. The probabilities defined in (2) with the appropriate Gaussian cumulative distribution function in place of *cdf* are then used as a basis to estimated the model by maximum likelihood.

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[12] Note that some authors suggest to use the degree of liberty mentioned above to fix the standard deviation σ to one rather than to fix the threshold $\bar{y}_3$ at an exogenously given value. Our different experiments have shown that convergence of the numerical procedure to maximize the log likelihood was easier to achieve when fixing the threshold $\bar{y}_3$.

IV-Overview of the data

From 1990 to the end of 2007, from a total of 3668 final merger decisions, the Commission cleared 238 concentrations with commitments (155 in Phase I and 83 in Phase II decisions)[13] (Figure 3). Our paper analyses a sample of 79 Phase I decisions adopted by the European Commission in the period 1990-2007. These 79 decisions account for 50, 96% of all merger decisions involving remedies in Phase I during that period. A description of the merging firms' countries of origin and of the merging firms' sectors is given in Table 1 and 2. For 25 of these, information on market shares and on the relevant market(s) was not available as it was covered by business secret. This leaves us with a net sample of 54 decisions for which the decision text was available at the Commission's homepage[14].

Insert table 1 and 2

Insert Figure 3

In order to build the database, the Phase I case files were reviewed using a standardized data-collection methodology. Using the published information available on DG Competition's website, we recorded a number of explanatory variables mentioned within the opinions of the cases (*Cf.* Table 3 for a list). These variables may be divided in two folds : in one hand, some "objective" variables independent from the decision of DG Comp such as the firms' worldwide turnover, their nationality; and in the other hand, some variables whose assessment is left in part to the discretion of DG Competition like the existence or not of barriers to entry. As we do not have at our disposal some objective and exterior indicators, we are unable to control for the use which is done by DG Competition and thus unable to correct this potential endogenous bias.

II.1-The "objective" variables

Our analysis of the design of merger remedies relies on some "objective" variables, i.e. independent from the decision of DG Competition. These variables are listed in Table3 but a simple definition of each variable is given below.

Insert Table 3

To get a better picture of past decisions, we included a sector variable (*SECTORA* to *SECTORO*) distinguishing 15 sectors (*Cf.* Table 2 for a detailed analysis). We also included a variable distinguishing the type of merger : horizontal (*HMERGER*), vertical (*VMERGER*), horizontal and vertical (*HVMERGER*), conglomeral (*CMERGER*) or whether it is a joint-venture (*JV*). Of the 54 merger examined, X% involved horizontal competition concerns, meaning that the undertakings concerned were actual or potential competitors in the same relevant market. In addition, a further X% of the 54 analysed mergers involved horizontal concerns including significant vertical concerns, such as foreclosure downstream or upstream of the market in which the merging firms were combining their activities, while X% of the 54 mergers analysed involved pure vertical concerns.

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[13] Chart 1 shows the yearly evolution of the number of Commission merger decisions and the number of decisions with commitments.

[14] http://ec.europa.eu/comm/competition/mergers/cases/

We also computed the number of relevant product markets where competitive concerned were identified by DG Competition (*NUMBRMARKET*) and whether the relevant geographical market was regional, national, EEA-wide or worldwide (*RGMARKET1* to *4*). Traditionally, the delineation of the relevant market is the Achilles' heel of the procedure. The number of relevant market is variable and strongly depends on the sector. In our sample, DG Competition determined between 1 and 38 relevant markets. The extreme cases are those for which a definition at the national level was not adapted and for which it had to delineate local markets. When this happened, we use instead the market share calculated at the national level. This situation has been underlined in the paper by the use of an indicator. Finally, we made the hypothesis, a contestable one, that the relevant markets identified by DG Competition were exogenous to the process of decision and rely on a well established methodology. In each case, we choose to consider only the most unfavourable relevant market for the parties (i.e. where the combined market shares were the largest). Indeed this market is *a priori* the one in which anti-competitive practices are most likely to arise. The nationality of the merging parties is also indicated (*NATION1* to *10*).

A variable was introduced to signal whether the merger was also notified to an extra-Community competition authority like the Federal Trade Commission or DOJ (*DOJFTC*). Another variable indicates whether DG Competition relies on a previous case in its assessment of the relevant market (*PREVDEC)* and if the merging parties were subject to regulatory control (*REGSECTOR*).

Last but not least, a variable takes into account the failing firm exception or defence (*RESCUE*). The perilous financial condition of a merging firm may change the analysis by a competition authority of an otherwise anti-competitive merger. Neither Article 2 of the Merger Regulation nor any other provision of the Community Merger legislation contains an express reference to the "failing firm defence" as a ground for authorizing a merger that would create or strengthen a dominant position in the EU. Despite the lack of statutory definition, the Commission has developed in its case-law the concept of a "rescue merger", which can be regarded as a version of the "failing firm defence". The concept of "rescue merger" is used to deal with those exceptional cases, where the merger cannot be considered as the cause of the deterioration in the competitive structure of a market, because even if the companies did not merge, dominance would still be created or strengthened. The basic principle underlying the "rescue merger" concept is that the future market structure would be equally detrimental to competition irrespective of whether the deal is cleared or not. Thus there is no link of causality between the merger and the negative effects on competition and therefore no legal ground for prohibiting the merger. Moreover, there might be, on economic grounds beneficial effects resulting from, *inter alia* : economies of scale, economies of scope or other efficiencies so that prohibiting the deal would add new detrimental economic and social effects to the effect on competition which would exist in any case.

II.2-The potentially endonegeous variables

As previously underlined, we use in this study the factors mentioned within the opinions of DG Competition as explanatory variables (Table 3), acknowledging a potential endogeneity issue. This is notably the case when one tries to assess the existence or not of barriers to entry (*BARRIER*). The methodology adopted by us is that the existence of barriers to entry is recorded in our database only when it is explicitly stated in the case by DG Competition. If

not the case, we do no try to give hazardous interpretation. The same methodology applies to entry considerations (*ENTRY*), namely its timeliness, likelihood and sufficiency.

This dependence on the Commission's subjective evaluations may also be encountered when one looks at market shares. Indeed, some critics point out that DG Comp may be tempted to delineate narrow markets so as to exaggerate the parties' market shares. One way to test this potential bias is to test two samples (one where the decisions do not rely on previous decisions (*PREVDEC*) and conversely). The underlying idea is that the EC is bound by the wording of the Merger Regulation and by legal precedence and that inconsistencies in market delineation from cases to cases are likely to be challenges by the parties. More generally, we computed a number of market structure variables. These include the post-merger Herfindhal index (*POSTMERG HHI*), its change (*CHANGEHHI*), the two pre-merger market shares (*SHARE1* and *SHARE2*)[15] and the combined market share of the parties (*POSTMERG MS*) as reported by the EC. Generally speaking, the post-merger Hirschman-Herfindhal index and the change in HHI brought about by a merger are rough indicators of the merger's anti-competitive impact. We also added a variable indicating whether one of the merging parties was a leader (*LEADER*). Some indications are also given regarding the market shares of the acquirer/acquired firm (*ACQUID1* to *4*/*ACQUIR1* to *4*) but also the market shares of the closest and second competitor (*COMP11* to *14* and *COMP21* to *24*).

The enforcement decision may also depend on the personalities controlling DG Competition as some commissioners are supposed to be advocates of a tough antitrust policy while some others have forged a reputation as being more lenient. For example, it has been suggested that Mario Monti, EU's competition commissioner for 1999-2004 was tougher than his predecessor, Karel Van Miert. In the same way, Nelly Kroes, competition commissioner since 2004 has emerged as arguably the world's most-feared antitrust enforcer whereas she was expected to take a hands-off, pro-business approach. We therefore test the supposedly more or less lenient reputation of the commissioner by using an indicator variable for Kroes', Monti's, Van Miert's and Sir Leon Brittan's time in office (*COMMISSIONER1 to 4*).

V. Results

A first step in this econometric study of mergers remedies was to determine whether EC competition authorities were focusing rather on concentration indicators or on dominant position indicators to define remedies for mergers accepted in phase 1. For this purpose, two types of models have been estimated. The first type involves the post merger level and/or the variation of the Hirschman Herfindhal Index (*HHI*) while the second type involves the post merger market share (*MS*) and/or its minimal increase (measured as the minimum market share of parties in the mergers). The rationale for introducing variations of *HHI* and *MS* in contrast with the standard theory that focuses on their levels is that the levels of these two indicators yield poor statistical results. This is depicted by Figures 4 which reports the distributions of *HHI* and *MS* conditionally on the class of remedy. By contrast, Figure 5 suggests that the variation of *HHI* and *MS* may impact the choice of the class of remedy.

Insert Figure 4

Insert Figure 5

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[15] Since the exact figures of market shares are often confidential but that a 5%-10% point market range is normally provided, we have used the mid point of the market range provided.

For each type of model, four versions have been estimated (see Tables 4 and 5). In version 1, both the level and the variation of indicators are used as explanatory variables while in version 2 the variation of indicators is the sole explanatory variable. Though there is one explanatory variable less in version 2 than in version 1, the log likelihood is not much lower with version 2. Whatever the type of model considered (with *HHI* or *MS*) it clearly appears that the latent variable increases significantly with the variation of the indicator but decreases with its level though this decrease is not statistically significant. These results suggest that the higher the level of the indicator the lower the influence of its variation. In order to get more insights into this combined effect, the rate of variation of the indicator from pre-merger to post-merger situations is used as the sole explanatory variable in version 3 of the two types of models. An unambiguous and positive effect on the latent variable is obtained, which means that the targeted monetary transfer increases with the rate of variation of *HHI* or *MS*. Moreover, version 3 with the percentage of change exhibits a higher log likelihood than version 2 with the absolute variation. It thus clearly seems that EC competition authorities focus on the percentage of change of concentration or dominant position rather than on their absolute levels and/or absolute variations to determine remedies in phase 1. Version 4 of the models aims at testing the existence of an endogeneity bias when using explanatory variables based on *HHI* and *MS* indicators. As already outlined in the previous section, one way to test this potential bias is to introduce the dummy variable *PREVDEC* that takes value one if there exist a legal precedence and zero otherwise. Legal precedence implies that EC competition authorities have a lower discretionary power to define the relevant market and thus to eventually manipulate the value of *HHI* and *MS*. The dummy variable *PREVDEC* is introduced both in additive form and in multiplicative form with the rate of variation of *HHI* or *MS*. The additive effect is strongly significant while the multiplicative effect is not significant in the two types of model. The existence of legal precedence thus lessens the level of targeted monetary transfers whatever the context in terms of concentration or dominant position. Conversely, competition authorities are systematically more stringent for mergers without precedent. This effect is so significant that it captures almost all the explanatory power of the models and makes the effect of the rate of change of *HHI* and *MS* no longer significant. Conclusions as regards the endogeneity bias are thus two folded. On the one hand, legal precedence influences the attitude of competition authorities regardless of the context, thus modifying the intercept in the two types of models. On the other hand, legal precedence does not have a significant impact on the influence of the rate of change of *HHI* and *MS* which thus not seem to be biased indicators. In a nutshell, it seems that legal precedence only affects the intercept of the models and that its introduction as an explanatory variable has the disadvantage to hide the impact of other variables. Since more than 75% of mergers cases examined in this study have a legal precedent, we conclude that estimates of version 3 are reliable as regards the coefficients of the rate of change of *HHI* and *MS* and may be used to assess the behavior of competition authorities.

Insert Table 4

Insert Table 5

A striking feature of Tables 4 and 5 is that the model with *HHI* systematically over performs the model with *MS* in terms of log likelihood. It thus seems that EC competition authorities are more concerned by concentration matters than dominant position problems. This is confirmed by Table 6 which reports results obtained with a model where the rates of variation of *HHI* and *MS* are simultaneously introduced as explanatory variables. Two versions of this

model have been estimated with conclusions in line with those already obtained in Tables 4 and 5 as regards the endogeneity bias. In version 1 without the dummy variable *PREVDEC* the sole variable that exhibits a significant coefficient is the rate of variation of *HHI*. In version 2, the dummy variable *PREVDEC* is introduced in additive form and captures almost all the explanatory power of the model.

Insert Table 6

Insert Table 5

With these comments as a guideline, version 2 of the model with *HHI* is used to simulate the behavior of EC competition authorities. Figure 6 displays a sensitivity analysis of the probabilities for a merger to be accepted with behaviorial remedies only ($\Pr[k = 1/phase\,1]$), with structural remedies only ($\Pr[k = 2/phase\,1]$) and with both behavioral and structural remedies ($\Pr[k = 3/phase\,1]$) conditionally on the fact that the merger is accepted in phase 1. These probabilities are computed by using expression (2). The most important arbitrage shown by Figure 5 is the arbitrage between structural remedies only on the one hand and both structural and behavioral remedies on the other hand. As the rate of change of *HHI* dur to the merger increases, the probability for a merger to be accepted with structural remedies only decreases at the benefit of acceptance with both structural and behavioral remedies. The probability of a merger to be accepted with behavioral remedies only is low and only slightly sensitive to a increase of the rate of variation of *HHI* due to the merger.

Insert Figure 6

VI. Conclusion

The question of how to design remedies is not an easy one. Our results show that DG Comp focuses on the percentage of change of concentration or dominant position rather than on their absolute levels and/or absolute variations to determine remedies in phase 1. Overall, we also find that the existence of legal precedence lessens the level of targeted monetary transfers whatever the context in terms of concentration or dominant position. Conversely, competition authorities are systematically more stringent for mergers without precedent. Finally, the most important tradeoff is between structural remedies only on the one hand and both structural and behavioral remedies on the other hand. As the rate of change of *HHI* due to the merger increases, the probability for a merger to be accepted with structural remedies only decreases at the benefit of acceptance with both structural and behavioral remedies. The probability of a merger to be accepted with behavioral remedies only is low and only slightly sensitive to a increase of the rate of variation of *HHI* due to the merger.

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Appendix :

Table 1. Merging firms' countries of origin

	Acquirer firms	Acquired firms	
France	41,66%	15%	
UK	8,33%	21,66%	
Germany	6,25%	10%	
The Netherlands	8,33%	8,33%	
Belgium	2,08%	6,66%	
Italy	2,08%	3,33%	
Scandinavian countries	8,33%	6,66%	
Other European Member States/associated countries	2,12%	2,53%	
USA	16,66%	20%	
Other (Japan, Australia)	4,16%		5,83%
	100%	100%	

Table 2. Merging firms' sectors

NACE code	Sector	Frequency	Percentage
Sector A	Agriculture, hunting and forestry	0	-
Sector B	Fishing	0	-
Sector C	Mining and quarrying	2	3,50%
Sector D	Manufacturing	36	63,15%
Sector E	Electricity, gas and water supply	4	7,01%
Sector F	Construction	0	-
Sector G-	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods	0	-
Sector H-	Hotels and restaurants	0	-
Sector I-	Transport, storage and communication	7	12,28%
Sector J-	Financial intermediation	3	5,26%
Sector K-	Real estate, renting and business activities	2	3,50%
Sector L-	Public administration and defence; compulsory social security	0	-
Sector M-	Education	0	-
Sector N-	Health and social work	0	-
Sector O-	Other community, social and personal service activities	3	5,26
Total		57	1

		Table 3. List of variables
ACQUID1		1 if the acquired firm's market share range is [0,25%], 0 else
ACQUID2		1 if the acquired firm's market share range is [25%, 50%], 0 else
ACQUID3		1 if the acquired firm's market share range is [50%, 75%], 0 else
ACQUID4		1 if the acquired firm's market share range is [75%, 100%], 0 else
ACQUIR1		1 if the acquirer's market share range is [0,25%], 0 else
ACQUIR2		1 if the acquirer's market share range is [25%, 50%], 0 else
ACQUIR3		1 if the acquirer's market share range is [50%, 75%], 0 else
ACQUIR4		1 if the acquirer's market share range is [75%, 100%], 0 else
ADVANT		1 if the EC finds that the merger provides an advantage over competitors
ANTICOMP1		1 if strengthening of a dominant position, 0 else
ANTICOMP2		1 if creation of a dominant position, 0 else
ANTICOMP3		1 if creation/strengthening of a dominant position, 0 else
BARRIER		1 if barriers to entry, 0 else
BCOMMIT1		1 if granting of non-discriminatory access to infrastructure, networks, technology via licences or other IPRs or essential inputs, 0 else
BCOMMIT2		1 if termination of exclusive vertical agreements, 0 else
BCOMMIT3		1 if other commitments (withdrawing of a brand, permits, licences and authorizations, contracts, leases and customer orders, customer lists, business reports), 0 else
BCOMMIT4		1 if firewall, 0 else
BUYPOWER		1 if existence of a buying power, 0 lese
CMERGER		1 for a conglomeral merger, 0 else
COLLUSION		1 if the EC finds a risk of collusion, 0 else
COMBI1		1 if the combined market share is [0,25%], 0 else
COMBI2		1 if the combined market share range is [25%, 50%], 0 else
COMBI3		1 if the combined market share range is [50%, 75%], 0 else
COMBI4		1 if the combined market share range is [75%, 100%], 0 else
COMP11		1 if the closest competitor's market share range is [0,25%], 0 else
COMP12		1 if the closest competitor's market share range is [25%, 50%], 0 else
COMP13		1 if the closest competitor's market share range is [50%, 75%], 0 else
COMP14		1 if the closest competitor's market share range is [75%, 100%], 0 else
COMP21		1 if the second closest competitor's market share range is [0,25%], 0 else
COMP22		1 if the second closest competitor's market share range is [25%, 50%], 0 else
COMP23		1 if the second closest competitor's market share range is [50%, 75%], 0 else
COMP24		1 if the second closest competitor's market share range is [75%, 100%], 0 else
		1 if the EC finds a risk , 0 else
DIVEST1		1 if divestiture of a controlling stake in a company that was already a viable stand-alone business, 0 else
COMMISSIONER1		1 if the Commissioner was Nelly Kroes, 0 else
COMMISSIONER2		1 if the Commissioner was Mario Monti, 0 else
COMMISSIONER3		1 if the Commissioner was Karel Van Miert, 0 else
COMMISSIONER4		1 if the Commissioner was Sir Leon Brittan, 0 else
DIVEST2		1 if divestiture of infrastructure, production units, stores, subsidiaries, 0 else
DIVEST3		1 if divestiture of a package of assets, 0 else
DIVEST4		1 if divestiture or grant of a long-term exclusive licence with indefinite duration, 0 else
DIVEST5		1 if personnel transferred
DIVEST6		1 if commitment to exit a JV, 0 else
DOJFTC		1 if the merger has also been examined by the American antitrust authorities, 0 else
ENTRY		1 if timeliness, likelihood and sufficiency of entry, 0 else
FORECLOSE		1 if the EC finds that the merger lead to foreclosure
HMERGER		1 for a horizontal merger, 0 else
HVMERGER		1 for a vertical & horizontal merger, 0 else
JVMERGER		1 for a JV, 0 else
INCREASDIST		1 if the EC finds that the merger increase distance to competitors
LEADER		1 if one of the parties is leader, 0 else
NATION1		1 if one the merging party is French
NATION2		1 if one the merging party is British
NATION3		1 if one the merging party is German
NATION4		1 if one the merging party is Italian
NATION5		1 if one the merging party is Spanish
NATION6		1 if one the merging party is Dutch
NATION7		1 if one the merging party is Scandinavian
NATION8		1 if one the merging party is an associate country
NATION9		1 if one the merging party is non-European
NATION10		1 if one the merging party is American
NUMBCOMP		This is the number of competitors
PREVDEC		1 if there is a previous decision regarding the delineation of the market, 0 else
PRICINCREASE		1 if the EC finds that the merger lead to price increase
REDUC		1 if the EC finds that the merger lead to a reduction of the number of competitors
REGSECTOR		1 if the sector is also subject to regulatory control, 0 else

REMED1	1 if remedies in Phase I, 0 else
REMED2	1 if remedies in Phase II, 0 else
RESCUE	1 if one of the party is in bankruptcy, 0 else
RGMARKET1	1 if the relevant geographical marker is local, 0 else
RGMARKET2	1 if the relevant geographical marker is national, 0 else
RGMARKET3	1 if the relevant geographical marker is EU-wide, 0 else
RGMARKET4	1 if the relevant geographical marker is worldwide, 0 else
SECTORA to SECTORO	X dummies variables that describe activity sectors. See table X for NACE codes
THHARM1	1 if single dominance, 0 else
THHARM2	1 if collective dominance, 0 else
THHARM3	1 if cooperation effects, 0 else
TURNACQUID	This is the worldwide turnover of the acquirer (expressed in million euros)
TURNACQUIR	This is the worldwide turnover of the acquired firm (expressed in million euros)
VMERGER	1 for a vertical merger, 0 else

Table 4
Estimation results with *HHI*

	Version 1	Version 2	Version 3	Version 4
Threshold $\bar{y}_1$ (coefficient reported: θ_1)	1.7312	1.7312	1.7300	1.0055
Threshold $\bar{y}_2$ (coefficient reported: θ_2)	0.0206	0.0197	0.0318	0.1857
Standard deviation σ	0.0431	0.0367	0.0450	0.1737
Intercept	4.6737	3.7114	3.3615	2.4325
HHI level	-0.0002			
HHI change	0.0003**	0.0001*		
HHI rate of change			0.3745**	0.0026
Dummy *PREVDEC*				-1.3303
Dummy *PREVDEC* * *HHI* rate of change				0.1114
Log likelihood	-25.5498	-26.7176	-26.3962	-23.8580

*: significant at 5%   **: significant at 10%
Statistical significance is tested on the basis of the log likelihood ratio test.
Since the thresholds, standard deviation and intercept are essential to the model, their significance has not been tested.

Table 5
Estimation results with *MS*

	Version 1	Version 2	Version 3	Version 4
Threshold $\bar{y}_1$ (coefficient reported: θ_1)	1.7314	1.7244	1.7312	1.1936
Threshold $\bar{y}_2$ (coefficient reported: θ_2)	0.0177	0.0607	0.0207	0.1841
Standard deviation σ	0.0312	0.3806	0.0390	0.1729
Intercept	4.1430	11.2552	3.7149	2.6345
MS level	-0.0087			
MS change	0.0144**	0.1206		
MS rate of change			0.4287*	0.00001
Dummy *PREVDEC*				-1.1063**
Dummy *PREVDEC** *MS* rate of change				0.0840
Log likelihood	-26.1376	-26.7311	-26.7371	-24.0610

*: significant at 5%   **: significant at 10%
Statistical significance is tested on the basis of the log likelihood ratio test.
Since the thresholds, standard deviation and intercept are essential to the model, their significance has not been tested.

Table 6
Estimation results with *HHI* and *MS*

	Version 1	Version 2
Threshold $\bar{y}_1$ (coefficient reported: θ_1)	1.7313	1.7283
Threshold $\bar{y}_2$ (coefficient reported: θ_2)	0.0193	0.0462
Standard deviation σ	0.0338	0.0405
Intercept	3.5054	4.3941
HHI rate of change	0.6578*	0.0479
MS rate of change	0.1712	-0.0082
HHI rate of change * *MS* rate of change	-0.1885	0.1088
Dummy *PREVDEC*		-1.2575*
Log likelihood	-26.2580	-23.7324

*: significant at 5%   **: significant at 10%
Statistical significance is tested on the basis of the log likelihood ratio test.
Since the thresholds, standard deviation and intercept are essential to the model, their significance has not been tested.

Figure 1
Compensation of consumers to make a merger Pareto improving
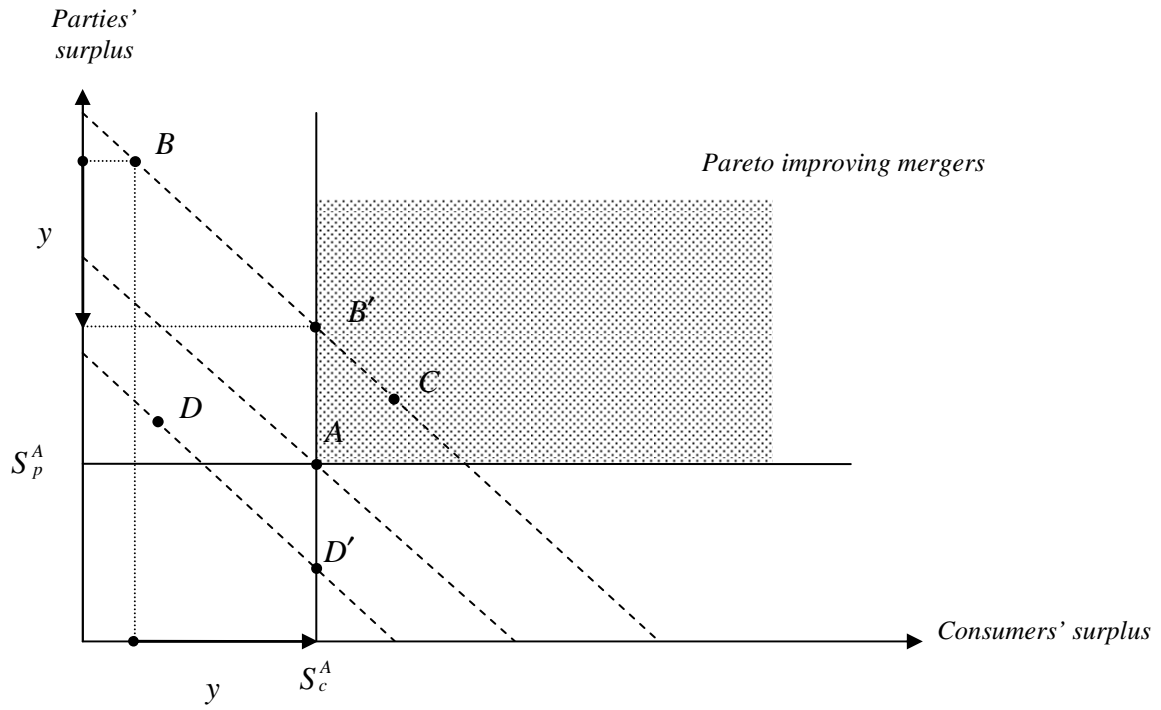
Figure 2
The ordered discrete choice model
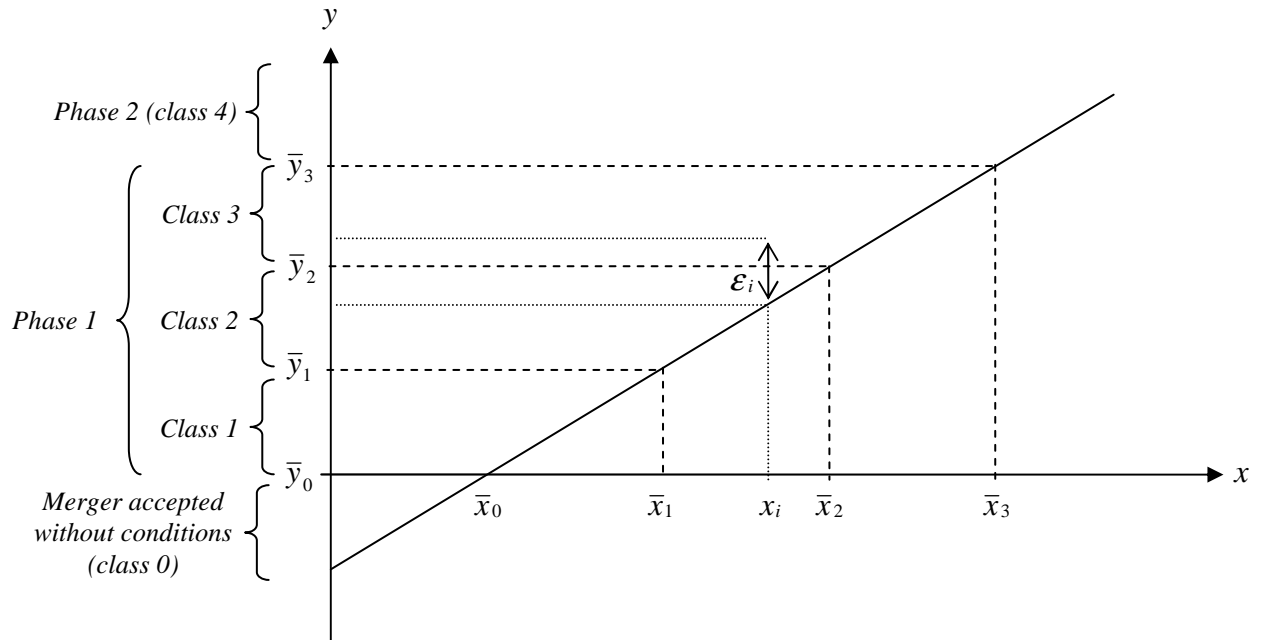
Figure 3 : *Number of Commission merger decisions with commitments compared to the total number of merger decisions in the years 1990 to 2007*
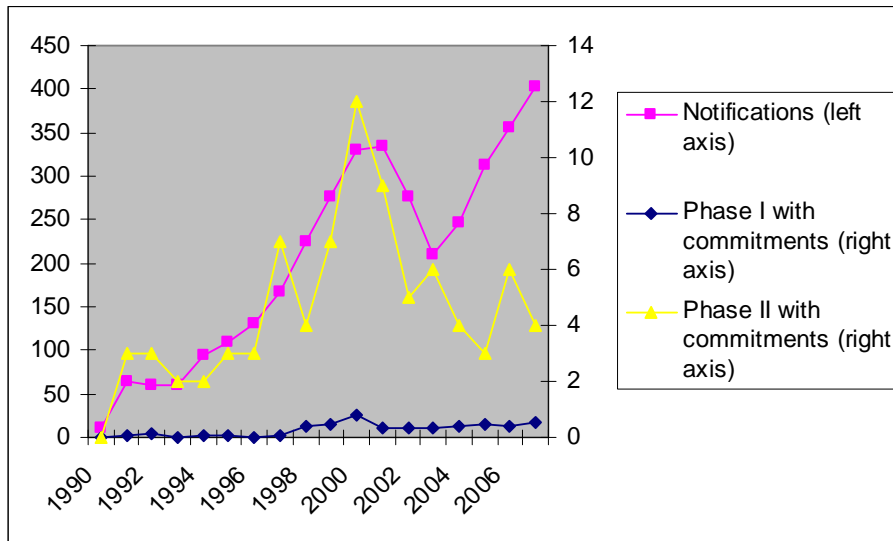
Figure 4
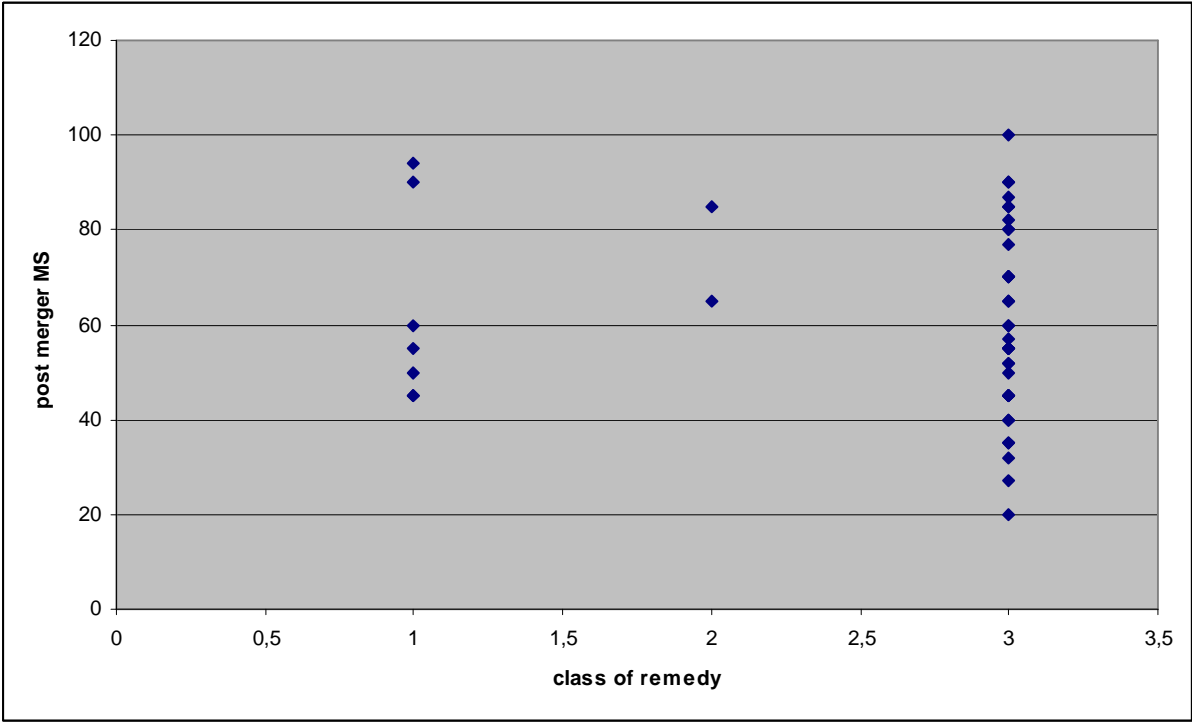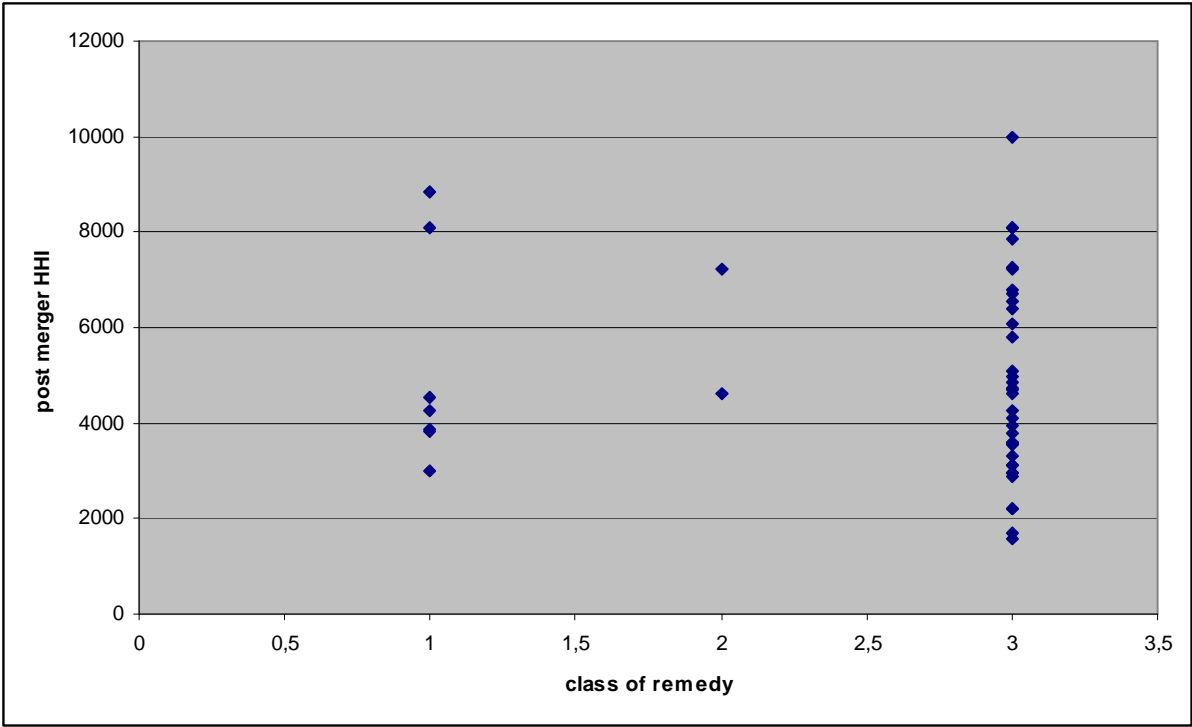*Distribution of the levels of post merger HHI and MS conditionally on the class of remedy*

Figure 5
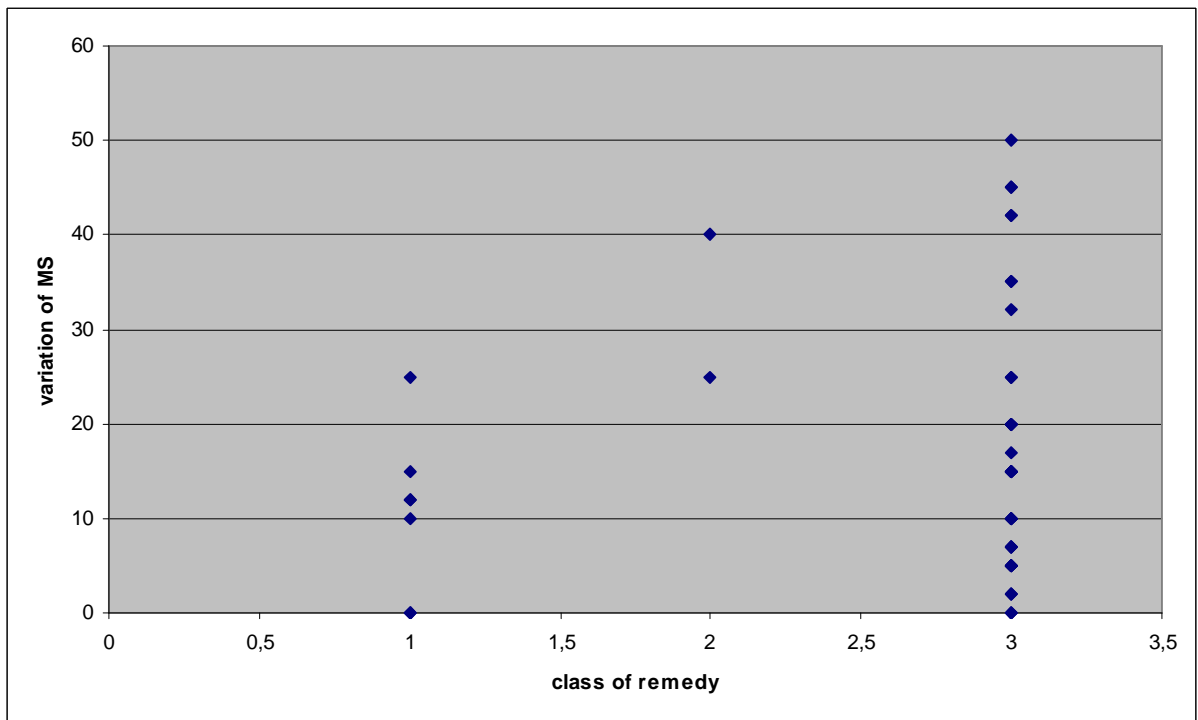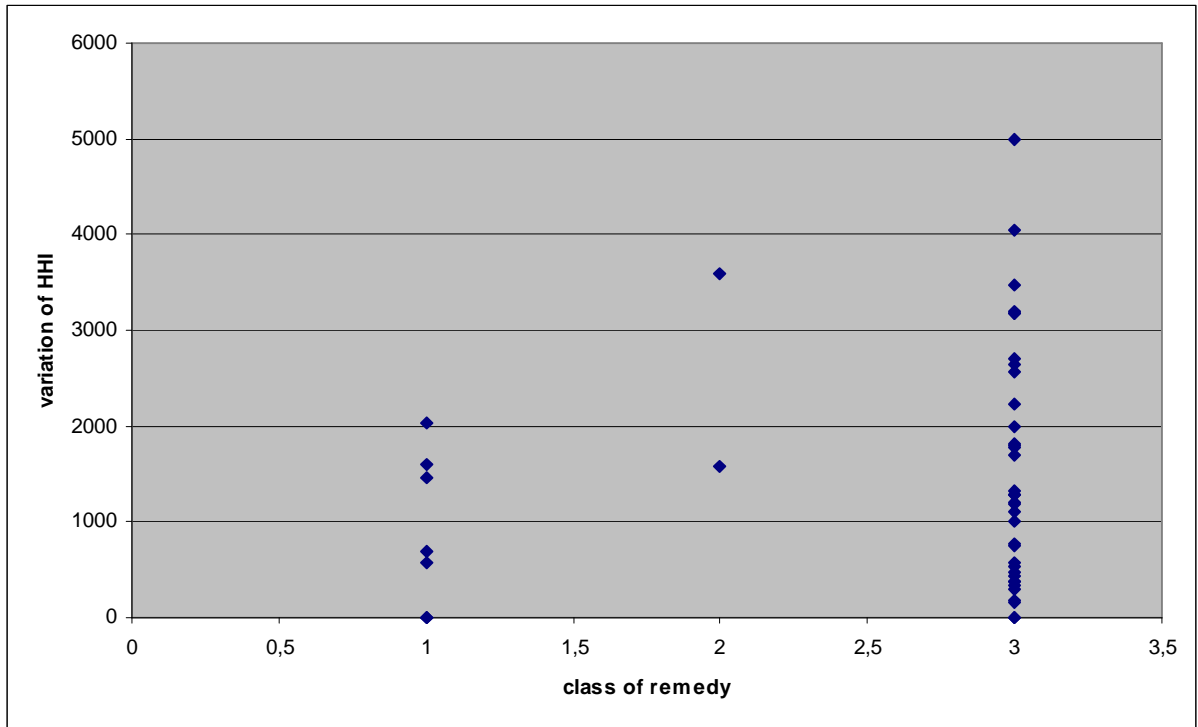*Distribution of the variations of HHI and MS conditionally on the class of remedy*

Figure 6
Sensitivity analysis of conditional probabilities of remedies