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MULTIMARKET CONTACT IN PHARMACEUTICAL MARKETS*

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Abstract

The purpose of this paper is to analyze the effect of multimarket contact on the behavior of pharmaceutical firms controlling for different levels of regulatory constraints using IMS MIDAS database. Theoretically, firms that meet in several markets are expected to be capable of sustaining implicitly more profitable outcomes, even if perfect monitoring is not possible. Firms may find it profitable to redistribute their market power among markets where they are operating. We present evidence for nine OECD countries with different degrees of regulation and show that regulation affects the importance of economic forces on firms' price setting behavior. Furthermore, our results confirms the presence of the predictions of the multimarket theory for more market friendly countries (U.S. and Canada) and less regulated ones (U.K., Germany, Netherlands), in contrast, for highly regulated countries (Japan, France, Italy and Spain) the results are less clear with some countries being consistent with the theory while others contradicting it.

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1 Introduction

Scott (1982) expressed the general concerns about the adverse effects of multimarket contacts over competition and welfare in the following way:

> *Multimarket grouping of sellers could reduce the flow of resources, thereby inhibiting a socially desirable competitive process, if it proceeded until mutual dependence among diversified sellers was recognized and reduction in competition coordinated, tacitly or otherwise.* Scott (1982, p.368)

Although he refers to the specific case of diversifying firms Scott (1982) builds on the old hypothesis of the existence of "spheres of influence" by Edwards (1955). This observation proposed that firms that meet each other in several markets may have incentives to relax competition because they will recognize the interest of its rivals on some markets (their spheres of influence) and they will respect them in the expectation that their own interests will also remain unaffected. Although some relevant works in the early eighties (c.f. Karnani and Wernerfelt (1985)) have also expand on this hypothesis, the article by Bernheim and Whinston (1990) was the first attempt to formalize the expected effects of multimarket contacts and review the traditional approach from a dynamic game theoretical framework. The setting of their theoretical exercise is that of a repeated competition game with discounting where firms meet in an infinite horizon. They show that under the existence of appropriate conditions, preeminently differences between markets or differences among firms, contacts among firms across independent markets increases the set of sustainable collusive equilibria. The incentive mechanism for this result is based on the strategic assumption that firms will prevent each other from competing more aggressively in one market because of the fear of triggering retaliation from rivals in the rest of markets where they meet. The additional assumption for this result is that market transparency is such that any deviation from the collusive equilibrium is easily detected. Bernheim and Whinston (1990) show that this traditional view is better supported by the redistribution of slackness of collective market power in some markets to other markets where collusion is difficult or not possible to sustain in isolation, i.e. not considering the multimarket nature of the industry. This result states that firms may strategically give up profits -reduce prices- in markets where collusion is easier to sustain[1] in favor of markets where collusion is difficult or less likely to arise, i.e. where it is expected a tougher price competition. In short, the prediction of this strategic effect is that under multimarket contact prices will be higher in markets were it is more difficult to sustain a tacit collusion equilibrium and lower in markets where it is easier to collude, than those prices expected in the absence of multimarket contact.

More recent theoretical developments on the analysis of multimarket contact includes Spagnolo (1999), who shows that the traditional effect of multimarket contact does not require asymmetries across markets or firms but the concavity of the objective function of the firms, and the article by Matsushima (2001), in which it is shown that multimarket contact may reduce the adverse effects for collusion derived from imperfect monitoring of

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[1] Ease of collusion depends on a number of factors such as the number of firms operating in the market, product homogeneity, speed of interaction, cost asymmetries, demand stability, etc.

rivals' actions (lack of transparency of markets). In general these new advances on the theory of multimarket contacts confirm the importance of this structural characteristic in shaping collusive equilibria and reinforce the call for testing and understanding it.

Taking Bernheim and Whinston (1990) as a starting point a number of empirical works have intended to test empirically the predictions of the multimarket theory from different perspectives. For instance, Evans and Kessides (1994) examine empirically the effects of multimarket contact on pricing in the U.S. airline industry, finding statistically significant and sizeable multimarket effects over the ability of firms to sustain higher fares [2]. Similarly, Jans and Rosembaum (1996) and Parker and Roller (1997) estimate structural models of firms' behavior in the cement and the mobile telephone industry respectively and find that multimarket contact significantly increases collusion. The former also shows that to identify the market power distribution effect it is crucial to account for the non-home markets' concentration. The latter takes advantage of the regulatory change observed in the cellular industry where former monopolies where replaced by duopolies allowing the authors to test the validity of the model. They show that multimarket contact can explain divergence of prices from the marginal costs. Fernández and Marín (1998) provide empirical evidence from the Spanish hotel industry supporting the predictions of the redistribution of market power, putting forward a particular specification to account for ease of collusion in a single market. Likewise, Pilloff (1999) results on the multimarket effect in the U.S. banking although relevant for a small number of firms confirms the importance of this structural feature in shaping economic performance.

In a somehow innovative way, Busse (2000) gives a step further by arguing that mutimarket contact may foster specific mechanisms of price coordination. It is tested for the U.S. cellular industry whether multimarket contact is significant in explaining price parallelism by firms across independent market as a device for facilitating collusion. The results suggest that multimarket contact help to sustain prices by means of facilitating the parallelism mechanism by which one firm parallels its pricing in one market to that of other linked by multimarket contact.

The present work provides an empirical implementation of the multimarket theory for the pharmaceutical industry for nine OECD countries. Given the existing institutional differences in the pharmaceutical markets across countries the objective of this paper is to test the theory in the context of price regulation variation. As an extension of the results, we aim at evaluating empirically how more or less stringent price regulations is likely to affect pricing decisions through the multimarket mechanism. As mentioned in Puig-Junoy (2005), arguments regarding classic market imperfections in the pharmaceutical industry have been used to sustain drug price controls., however the main concern is the level of public expenditures in pharmaceutical products, specially for systems financed through public sources as is the case of most EU experiences [See commments in Danzon (1999)][3].

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[2] Evans and Kessides (1994) reported the term "living by the golden rule" to picture the mechanism of mutual forbearance.

[3] These concerns are also related to the well known aging of Western European population that has been challenging the public health care systems' sustainability

Thus, many different types of price regulations and other policies have been put forward by developed countries, and EU countries in particular, to alleviate the price incidence over public health expenditures. Price regulations usually do not pay attention to the external features that may be affecting players' decision in a regulated market. By external elements we mean interactions of players out of the market of reference but in the same industry. In the pharmaceutical industry at a national level, an important feature is the coexistence of many corporations in different products markets or *business/product lines.* Consequently, the relevant question is to investigate whether strategic behavior driven by multimarket contacts is affected by the level of price regulation. Obviously it is also of relevance to understand and test how price regulation conditions pricing decision in the light of the multimarket contact nature of the industry.

In the context of different regulatory regimes, Danzon and Chao (2000) identify different groups of countries depending on the severity of regulation. From more to less regulated, the first group includes Italy, France and Japan were launch prices are regulated and afterwards are revised downwards over the drug's life cycle, and the price of new varieties is related to the price of established varieties. In addition, generic substitution by pharmacists is not allowed in France and Italy. Moreover, in the latter countries, pharmacies are paid a margin on the product price which may encourage them to sell more expensive products. The second group includes UK and Germany were corporations are free to set prices at launch but prices cannot increase later on. In addition, in both countries there is some type of upper bound to prices, implemented either through a Reference Price (Germany) or a maximum overall rate of return (UK). Consumer demand substitution is partially possible only in Germany because of the possibility of multisource drugs. Generic substitution by pharmacists is the main source of price-demand elasticity since they keep the margin between the reimbursement price and the manufacturers price. This is possible in UK, and to a lesser extent in Germany. The third group includes US and Canada where prices are free, consumers' and physicians' demands appear to be less inelastic and generic substitution on the side of the pharmacists is encouraged as a mean to promote competition. Danzon and Furukawa (2003) indicates that in the US the existing type of regulation is in fact a mild Reference Price; in any case this country is taken as a benchmark for competition analysis.

Danzon and Chao (2000) estimate reduced form equations for prices on quality attributes and competition characteristics. According to their expectation, the competition variables should be significant only in less regulated markets. The empirical results suggests that regulation constraints competition. The main goal of our work can be seen as an extension of this type of analysis to account for the effects of multimarket contact on competition in order to identify additional effects of regulation on competition.[4]

Apart from the institutional constraints for business practices, the industry presents several particular characteristics that are worth noting. Previous evidence in this industry

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[4] Danzon and Furukawa (2004) suggest that fixed costs are distributed across countries depending on demand elasticities, so that higher prices happen to be in richer countries. This suggest that in a cross-country study specific country measures should also be included in the regression.

suggest that marginal costs are almost irrelevant in the industry and recommend the use of a hedonic price approach[5]. In particular, Berndt et al. (1999) estimate a hedonic price equation that measures the price impact of drugs attributes such as adverse interactions (number of major drugs with which our drug had adverse interactions), the number of side effects, dosage (number of tablets per day required to attain the recommended daily consumption of the active ingredient), number of indications, etc.[6] Likewise, in the context of an entry model, Frank and Salkever (1997) include past sales reflecting learning or word of mouth effects but it could also measure if entry by generics is more or less attractive (this variable is treated as an additional attribute that proxies perceived quality by consumers).

Several authors have also accounted for perceived quality when modeling the pharmaceutical industry, particularly from the likely (static) effects of advertising and promotion over exacerbated price insensitiveness. In particular, King (2000) and Windmeijer et al. (2004) conclude that brand advertising and promotion further reduces price sensitiveness of drugs. In a somehow related work, Coscelli (2000) suggests that drug consumption exhibits time dependence which implies additional price insensitiveness due to what can be understood as brand loyalty.

With respect to the effects of entry of generic products on price evolution, the empirical evidence is ambiguous. After entry of generic products, some authors (Grabowski and Vernon, 1992 and 1997, and Caves, Whinston Hurwitz, Pakes and Termin, 1991) report that brand-name prices increased relative to generic prices, while others (Wiggins and Maness, 1994) find a reduction in prices following entry. Finally, Frank and Salkever (1992 and 1997) report that brand name prices increased while generic products prices fell, producing a reduction in average prices. The latter explain the correlation between brand name prices and generics' entry through a Stakelberg price leader model, where brand name producers set prices for their products in the first stage and generic product producers set prices only after observing brand name product prices. Demand is formed by two segments: one is price insensitive and the second is price responsive. After the entry of generics price responsive buyers shift to generics and brand name firms, who are left with price insensitive consumers decide to raise their prices [7]. We will differentiate the effect of generic prices over the pricing decisions of firms considering that brand-name drugs belong to a particular (though not independent) segment of the market.

In sum, we believe the pharmaceutical industry accounts for many interesting aspects

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[5] This is the treatment given by Stern (1996) for example and also implicitly assumed in Danzon and Chao (2000)

[6] Berndt et al. (1996), Cockburn and Anis (1998) and Suslow (1996) followed a similar approach.

[7] However, this mixed evidence could also be interpreted in the context of more traditional models of competition were we take into account the existence of multimarket contact and the interaction between brand name and generic products markets. For instance, assume that ease of collusion was lower (for whatever reason) in the brand name market while it is higher in the generic products market (for instance, because of cost and brand image symmetry, that would make competition very tough in the absence of some degree of tacit collusion). Now, in the presence of multimarket contact, if the same firms operate in both markets, the emergence of the generic products market could induce an increase in brand-name product prices, while being consistent with a lower average price in the market.

such as different levels of regulation across countries, product differentiation possibly both at the horizontal and quality levels, different degrees of competition across markets and other institutional arrangements that affects price sensibility. Differences in competitive levels across markets according to Bernheim and Whinston (1990) may foster the collusive mechanism through multimarket contact. At the same time, differences among firms and across markets in terms of the perceived quality of the product by doctors, for instance, are also likely to enhance the multimarket contact mechanism to sustain collusion. Therefore, it appears that this industry satisfy the conditions for a relevant study of the effects of the external (to the individual market) multimarket industry structures as a source of price variation.

The theoretical results about competition and multimarket contact can lead to several types of tests and applications in the context of the pharmaceutical markets. As Evans and Kessides (1994) suggest: '*In empirical tests of the multimarket contact hypotheses, appropriate definition of the market is of paramount importance.*' Pharmaceutical markets are usually bounded in terms of therapeutic classes of drugs, the members of which often are therapeutic substitutes, e.g., antiulcer drugs, antidepressants, anticholesterol drugs. etc.[8] In addition, within each therapeutic class we find a large number of countries which might be regarded as independent markets on the demand side because of differences in their regulatory systems and various barriers to the mobility of drugs. Then from a geographical point of view, markets might be defined as countries and within countries a market is to be regarded either as a product line or a grouping of related product lines.

We motivate the empirical exercise by showing that it is possible to formulate, within a model with (symmetric) product differentiation, an expression for the observed prices as the equilibrium strategies of an infinite horizon game with discounting which has three separable parts: First, a function for the stage game price in equilibrium, Second, a function of the multimarket external conditions, and a function of the time preference. This formulation is comparable to that followed in Fernández and Marín (1998). For the empirical test of multimarket contact effects, we use a multicountry and multiproduct data set from the IMS MIDAS international dataset for the period 1998-2003. This dataset encompasses a large number of countries including the top seven in terms of pharmaceutical expenditures, as well as medium size and small countries. It also includes a large number of groups or anatomic classifications, and allows to study between countries variations, specially in terms of both regulatory regimes and industry structure. Provided with this data set, we select a sample of nine OECD countries, namely U.S., Canada, U.K., Netherlands, Germany, France, Japan, Italy and Spain that differ mainly in the toughness of pricing regulations but other institutional arrangements are comparable such as the compulsory need of a prescription for drug delivery. We estimate the effect of multimarket contact on prices using panel data methods which also helps us to control for a variety of effects such as idiosyncratic corporation effects and where the case requires country specific fixed effects.

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[8] See Berndt et al. (1995)

Our preliminary results confirms the presence of the predictions of the multimarket theory for more market friendly countries (U.S. and Canada) and less regulated ones (U.K., Germany, Netherlands), in contrast, for highly regulated countries (Japan, France, Italy and Spain) the results are less clear with some countries being consistent with the theory while others contradicting it. Interestingly in all the cases where the theory seems at least weakly consistent if we omit the market power distribution effect from more collusive single markets to more competitive ones, our multimarket variable appears to deliver biased estimates. Therefore, our data and results suggests that in the pharmaceutical industry the distribution of market power is a relevant feature to explain economic performance. We expand further the analysis by conjecturing that given the observation that price regulations tend to decrease or limit competition (e.g. Danzon and Chao (2000)), the size effect of the distribution of market power should be bigger in regulated countries than in less regulated ones. This conjecture seems to be sustained by the results meaning that (price) regulation not only limits competition in a single market but also helps to relax competition in plausibly more competitive ones by the multimarket contact mechanism in this industry. The relevance of additional analysis of these findings is uncontroversial, for instance cross industry studies as well as individual industry investigations.

The paper proceeds as follows: After this introduction we present in section 2 the theoretical implications of multimarket contacts and show how observed prices can be approached from this framework; section 3 describes the data set and the variables to be used; next, section 4 presents the empirical specification based on the suggestions of section 2 and also discusses the econometric methods, identification problems and solutions; finally, section 5 describes the results and their interpretations as well as some robustness exercises.

2 Discussion on the implications of multimarket contact

It is a well known result that firms could achieve more collusive outcomes when they expect to meet and compete for an infinite number of periods. To achieve these outcomes, the firms involved must design a set of credible penalties for deviating players. For instance, if a firm decides to deviate from the collusive outcome, the penalty imposed could consist of reverting for the remainder of the game to the equilibrium strategy for the stage game, since this is also a subgame perfect equilibrium in the repeated game. In what follows we present the implications of the multimarket contact theory and a discussion of the possible effects of regulations over the collusive mechanism it disentangles.

2.1 Observed prices from a multimarket perspective

To simplify the analysis, assume a market k where N_k firms producing symmetrically differentiated products compete in prices and denote the equilibrium prices in the one shot game by p_i^*, $i = 1, ..., N_k$. Consider this as the stage game of an infinitely repeated game with discounting. Let p_i^m denote the price that jointly maximizes the profits of all the N_k firms in the market [9]. Now firms have the possibility of choosing from a set of alternative prices in the repeated game and tacitly support prices above the stage game outcome in the long run. Detection of any deviation from this collusive outcome will be penalized by all the members of the coalition by reverting to the stage game equilibrium from then on. This also implies that market transparency is such that rivals can easily find out whether a member of the coalition has defected or not, an assumption that has been criticized from many instances in the literature [10]. Denote by $p_i^{'}$ the price for firm i in the repeated game and assume that $p_i^{'} \in [p_i^*, p_i^m]$. $p_i^{'}$ then is selected such that it maximizes the present discounted value of the firm's expected flow of profits subject to the incentive constraint that loses implied by deviations from the collusive path are greater than the implied gains [11]:

$$\frac{\delta}{1-\delta}[\pi_i^{'} - \pi_i^*] \geq \pi_i(R_i(p_{-i}^{'}), p_{-i}^{'}) - \pi_i^{'} \tag{1}$$

where π_i^* and $\pi_i^{'}$ are firm i's profits when prices are p_i^* and $p_i^{'}$ respectively, $\pi_i(R_i(p_{-i}^{'}), p_{-i}^{'})$ are firm i's profits when all firms other that i set their collusive prices, $p_{-i}^{'}$, and firm i chooses its best response to them, $R_i(p_{-i}^{'})$, and $\delta \in (0,1)$ is the discount factor. Now, note that if p_i^m is to be supported as a sub game perfect equilibrium, then it must be the case that there is no profitable deviation from it, in other words it satisfies:

$$\frac{\delta}{1-\delta}[\pi_i^m - \pi_i^*] \geq \pi_i(R_i(p_{-i}^m), p_{-i}^m) - \pi_i^m \tag{2}$$

Where π_i^m is firm's i profits from the joint profit maximization outcome. While the left hand side of this expression depends on δ, and increases monotonically in this argument, the right hand side is independent of the discount factor. If we denote the left hand side by $F(\delta, \pi_i^m - \pi_i^*)$ the following condition is true:

$$F(0, \pi_i^m - \pi_i^*) < \pi_i(R_i(p_{-i}^m), p_{-i}^m) - \pi_i^m < F(1, \pi_i^m - \pi_i^*) \tag{3}$$

This expression implies the existence of some threshold for the discount factor, say δ^m, above which the joint profit maximization outcome is a sub game perfect equilibrium. Although other strategies may be supported in equilibrium by values above δ^m, we shall assume that firms will select the highest price π_i^m. Below δ^m, p_i^m cannot be supported and the maximum sustainable price is given by $p_i^+(\delta)$. Lets define the maximum sustainable price as a function of the discount factor by $p_i^+(\delta) = \max\{p_i \in [p_i^*, p_i^m) \mid F(\delta, \pi_i - \pi_i^*) \geq \pi_i(R_i(p_{-i}), p_{-i}) - \pi_i)\}$. Note that the condition in this function when

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[9] With symmetric product differentiation it is expected that joint profit maximization give also a symmetric price equilibrium. See Bernheim and Whinston (1990) and Chang (1991)

[10] For example a sudden reduction on a firm's sales may be an indication that one or more rivals have defected or can be just the result of a random demand shock which implies that perfect monitoring of rivals' decisions is not possible

[11] More precisely, in a symmetric product differentiation set up $p_i^{'}$ is the price that maximizes joint profits under the constraint that loses from deviations are greater or equal than the gains from such an strategy.

$p_i^+ = p_i^*$ implies $F(\delta, 0) = \pi_i(R_i(p_{-i}), p_{-i}^*) - \pi_i^*) = 0$ and when $p_i^+ \rightarrow p_i^m$ implies $F(\delta, p_i^m) < \pi_i(R_i(p_{-i}), p_{-i}^m) - \pi_i^m)$; therefore if $p_i^+(\delta) > p_i^*$ it should be the case that the condition is hold with equality. To proceed with the analysis we need to make some monotonicity assumption on this function. Furthermore in the context of product heterogeneity, the way in which the discount factor affects the maximum sustainable price depends on the nature of product differentiation. For instance, Chang (1991) showed that in the context of symmetric horizontal product differentiation the maximum sustainable price, also known as best collusive price, has the property that $\partial p_i^+ / \partial \delta > 0$ while in the case of vertical (quality) product differentiation explored by Häckner (1994) there is not a clear answer. However, it is possible to show in the context of Hackner's analysis that given a level of (non symmetric) product differentiation, the price of the high quality firm that maximizes joint profits is increasing in the discount factor. For our analysis we will adopt the plausible property that $p_i^+(\delta)$ is a monotonically increasing function. This implies the intuitive result that whenever future profits are more valuable, short run benefits from defecting are accordingly less preferred. Therefore $p_i^{'}$, the collusive price, will be a non-decreasing function of δ.

At any given δ, $p_i^{'}$ will depend on the same cost and demand conditions that determine p_i^*. This last fact together with assumption that $p_i^{'} \in [p_i^*, p_i^m]$ and the discussion above allows us to express $p_i^{'}$ as a separable function of the equilibrium price in the stage game and a function of the discount factor, $p_i^{'} = \Phi(\delta)\ p_i^*$, where:

$$\Phi(\delta) = \begin{cases} \frac{p_i^m}{p_i^*} & \text{if } \delta > \delta^m \\ \frac{p_i^+(\delta)}{p_i^*} & \text{if } \delta^m > \delta \end{cases}$$

Note that for sufficiently low δ ($< \delta^m$) the most collusive outcome requires $p_i^+ = p_i^*$ which readily implies $\Phi(\delta) = 1$. From there this function increases until it reaches the upper bound $\frac{p_i^m}{p_i^*}$. Once this simple analysis is expanded to allow for the realistic situation in which firms interact with their rivals in many independent markets, some interesting hypotheses on the expected strategic behavior of firms may be extracted.

To model the implications of multimarket contacts it is reasonably assumed that any firm which intends to deviate from the collusive equilibrium in any market k will face a penalty in every of the markets where it meets its market k rivals. Given that the punishment is going to spread over all the markets, when a firm decides to deviate from the collusive strategy it does so simultaneously in all the markets where it operates. Therefore, assuming that firm i is present in K independent markets, the incentive constraint under the multimarket contact hypothesis becomes:

$$\sum_{k=1}^{K} \frac{\delta_k}{1-\delta_k}[\pi_{ik}^{'} - \pi_{ik}^*] \geq \sum_{k=1}^{K} \left\{\pi_{ik}(R_{ik}(p_{-ik}^{'}), p_{-ik}^{'}) + \pi_{ik}^{'}\right\} \tag{4}$$

This condition is a pooling of the K individual market incentive constraints. From this expression Bernheim and Whinston (1990) derive several interesting results. First, for identical markets and firms' characteristics across markets, both profits and losses from deviating are multiplied by the number of markets where the firms are meeting, and the set of strategies that form subgame perfect equilibria remains unchanged. [12].

Second, when markets differ, for example by different degrees of symmetric product differentiation, or firms have market specific characteristics (have different quality premiums for instance), we can obtain a larger set of sustainable equilibria for each market that still includes all the equilibrium strategies available in the absence of multimarket contact. In particular, a firm can reach more collusive outcomes in some markets by violating condition (1) as long as this condition holds in other markets as a strict inequality, i.e., when $p_{ik}^{'} = p_{ik}^{m}$ for some k, and condition (2) holds for the whole set of markets where the firm operates.

Third, and more interestingly, firms can go further than what is implied by the last possibility. Imagine a situation in which condition (1) holds as an equality for all the markets where the firm is operating, i.e. $p_{ik}^{'} = p_{ik}^{+}$ for all $k \in K$. In this case, firms can reduce their price in a sub set of markets so that condition (1) in these markets holds now as a strict inequality. In this way firms create some slackness in a number of markets so that they can increase prices in some (or all) of the rest of the markets, violating condition (1), as long as condition (2) still holds. Along this line of argumentation, Bernheim and Whinston (1990) conclude that firms can find it optimal to redistribute their market power, giving up profits in some markets where the collective action is easier to coordinate in order to increase profits in other markets where the toughness of price competition precludes a more collusive result. Given the link between ease of collusion and demand responsiveness, the expected outcome of this strategy is a positive net gain for the firm.

Assuming as given the structure of each k market and as a consequence the structure of multimarket contacts for firm i, we can represent the firm's equilibrium price of the repeated game in market k as a function of three separable components:

$$p_{ik}^{'} = \Gamma(MMC_{ik}, \theta_k)\ \Phi(\delta_k)\ p_{ik}^{*} \tag{5}$$

where $\Gamma(MMC_{ik}, \theta_k) > 0$ measures the effect of the multimarket contacts structure given by variable MMC_{ik} and some measure of the toughness of price competition at the stage game in market k, which we denoted θ_k. In terms of the hypothesis of the strategic behavior supported by the existence of multimarket contacts, the key prediction implies that $\frac{\partial^2 \Gamma(.)}{\partial MMC_{ik} \partial \theta_k} > 0$. That is, the strategic effect of multimarket contact over the repeated game equilibrium price is expected to be increasing in the toughness of price competition. More precisely, it is expected to observe $\Gamma(MMC_{jik}) < 1$ in markets where a collusive price is easier to support (less toughness of price competition) in equilibrium and $\Gamma(MMC_{jik})$ > 1 in markets with less favorable conditions to sustain collusion.

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[12] This is labeled as the irrelevance result by the authors. Spagnolo (1999), however, has shown that when the objective function of the agent is strictly concave then multimarket contact can increase the ability of firms to support collusion even if no asymmetries exist between markets

2.2 Effects of regulation on strategic behavior

There are many types of regulations within the pharmaceutical industry across countries and even in a particular country many kinds of controls coexist. However, we are interested on policies aim at promoting competition between brand-name drugs and generic substitutes and in opposition direct price ceilings. The former are supposed to relax the price elasticity of demand, and usually this type of regulations take the form of reference price systems. On the other hand, direct price controls and the impediment to increase prices once the ceiling has been adopted are considered to be counterproductive.

Although we do not present a formal discussion on the likely effects of regulation, in particular price ceilings for drug products, the literature on the topic gives us some initial thoughts about the kinds of distortions that may affect the strategic behavior of firms in this industry. Cabrales (2003) provides a theoretical approach to the effects of price ceilings in the pharmaceutical industry using a vertical differentiation oligopolistic model. He is able to show that increasing the stringiness of regulation increases the relative market share of the branded product with respect to generic drugs, a result that is compatible with what is informally observed in practice. [13]

From an empirical perspective, Aronson et al. (2001) studies the effect of reference price systems over well established brand name drugs. The results are mixed, showing a positive relation between price controls and brand name product market shares for some products and a negative one for others. Likewise, Danzon and Chao (2000) have found that countries where price regulations are more strict, such as France, Italy and Japan, price competition is less dynamic and tough. One interpretation of the latter result would be that regulation is helping collusion and so the full gains of price controls are not been realized.

The above mentioned studies will at least weakly suggest that price reference systems and more importantly price caps increase relatively the market power by increasing the share of brand name products in some particular markets. Therefore, it could be conjectured that price cap regulation, and to a less extent reference pricing, moves the distribution of the concentration index towards 1 in more regulated industries. However the mechanisms for this result are interesting we want to focus in the likely result of this in practice from our perspective. If price regulation induces such a move in the concentration distribution it will tend to increase asymmetric concentration in general regulated industries. Therefore, the strategic effect of multimarket contacts may be influenced by more stringent price controls. Hence we will formally expect that the size of the market power re-distribution to be affected. A conjecture will be then that price regulation, and preeminently price caps, may increase the size of the re-distribution mechanism by creating some (additional) slack in markets where prices are higher either by reducing the prices or increasing the concentration and potentially relaxing competition.

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[13] This model also reproduces the so called *generic price paradox* briefly described lines above.

3 Data and construction of the variables

3.1 Data set description and analysis

We use a multicountry and multiproduct data set from the IMS MIDAS international dataset for the period 1998-2003[14]. This dataset encompasses a large number of countries including the top seven in terms of medicine expenditures, as well as medium size and small countries(see Table 1 for a list of countries and data summary). The most widely used classification for pharmaceutical products is the Anatomical Therapeutic Chemical classification or ATC code which groups medicines in different levels starting from the basic chemical entity or molecule at the bottom level. This classification provides the researcher an a priori way to approach the study of markets for drugs with the possibility of using many alternative relevant market definitions [15]. The panel structure of the data set also provides the econometrician with several sources of price variations that can be studied. This is particularly interesting for our work given that market structure and the configuration of multimarket contacts will vary across product markets, whatever their definition, and time.

As in any applied industrial organization and competition analysis, a correct market definition is crucial. The pharmaceutical industry represents, however, a complex exercise of market definition considering that shaping geographical boundaries within a country or clear mutually exclusive sets of substitute products is not straightforward. We disregard any delimitation of regional markets within a country, as it is reasonably to assume that value to cost transportation in this industry is high. In the ATC classification, the basic unit of differentiation between two products is the main chemical substance of the products, called the molecule. When two products have the same chemical substance are thought to be therapeutically equivalent. When they belong to different molecules they can be imperfect substitutes for a therapy or have no relation at all. In the current study we define a market as the set of products whose main chemical composite belongs to the same molecule. However, this definition may be too narrow based on the well known fact that different molecules can be used to treat the same medical condition. We then contrast the results with a broader definition of the market: the 4-digits Anatomic Therapeutical Classification (ATC4) the molecule belongs in. Table 1 (panel B) presents the distribution of corporations depending on the number of markets supplied for the set of countries considered in our sample, namely: US, Canada, Germany, UK, Netherlands, France, Italy, Japan, and Spain.

This data set is specially valuable to conduct a cross country study which is of particular interest for the industry due to the different regulatory regimes each country have designed and currently applies. Following the comprehensive study by Danzon and Chao

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[14] We dispose of information from the 4^{th} quarter of each year, apart from 2003, for which the information is provided for the 2^{nd} quarter.

[15] The ATC classification is supported and maintained by the World Health Organization Collaborating Centre for Drug Statistics Methodology with a base in the Norwegian Institute of Public Health

(2000) as well as the advice of recognized experts[16] we group the countries considered in the sample in three regulatory categories. (I) US and Canada belong to the group of more market friendly policies; (II) Germany, UK, Netherlands belong to the group of medium regulated; and, finally, (III) France, Italy, Japan, and Spain belong the highly regulated group.

The list of variables that we construct is the following. The variable price, called *Price*, corresponds to sales revenue divided by the number of 'standard units' sold. As pointed out by several authors marginal costs are almost irrelevant in the industry [c.f. Stern (1996)]. This suggests the use of a *hedonic* approach.[17] Accordingly, in our regression we incorporate this approach and include quality variables as regressors to proxy the stage game equilibrium price. The quality variables for which we do have information and therefore we include in our regressions are as follows: The variable firm's size, *Fsize*, is constructed as total corporation sales correcting it by excluding sales of the product under analysis in each country. Molecule age, *Molage*, is the time elapsed since the molecule was launched to December 31, 2003. The age distribution of molecules and products is presented in table 1 (panel C). Also competition variables related to the mark-up are also computed. These variables are: Number of generics, *ngenerics*, is the number of generic products in each market and country. Given that there is not a clear definition of what a generic product is [see discussion in Scherer (1993)], we use an economic approach based on the difference between product produced by a corporation holding a brand reputation and small producers; the Hirschmand-Herfindähl concentration index, *HHI*, is constructed using corporation sales value, with squared market shares of the corporation under analysis excluded from the index, *HHI-corr*. We construct the market share of each variety in the market, *Mshare*, and the aggregate market share of all other varieties supplied by the same corporation in each market, *Cshare*. For the regression analysis we use log transformations of *Price*, *Fsize* and *Molage*, so we value more the differences in smaller than in larger values.

Several dummy variables are also constructed: *New* is a dummy variable equal to one if the product was launched in the previous year and zero otherwise, *Censormol* equals 1 if the variable was launched before January 1, 1991 and zero otherwise, *Censorlag* equals one for products launched before January 1, 1991 and zero otherwise. These dummies are part of the quality variables used to capture price variation.

In addition to these variables, concerns on the endogeneity of some of the regressors led us to find a way to include some additional information. The argument is that in pharmaceutical markets, product differentiation in terms of attributes is of particular relevance. However many important attributes are not observable for the econometrician because are not measurable or as it is in our case are absent from our data set. The stage game price P^*_{ik} will be a function of marginal costs, usually thought to be irrelevant in the industry,

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[16] We are indebted to Guillem López and Vicente Ortún from the Center for Health Economics Research (UPF) and Félix Lobo (UC3M) for helpful advice on this regard.

[17] See Berndt, Cockburn and Griliches, 1996, Berndt, Pindyck and Azoulay, 1999, Cockburn and Anis, 1998, and Suslow, 1996.

and a mark-up term. This mark-up will depend on some measures of market participation such as those commented lines above. However this mark-up variables will be correlated with unobserved characteristics of the product i whose effect by definition will be located in the error term. Abusing the language of the Instrumental Variables approach to the problem, we put forward an identification assumption that the independence of markets across countries gives us the possibility of using the price of other products in the same market definition in other countries to control for the unobserved effects. The argument is that this prices will be correlated with time variable and time invariant unobserved attributes of a number of products that interact with product i in market k, information that is also relevant to the firm to set prices. However this attributes of other products are not correlated with product's i own characteristics and as such helps as to control for some of the unknown price variability. The variable constructed is a global price, *Gprice*, which is the average price of the products belonging to the same market definition of i but in other countries.

In addition, and concerned with the same endogeneity problem, firm specific attributes that are time invariant in the sample such as brand reputation are usually unobserved for the econometrician and can be correlated with some of the left hand side variables. For these reason we will used a fixed corporation effect approach in the regression analysis. Given its relevance for this paper, the definition and construction of variables capturing the influences of multimarket contact will be discussed in the following sub-section.

3.2 Alternative measures for multimarket contact

In the empirical literature discussed in the introduction, many different ways of defining multimarket contact have been tried. From a purely strategic point of view, there has been consensus that a contact of firm i with its rivals in the focal (or reference) market k in other markets should reflect the importance of this last contact market for the firm. This is considered in our definitions either by using market shares or concentration indexes in terms of quantities or sales as weights for each market contact. Other important general consideration is concerned to the extent to which individual price variation is explained by the firm individual multimarket contacts variation or average multimarket contact across firms within a given market. The former approach will for instance capture the effect of small prediction power of multimarket contacts because of the presence of small firms producing a very limited number of products. In contrast, the latter implies that average multimarket contacts across firms within a market will affect all the firms in this markets in the same way, no matter how many individual market contacts have each firm. We will try both specifications.

With respect to the multimarket contact variable, an instance of multimarket contact occurs, according to our definition, when a corporation i and its competitor l in the focal market k, also meet in a different market m that we will call the contact market. If an event of multimarket contact occurs we define a dummy variable $C_{il,km} = 1$, otherwise $C_{il,km} = 0$. We define first individual measures of multimarket contact. The variable, MMC, is defined:

$$MMC_{il,km} = C_{il,km}\, Y_m$$

where Y measures the corporations' interests in the contact market m. We can think of several instances for Y, such as the degree of concentration, the corporation's market share or the percentage of the corporations' operations in that market. The measure of multimarket contact is the weighted average number of multimarket contacts with the competitors in the focal market which is calculated as follows:

$$AVMMC_{ik} = \frac{1}{(N_k - 1)} \sum_{l \neq i} \sum_{m \neq k} MMC_{il,km} \tag{6}$$

where N_k is the number of competitors in the focal market. An alternative way of defining the multimarket contact variable is to average across all the weighted contacts of every firm with its rivals in the focal market using the total number of potential pairings of the same firms. In this case the multimarket contact variable will vary across markets but remain fixed within markets. The definition will be given by:

$$AVMMC_k = \frac{1}{(N_k(N_k - 1))/2} \sum_{i} \sum_{l \neq i} \sum_{m \neq k} MMC_{il,km} \tag{7}$$

where $(N_k(N_k - 1))/2$ is the total number of possible pairings of the firms belonging to market k. This indicator will punish markets where a large number of firms exists in the focal market but very few interact with each other out of the focal market. Descriptive statistics for these two definitions as well as respective not weighted versions, that is for the case $Y_m = 1$, are shown in table 2.

4 Empirical specification and Econometric methods

In section 2 we have shown an expression for the observed price of a product considering the multimarket structure of the industry. We generalize this expression for the case of a firm that might be producing more than one product within the same market. Therefore the price for a product j of firm i in market k, denoted p'_{jik}, can be represented as a separable function of its equilibrium price in the stage game, p^*_{jik}, a mark-up on this price which depends on the discount factor, δ, and a function of the degree of multimarket contact and the ease of collusion in both the focal and the contact market. Assuming linearity we consider the following log-linear specification:

$$log(p'_{jikt}) = \alpha + \Omega(MMC_{ikt}, \theta_{kt}) + \Phi(\delta_i) + log(p^*_{jikt}) \tag{8}$$

where t denotes time, $\Omega(MMC_{ikt}, \theta_k) = \log \Gamma(MMC_{ikt}(\theta_{kt}))$, and α is a parameter. Note that the multimarket contact indicator varies across firms within a given market. In the related literature this variable is considered fixed within markets in most of the cases. This approach is based on the assumption that the complete set of multimarket contacts within a market will affect the pricing decisions of all the firms in the same amount. However we may think of small firms within a market for which multimarket contact does not explains too much variation on prices. This is the case of the pharmaceutical markets where large corporations share a given market with small (possibly local) producers. Allowing for a multimarket contact indicator that varies across firms helps us to factor in possible effects of the presence of local firms, in particular over the ability of firms to coordinate. The log of the stage game equilibrium price is specified as:

$$\log(p^*_{jikt}) = X^{1'}_{jikt}\beta_1 + X^{2'}_{jik}\beta_2 + Z^{1'}_{kt}\gamma_1 + Z^{2'}_{k}\gamma_2 + \eta_{1i} + v_{jikt} \tag{9}$$

where the Xs and Zs are vectors of respectively time-variant and time-invariant variables concerning product j of firm i on one hand, and market k on the other, that potentially affect the stage game equilibrium prices through different meaningful ways, β, and γ are the corresponding parameter vectors, η_{1i} is a firm fixed effect and v_{jikt} contains unobserved elements for the econometrician. Given the product differentiation nature of pharmaceutical markets we can interpret the pricing equation as a function of variables affecting marginal costs (which are usually thought to be negligible in this industry) and the product's mark-up such as observed attributes that are fixed or vary through time. From a structural point of view these attributes will affect the firm's and specific product market shares. At the same time, the fixed effect is included to control for elements of vertical (quality) product differentiation which are one of the most highlighted peculiarities of this industry. The v_{jikt} can be regarded as that information on attributes that are not observed by the econometrician but firm's do take into account when taking their pricing decisions. To complete the specification, we use the following expression for the discount factor function:

$$\Phi(\delta_{jikct}) = \eta_{2i} + \lambda_t \tag{10}$$

That is, taking advantage of the panel structure of the data, we proxy the discount factor by an specific firm effect η_i, and λ_t, a time specific factor. After replacing these expressions in the above equation we obtain:

$$log(p^{'}_{jikt}) = \alpha + \Omega(MMC_{ikt}, \theta_k) + X^{1'}_{jikt}\beta_1 + X^{2'}_{jik}\beta_2 + Z^{1'}_{kt}\gamma_1 + Z^{2'}_{k}\gamma_2 + \eta_i + \lambda_t + v_{jikt} \tag{11}$$

Note that we have collapsed the two firm specific time invariant effects of the two previous expressions (η_{1i} and η_{2i}) respectively) in η_i.

In some of the related works reviewed [e.g. Evans and Kessides (1994)] there is some important industry specific features that call for controlling for market fixed effects which are absent in our specification. The need for including market effects should be supported by relevant structural characteristics. For example, in the airline industry, a market defined as a route has important structural characteristics such as market specific fixed costs. In our case we are in fact identifying the effects of important time-invariant product and market features in the industry through the inclusion of the X^2_{jik} and Z^2_k vectors respectively.

We estimate equation (11) country by country using a Within Groups panel data method, where the firms' specific heterogeneity effect ν_i are accounted for. Some of the left hand side variables are potentially endogenous, mainly because they can be directly influenced by unobserved attributes of the product in the stage game price equations. For instance, as we will see in the next sub-section, different market shares definitions are incorporated as regressors. For these reason we adopt the identifying assumption that product markets are independent across time and countries and the global price variable is used so as to control for time varying unobserved features. In addition we use the panel data structure of the data and variables that are thought to be endogenous to the disturbances are lagged one period in an attempt to further avoid inconsistent estimators.

4.1 Variables and multimarket contact definition

To sum up, the different groups of variables included in the panel data regression are as follows. Variables that varies across products and time are: the corrected Firm's size variable, in order to proxy firm's brand image that spills over all its products, a dummy variable indicating if the product was launched in the previous year to proxy for entry lag disadvantages, the corrected Hirschmand-Herfindähl index, the product's market share and other products' joint market share; a variable that varies across products but is time invariant is the dummy indicating if the product was launched before the censored date, January 1, 1991. Likewise, variables that varies across markets and time are: molecule age to proxy for inverse efficiency, the number of generic products in the market; a variable that varies across markets but is time invariant is the dummy indicating if the age of the molecule is censored in January 1, 1991. Firm's size and molecule age are included in log form in order to give more weight to differences in small vales than in large values.

Among the competition variables we include the number of generics and the Hirschmand-Herfindähl concentration index. Both variables are potentially endogenous, accordingly the former is lagged one period and the latter is corrected excluding the squared market share of the product under analysis. We also include the market shares of the product under analysis and of other drugs of the same corporation in the market, since we would expect that higher sales lead to higher prices. Again both variables could be regarded as endogenous and we lag them one period.

For the purposes of this paper, the most important independent variable is the one describing multimarket contact. Provided with this measure of multimarket contact, we consider two different specifications for $\Omega(MMC_{ikt})$. Firstly,

$$(A.1) \qquad \Omega(MMC_{ikt}) = \alpha_1 \ AVMMC_{ikt}$$

which is independent of the characteristics of the focal market. This specification can allow us to test the sign and significance of the effect that the variable measuring multimarket contact has on prices in average terms. A positive and significant sign for α_1 would be consistent with the traditional view on multimarket contact, but it could also be measuring the effects of omitted variables highly related to multimarket contact, such as the establishment size.

Secondly,

$$(A.2) \qquad \Omega(MMC_{ikt}, \theta_{kt}) = \alpha(\theta_{kt})\ AVMMC_{ikt}$$

where the assumption in (A.1) is now relaxed allowing for heterogeneity of the multimarket contact effect across markets. The effect of a specific contact in market k can be stated as a function of the ease of collusion in the market, θ_k in a way which represents the transfer of market power from one market to others. We use the variable HHI_k, to measure ease of collusion adopting the result of most dynamic oligopoly models by which the higher the market concentration the more collusive the output of the repeated game. Following a specification by Gimeno and Woo (1995) also used by Fernández and Marín (1998), we specify $\alpha(\theta(HHI_{kt}))$ as

$$\alpha(\theta(HHI_{kt})) = \alpha_1 + \alpha_2\ HHI_{kt}$$

Therefore, we can rewrite (A.2) as

$$(A.2b) \qquad \Omega(MMC_{ikt}, \theta(HHI_{kt})) = \alpha_1\ AVMMC_{ikt} + \alpha_2\ HHI_{kt}\ AVMMC_{ikt}$$

According to Bernheim and Whinston (1990), we expect to observe $\alpha_1 > 0$, which means that in markets with little capacity of collusion, i.e., low HHI_k, MMC has a positive effect on prices. This effect has to decrease as the ease of collusion, measured by HHI_k, increases, i.e., we expect $\alpha_2 < 0$. Additionally, the theory predicts that $\alpha(\theta_{kt})$ is to be equal to zero for a value of HHI_k between the minimum and the maximum values in our set of observations. Summing up, the effect of multimarket contact is expected to be greater in absolute terms if the variable measuring the ease of collusion in the focal market, HHI_k, is among either the largest or the smallest in the sample, being positive in markets with very low values for HHI_k and negative in markets with very high values for HHI_k. The analysis is invariant to the alternative definition of multimarket contacts where the variable MMC is the average of the sum of the weighted contacts of each firm in the focal market and as such is invariant within markets.

5 Preliminary results and interpretation

5.1 Results from baseline specifications

Tables 3 to 5 present the set of basic results, running a regression of Log (Price) on the set of quality and competition characteristics as well as multimarket contact variables explained above and when the market is defined as the molecule and the multimarket variables are firm specific (as defined in 6). In these and other tables the results are shown with the countries grouped from the more market friendly ones to the more heavily regulated in prices. The regressions in all cases include time trends and fixed effects at the corporation level. Accordingly, the t-statistics shown in parenthesis are computed with robust standard errors clustering the observations by corporations. Table 2 does not include multimarket contact variables. Its purpose is to show to what extent the remaining variables explain prices in the different countries and the type of consequences that the omission of relevant structural variables entails. It can be seen that variables New, $Fsize$, $Priceg$ and $Molage$ have the expected signs in all the cases, however not significant in very few of them. Firm size, $Fsize$, is highly significant, indicating that large corporations enjoy higher prices either because its products are of higher quality or perceived as such. $Molage$ has a negative impact showing that the prices fall with the life-cycle of the molecule. However, $Censormol$ which is expected also to have a negative effect appear to be with the wrong sign but with weak significance in most cases. These variables proxy molecule efficiency since new molecules are expected to improve upon previously existing molecules. New is also negative, indicating that new products launched in an existing market suffer from some late entry disadvantage.

Consistently, $Censorlag$ is positive in most cases, showing that products launched in the market before January 1991 maintain higher prices than those launched later within the same market. For three countries where regulation is more stringent, this variable appears with positive sign. The latter may be indicating that old products which are likely to belong to large corporations suffer from price regulation. In most cases however the variable is not significantly different from zero. Regarding the number of generics, the expected sign of this variable is not necessarily well defined. As explained in the introduction, the existence of generics on a market does not mean that brand name products will reduce their prices. The evidence presented by the specialized literature is mixed. In some cases, the presence of generics will have the impact of concentrating brand name products over the inelastic portion of the demand which will then increase the price of this products. Hence, the expected sign of the number of generics will be positive. On the other hand, the number of generics or generic competition, will reduce prices for everyone whenever, for instance, the quality of the existing products is not necessarily perceived to be high enough. In any case in this firs set of regressions this variable does not appear to explain much of the price variations.

The HHI concentration index, $HHI - corr$, is not significant and in some cases appear with the wrong sign. For the Market share of the product, $Mshare$, and of other corporation's products in the same market, $Cshare$, the expected signs are observed except for the particular cases of Canada, France and Spain. These variables are lagged before including them in the regressions for obvious potential endogeneity problems. Also, for the majority of less regulated countries, $Mshare$ is significant while $Cshare$ is not, and taking Japan as an exception, these variables are not significant for highly regulated countries. The unintuitive results for the signs of the variables proxying competition may be due to inconsistent estimators because of the omission of variables that are related to market power in the dynamic game. These is expected to be true for Canada where prices are expected to be highly market based while in Spain and France the inclusion of the omitted variables may not solve the question because of interactions with particular regulatory arrangements.

From these first set of results interesting preliminary conclusions can be drawn. First, it appears that most attributes and quality characteristics explains a reasonable portion of price variations which is robust across countries. This suggest that different degrees of regulation does not distorts the effects of these attributes. The only attribute that seems to have a different effect with respect to the level of regulation is *Censorlag*, although the significance of the variable is in general poor. With respect to variables controlling competition, apart from the number of generics, although not significant in many cases at least the signs appear correct for most less regulated countries, excluding Canada, while two of the four regulated countries have wrong signs.

Table 4 presents the results of the same regressions after including the average multimarket contact variable, AVMMC. All other coefficients remain fairly stable and AVMMC is positive and significant for Canada and less evident for the UK, it is not significant for the rest of the countries excluding France where it is negative and significant.

Table 5 allows for the possibility of a differentiated effect of AVMMC on prices depending on the concentration of the reference market, that proxies ease of collusion. According to the theory, in presence of multimarket contact, prices are expected to fall in markets where it is easier to reach collusive outcomes whilst they are expected to increase where it is more difficult to collude. This means that the coefficient for AVMMC, α_1, is expected to be positive and the coefficient for AVMMC*HHI , α_2,is expected to be negative, with the latter larger in absolute value than the former. The results for the less regulated countries plus France are strongly consistent with the theory except for the UK, i.e., both coefficients are significant, have the expected signs and $|\alpha_2| > \alpha_1$, for US, Canada, Germany the Netherlands and France (see figure 1). In addition, the coefficients are weakly consistent, e.g., have the expected signs but either one or both of them are not significant, for UK and Spain. Only for the case of Italy the coefficients contradict the theory in both cases and for Japan the sign of α_2 is incorrect. In addition, after controlling for these effects, the coefficients associated to $HHI - corr$, $Mshare$ and $Cshare$ appear with the correct sign with the first two groups of countries however not significant in some cases. For the heavily regulated countries still nonintuitive signs remains with the vast majority being not significant.

As shown in the previous results, the estimation of this preliminary version of the model performs well enough. It is clear that prices are determined according to market rules in more liberalised countries while they behave quite independently of economic variables in more regulated markets. The analysis needs to be extended in several dimensions: broader markets, such as anatomic therapeutical classes, that encompass several molecules, panel data techniques, instrumental variables, ... Some of this extensions will be easily implemented as soon as more data become available to the researchers.

5.2 Sensibility analysis: MMC and Market definitions

We perform two different exercises to test for the sensibility of the results. On one hand we change the definition of the multimarket variables MMC to allow only for changes of average multimarket contacts in explaining price variation. To this end we use the mutimarket variable computed as in the second definition in section 3.2. On the other hand, we broaden the definition of a relevant market and consider the four-digit grouping of the ATC classification or ATC4. Accordingly, a market is defined as the group of molecules or chemical substances that belongs to the same chemical, pharmacological and therapeutical set.

Table 6 presents the analogue to Table 5 considering the alternative definition of the MMC variable (see equation 7). No remarkable changes appear to occur either on the variables controlling for firm and market characteristics and those controlling for competitive elements not including the MMC variables. Perhaps the only change worth to notice is that of the increase of the MMC variables marginal effect both in size and significance for some countries. As shown in the summary Table A, α_1 more than double for the US, the Netherlands and the UK and also $|\alpha_2|$ increases considerably, while remaining almost unchanged for the rest of the countries where the effects of multimarket contacts are consistent with the theory.

Table A: Marginal effects of MMC variables by definition
(Robust T-statistics in parenthesis)

Def./Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
Definition 1									
$AVMMC_{ikt-1}$	0.037	0.150	0.031	0.035	0.063	0.020	-0.053	0.004	0.088
	(1.08)	(5.55)	(2.83)	(2.22)	(0.99)	(1.92)	(-0.62)	(0.09)	(0.78)
$AVMMC_{ikt-1}*$	-0.069	-0.192	-0.034	-0.040	-0.044	-0.089	0.164	0.012	-0.313
HHI_{kt-1}	(-2.00)	(-6.70)	(-4.15)	(-2.13)	(-0.43)	(-4.46)	(1.03)	(0.20)	(-1.13)
Definition 2									
$AVMMC_{kt-1}$	0.118	0.128	0.045	0.201	0.154	0.021	-0.035	-0.033	0.055
	(4.18)	(5.99)	(6.95)	(4.09)	(2.27)	(2.08)	(-0.66)	(-0.61)	(0.42)
$AVMMC_{kt-1}*$	-0.139	-0.172	-0.042	-0.223	-0.146	-0.069	0.119	0.037	-0.205
HHI_{kt-1}	(-2.59)	(-6.58)	(-4.63)	(-3.68)	(-1.52)	(-3.68)	(1.04)	(0.62)	(-0.71)

The explanation for these result seems to be purely statistical. Given the sign of effect of multimarket contacts in the market, if changing the definition reduces the variability of the $AVMMC$ regressors when averaging within markets, the size of this effect may increase in absolute value.

Tables 7 to 9 presents an entire set of results for the alternative market definition (ATC4). For this purpose the following variables have been calculated for the new market definition, $Ngenerics$, $Priceg$, $Mshare$, $Cshare$, $HHI-corr$ and $AVMMC$, the rest remain unaffected for this exercise. The results for the marginal effects of the variables controlling for attributes parallel those obtained with the narrower market definition. Focusing our attention to the more general specification (reported in Table 9), it appear to be an increase of the marginal effects of New and $Molage$ in absolute values. Other difference comparing to the base results is that the effect of $Ngenerics$ is now significant for many more countries and it is positive in the great majority of these cases (Germany, Netherlands, Japan and Spain). In general, broadening the market definition appears to affect size and significance of the hypotheses derived from the multimarket contact theory to the point of rejecting them from the data in most cases. Curiously, the results for Italy that before rejected the theory now seems to fit in it very well.

As a very preliminary conclusion, the results as it could be expected are very sensitive to changes on the side of the market definition. However, changing from a the molecule definition to the ATC4 definition may be a too difficult condition to satisfy for the theory. A more rigorous analysis should require small variation in the definition of a relevant market, perhaps including specific molecules that are closer substitutes to each other. At this point the information available does not allow us for these type of exercises nevertheless it is an important item in the future research agenda.

5.3 A first extension on the regulatory effects

In subsection 2.2 we have discussed informally the likely effects of stringent price regulations such as some forms of capping prices. The literature on the matter suggests that one effect is that of increasing instances of higher concentration, that is limiting competition in some markets [See Cabrales (2003) for a discussion and a theoretical explanation]. If this would be the case, a natural trend to higher concentrated market will be observed in the group of highly regulated countries. Furthermore, from the perspective of the multimarket contact theory, this trend should be reflected in a greater effect of re-distribution of market power from markets with suitable conditions to sustain collusive equilibria to more competitive ones. In short, we would expect higher values both for $|\alpha_1|$ and $|\alpha_2|$ in more regulated countries. From the base model results in table 5, the two cases in which the parameters of interest have the predicted sign, France and Spain, have greater figures for α_2 than the more market based countries except for Canada, however $|\alpha_1|$. A direct way to test the implications of this discussion is to pool the countries' sub-samples and conduct a joint regression analysis. This preliminary extension is done under the consideration that from Table 5 the size of the marginal effects, at least for the significant quality variables are not extremely different across countries which allow us to control for differences in the size effect of the variables of interest, in particular α_1 and α_2.

Tables 10 and 11 present the results for two sets of 6 regressions considering the two alternative definition for the MMC variables (as presented in equations 6 and 7) respectively. In addition to the usual set of regressors, whose results are shown in columns (1) to (3) of these tables, we consider interacting the following variables $Ngenerics$, $AVMMC$ and $AVMMC * HHI$ with a dummy, *Dumreg*, indicating whether the observation pertains to one of the four highly regulated countries in the sample . Likewise we included country specific dummy variables to account for idiosyncratic elements at this level. The results show again that the significant quality variables are not affected by the omission of the MMC variables. The number of generics still has no predictive power in any case while the other competition variables appear with the correct sign and statistic significance only in the full versions of the models, (3) and (6). The marginal effects for $AVMMC$

and $AVMMC * HHI$ are significant and consistent with the prediction that the latter should be greater than the former in absolute value. Furthermore, the marginal effects of the interaction of *Dumreg* with the last two variables have on one side a not significant value for $AVMMC$ and a significant and negative one for $AVMMC * HHI$. Hence, the results suggest that the multimarket contact alone does not have a differentiated effect for distinct regulatory levels, while the strategic effect of market power re-distribution has a significant and sizeable difference. In fact the marginal effect of $AVMMC * HHI$ for less regulated countries appear to be of the order of $\frac{1}{3}$ the value for a highly regulated one. Therefore our initial conjecture seems not to be in line with the data. Rather than that the results in Table (10) suggests that stringent price regulation , which we think is better understood as direct price caps, is reducing prices in the regulated markets as well as markets where there is more competition and therefore less regulation.

Table 11 show the results for the second definition of the MMC variable. In this case it is rejected a differentiated effect controlling for regulation levels for both $AVMMC$ and $AVMMC * HHI$; thus, the previous result is not robust to changes in the definition of the multimarket contact variable. However, it would be interesting for policy making a more detailed analysis of the consequences of stringent price regulations over the strategic behavior of firms which is in turn influenced by the structure of the industry. The first set of results, for instance, is a warning for the likely effects of price regulations since it implies that regulation apart from increasing concentration in some markets will also have a more strategic effect of distributing this increased market power to sustain higher prices in more competitive instances. Then, the ultimate objective of regulation which is to reduce prices and reduce the burden of medicines over health system's expenditures will not be guaranteed.

6 Concluding remarks

The theoretical literature of dynamic oligopoly models have proposed some interesting results from the situation in which firms contact with their rivals in several markets. A traditional view predicts the *Mutual Forbearance Hypothesis* by which firms may increase the set of collusive equilibria because of repeated interactions in many independent markets. Furthermore, when appropriate incentive constraints permits, multimarket contact may also promote the re-distribution of market power from markets with easier conditions for collusion to markets where colluding is more difficult. The first hypothesis has been successfully studied for several industries such as the US's industries of cement, cellular communications, airline services, banking and others while studies for Europe have been conducted for the Banking industry and the Spanish hotel industry, the latter been also approached considering the re-distribution of market power. We expand on this empirical literature by considering the effects of the multimarket structure in the pharmaceutical industry for nine countries of the OECD. The cross country nature of the data allow us to control for a very important feature of the industry which is the different degrees of regulation and in particular price controls. We perform Panel Data regressions for specifications in which we incorporate several important issues such as the relevance of quality variables in the industry, the importance of corporation fixed effects to control for quality product differentiation, and an instrumental variables argument to control for possible endogeneity of variables related to the competitive environment. The multimarket structure is also part of the specification in such a way that provides a simple relation between the contacts and the ease of collusion across markets to test both the traditional and the more strategically based hypotheses predicted by the theory. The baseline model appears to fit the hypotheses of multimarket contact reasonably well for the case of less regulated markets, while the results are unclear for the more regulated ones. This confirms that in more regulated markets there are some existing distortions that are interacting with market forces.

Nevertheless, we take one step ahead and propose a way in which regulation may be altering the effects of multimarket contacts. In particular, the informal observation in the literature of the industry that more regulated countries tend to have less competition and in some cases more concentrated markets for drugs suggest that in these cases the size of the re-distribution of market power should be expected to be higher than in more market friendly countries. Based on the observation that in general the marginal effects of the quality variables and some competition variables does not change too widely across countries in the sample we pool the countries' sub-sample and interact the multimarket variables with an indicator variable for heavily regulated markets. Although the results are not robust to the definition of the multimarket variable, they suggest that our conjecture is not supported and on the contrary, market intervention in more concentrated markets induces a reduction in prices also in more competitive -less regulated- markets. These result is of paramount importance for policy making. Since price controls and related regulatory systems barely take into account the structure of the industry and its peculiarities, our work could be of great interest to empirically predict undesirable effects of public interventions in this particular case. For instance, reducing prices in more competitive markets may discourage entry and may have a negative dynamic effect in the development of the industry. Therefore, this could be used as an alternative explanation for the observation that in highly regulated markets entry is less dynamic [c.f. Danzon and Furukawa (2003), Kyle (2005)].

Possible extensions of this analysis include specializing for specific product markets such as anti-ulcer or anti-hypertensive drugs. Focusing in cases will help to model in a more precise fashion features such as horizontal product and vertical product differentiation, precise definitions of price regulations on their strategic effects and so on. Likewise, we have also drop the idea of defining a group of countries as different markets of the same industry structure much in the way states of the US are considered. For example, contacts among firms inside the EU could also be a dimension to study.

References

Aronson, T., Bergman, M. and Rudholm, N.: 2001, The impact of generic drug competition on brand name markets shares - evidence from micro data, *Review of Industrial*

Organization **19**, 425–435.

Berndt, E., Bui, L., Reiley, D. and Urban, G.: 1995, Information, marketing and princing in the u.s. antiulcer drug market, *American Economic Review* **85**(2).

Berndt, E., Cockburn, I. and Griliches, Z.: 1996, Pharmaceutical innovations and market dynamics: Tracking effects on price indexes for antidepressant drugs, *Brookings Papers on Economic Activity: Microeconomics* pp. 133–188.

Berndt, E., Pindyck, R. and Azoulay, P.: 1999, Network effects and diffusion in pharmaceutical markets: antiulcer drugs, *NBER Working Paper Series, No. 7024* .

Bernheim, D. and Whinston, M.: 1990, Multimarket contact and collusive behavior, *Rand Journal of Economics* **21**.

Busse, M.: 2000, Multimarket contact and price coordination in the cellular telephone industry, *Journal of Economics and Management Strategy* **9**.

Cabrales, A.: 2003, Pharmaceutical generics, vertical product differentiation and public policy. Working Paper, Universitat Pompeu Fabra.

Chang, M.-H.: 1991, The effects of produc differentiation on collusive behavior, *International Journal of Industrial Organization* **9**, 453–469.

Coscelli, A.: 2000, The importance of doctors and patients preferences in the prescription decision, *The Journal of Industrial Economics* (3).

Danzon, P.: 1999, The pharmaceutical industry. MIMEO.

Danzon, P. and Chao, L.: 2000, Does regulation drive out competition in pharmaceutical markets?, *Journal of Law and Economics* **43**.

Danzon, P. and Furukawa, M.: 2003, Does regulation drive out competition in pharmaceutical markets?, *Health Affairs* .

Edwards, C.: 1955, Conglomerate bigness as a source of power, *The National Bureau of Economic Research Conference Report, Business Concentration and Price Policy*, Princeton University Press, pp. 331–359.

Evans, W. and Kessides, I.: 1994, Living by the “golden rule”: multimarket contact in the u.s. airline industry, *Quarterly Journal of Economics* **109**.

Fernández, N. and Marín, P.: 1998, Market power and multimarket contact. some evidence from the spanish hotel industry, *Journal of Industrial Economics* **46**.

Häckner, J.: 1994, Collusive pricing in markets for vertically differentiated products, *International Journal of Industrial Organization* **12**, 155–177.

Jans, I. and Rosembaum, D.: 1996, Multimarket contact and pricing: Evidence from the u.s. cement industry, *International Journal of Industrial Organization* **15**.

Karnani, A. and Wernerfelt, B.: 1985, Multiple point competition, *Strategic Management Journal* **6**.

King, C.: 2000, Marketing, product differentiation, and competition in the market for antiulcer drugs, *Harvard Business School, Working Paper* **01**.

Kyle, M.: 2005, Price controls and entry strategy, *Review of Economics and Statistics* .

Matsushima, H.: 2001, Multimarket conctact, imperfect monitoring and implicit collusion, *Journal of Economic Theory* **98**, 158–178.

Parker, P. and Roller, L.: 1997, Collusive conduct in duopolies: Multimarket contact and cross-ownership in the mobile telephone industry, *Rand Journal of Economics* **28**, 304–322.

Pilloff, S. J.: 1999, Multimarket contact in banking, *Review of Industrial Organization* **14**, 163–182.

Puig-Junoy, J.: 2005, Price regulation systems in the pharmacetical market, *in* J. Puig-Junoy (ed.), *The Public Financing of Pharmaceuticals*, Edgard Elward Publishing.

Scherer, F.: 1993, Pricing, profits and techonological progress in the pharmaceutical industry, *Journal of Economic Perspectives* **7**(3).

Scott, J. T.: 1982, Multimarket contact and economic performance, *The Review of Economic Studies* **64**(3), 368–375.

Spagnolo, G.: 1999, On interdependent games: Multimarket contact, concavity and collusion, *Journal of Economic Theory* **89**, 127–139.

Stern, S.: 1996, Market definition and the returns to innovation: Substitution patterns in pharmaceutical markets. MIMEO, MIT Sloan School.

Windmeijer, F., de Laat, E., Douven, R. and Mot, E.: 2004, Pharmaceutical promotion and gp prescription behaviour, *CPB Discussion Papers 30*, CPB Netherlands Bureau for Economic Policy Analysis. available at http://ideas.repec.org/p/cpb/discus/30.html.

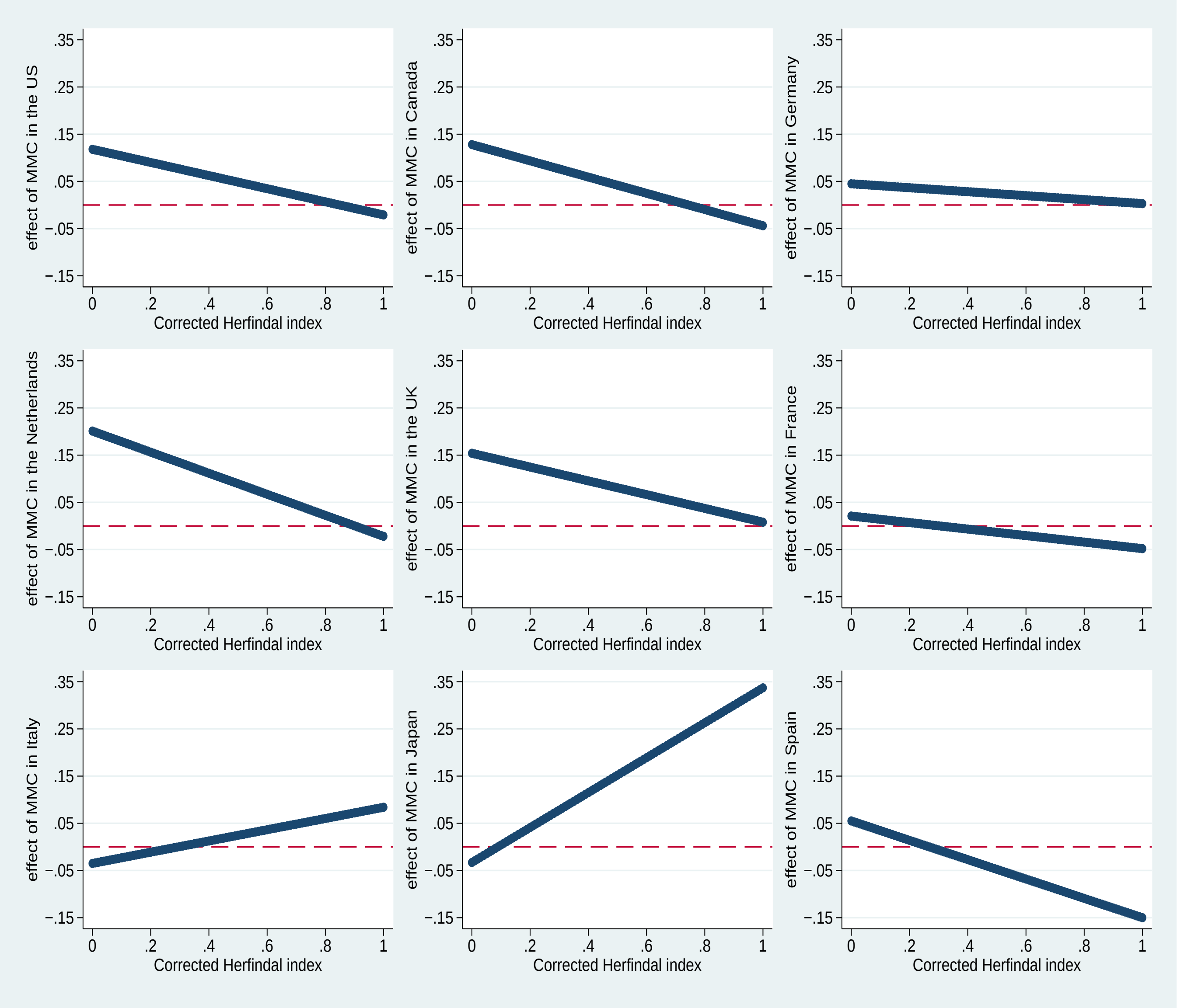

Figure 1: Effect of multimarket contact in selected markets. Market definition: molecule

Table 1: Descriptive statistics

Panel A: Summary statistics by country

		No. markets		No.	No.		molecule		ATC4	
Type	country	molec.	ATC4	corp.	products		HHI		HHI	
		(A)			(C)	A/C	mean	median	mean	median
I	Canada	867	213	160	2552		.159	.080	.23	.148
	US	1574	264	621	7170		.531	.492	.167	.093
II	Germany	1874	261	587	6985		.514	.451	.152	.082
	Nether	421	146	87	1148		.668	.764	.365	.246
	UK	618	189	147	1143		.663	.830	.377	.283
III	France	782	214	164	1929		.569	.500	.254	.191
	Italy	726	215	253	1992		.533	.499	.265	.179
	Japan	674	181	174	2401		.508	.435	.253	.163
	Spain	660	220	179	1693		.523	.496	.295	.205

Panel B: Distribution of corporations by country

Type	country	1	2-4	5-9	10-14	15-20	21+	Total
I	Canada	48	30	30	15	4	33	160
	US	232	178	91	26	22	72	621
II	Germany	208	141	94	46	32	66	587
	Nether	18	28	14	9	5	13	87
	UK	49	45	25	7	8	13	147
III	France	54	46	30	10	5	19	164
	Italy	65	81	49	30	11	17	253
	Japan	32	32	43	20	19	28	174
	Spain	43	45	36	22	15	18	179

Panel C: Distribution of molecule age by country

Type	country	1	1-2	3-4	4-7	7-10	11+	Total
I	Canada	17	107	104	247	309	83	867
	US	17	190	246	418	405	298	1,574
II	Germany	45	338	218	423	512	338	1,874
	Nether	12	64	67	132	100	46	421
	UK	17	93	104	212	130	62	618
III	France	24	94	126	294	151	93	782
	Italy	16	96	136	264	143	71	726
	Japan	8	104	123	191	171	77	674
	Spain	22	106	119	215	127	71	660

Table 2: **Summary of Statistics for Alternative MMC definitions**

Country	**MMC Def.**	**mean**	**N**	**S.D.**	**min**	**max**
Canada	$ANMCC_i$	8.211206	7152	11.49036	0	56
	$ANMCC_k$	30.67695	7152	34.63271	0	288
	$WANMMC_i$	3.321367	7152	4.564277	0	23.31293
	$WANMMC_k$	4.012449	7152	5.102903	0	40.64036
US	$ANMCC_i$	3.655273	15288	5.018546	0	44
	$ANMCC_k$	13.38363	15288	15.81597	0	156
	$WANMMC_i$	1.378756	15288	1.887686	0	21.26602
	$WANMMC_k$	1.246454	15288	1.629568	0	17.39792
Germany	$ANMCC_i$	12.33581	17088	17.17776	0	96
	$ANMCC_k$	54.63219	17088	72.55975	0	633
	$WANMMC_i$	4.371994	17088	7.550694	0	43.61862
	$WANMMC_k$	4.095285	17088	5.26308	0	60.53645
Nether	$ANMCC_i$	10.70754	2584	13.88268	0	68
	$ANMCC_k$	29.77987	2584	32.43827	0	290
	$WANMMC_i$	6.338841	2584	8.163896	0	41.52764
	$WANMMC_k$	1.800272	2584	2.071789	0	16.65326
UK	$ANMCC_i$	1.192754	3030	2.751902	0	22
	$ANMCC_k$	3.262869	3030	6.466102	0	72
	$WANMMC_i$	.7273696	3030	1.831923	0	14.53169
	$WANMMC_k$	.6189357	3030	1.604083	0	15.78605
France	$ANMCC_i$	10.45419	5779	16.03264	0	65
	$ANMCC_k$	28.51955	5779	39.76581	0	269
	$WANMMC_i$	2.902696	5779	4.333551	0	19.00611
	$WANMMC_k$	3.275765	5779	4.624059	0	51.90288
Italy	$ANMCC_i$	1.206306	5687	2.296243	0	18
	$ANMCC_k$	3.363442	5687	5.665746	0	41.33333
	$WANMMC_i$	.3093299	5687	.5683802	0	4.732255
	$WANMMC_k$	.4180106	5687	1.028211	0	13.19793
Japan	$ANMCC_i$	3.209296	5268	4.760009	0	41
	$ANMCC_k$	10.73129	5268	14.53885	0	135
	$WANMMC_i$	1.105852	5268	1.57031	0	13.41884
	$WANMMC_k$	1.051169	5268	2.366547	0	20.04237
Spain	$ANMCC_i$	1.71324	5018	2.913971	0	16
	$ANMCC_k$	4.933521	5018	7.398479	0	50
	$WANMMC_i$	.467612	5018	.747091	0	4.525763
	$WANMMC_k$	.4922954	5018	.8641015	0	7.72376

Note:

Subindex i refers to a definition that varies across corporations, while subindex k to a definition that varies across markets

Table 3: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. Without controlling for multimarket contact. Market definition: molecule (Robust Standard Errors by Corporation Clusters)

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	-0.037	-0.312	-0.185	-0.196	-0.289	-0.162	-0.190	-0.145	-0.191
	(-0.82)	(-4.76)	(-6.28)	(-2.79)	(-5.39)	(-3.52)	(-4.41)	(-3.13)	(-3.92)
Ln(Fsize)$_{t-1}$	0.218	0.281	0.202	0.110	0.199	0.167	0.155	0.299	0.151
	(14.77)	(10.53)	(14.50)	(4.41)	(9.51)	(8.37)	(6.95)	(12.18)	(6.85)
Ln(Molage)$_t$	-0.404	-0.232	-0.171	-0.101	-0.240	-0.168	-0.131	-0.080	-0.324
	(-6.01)	(-2.62)	(-5.00)	(-1.41)	(-2.38)	(-2.21)	(-2.32)	(-1.14)	(-4.46)
Censormol$_t$	-0.039	0.043	0.071	-0.073	-0.496	0.041	0.084	0.207	0.177
	(-0.52)	(0.36)	(1.32)	(-0.61)	(-2.25)	(0.30)	(0.69)	(0.88)	(1.11)
Censorlag$_t$	0.408	0.093	0.046	0.180	1.116	0.410	-0.140	-0.543	-0.116
	(1.74)	(0.21)	(0.45)	(1.47)	(3.21)	(1.97)	(-0.49)	(-1.24)	(-0.39)
ngenerics$_{t-1}$	0.001	-0.003	0.006	0.033	0.032	-0.006	-0.003	0.007	0.006
	(0.28)	(-0.95)	(3.39)	(4.34)	(1.66)	(-1.11)	(-1.26)	(1.41)	(1.38)
Ln(Priceg$_{t-1}$)	0.555	0.541	0.651	0.856	0.612	0.668	0.687	0.603	0.694
	(15.59)	(14.69)	(22.00)	(29.03)	(15.32)	(17.89)	(20.44)	(20.21)	(17.86)
Dupriceg$_{t-1}$	-1.142	-1.362	-1.440	-1.261	-1.216	-1.489	-1.087	-0.671	-0.845
	(-8.15)	(-8.76)	(-13.46)	(-1.92)	(-6.02)	(-6.83)	(-6.35)	(-3.14)	(-4.32)
HHI-corr$_{t-1}$	0.148	-0.703	-0.114	0.295	0.361	-0.219	0.296	0.134	-0.375
	(1.17)	(-2.99)	(-1.26)	(1.73)	(1.55)	(-1.58)	(2.30)	(1.01)	(-2.27)
Mshare$_{t-1}$	0.563	-0.272	0.474	0.664	0.477	0.210	0.112	0.570	-0.284
	(4.32)	(-1.06)	(4.59)	(3.95)	(2.10)	(1.55)	(0.99)	(3.49)	(-2.32)
Cshare$_{t-1}$	0.047	-0.643	0.026	0.339	0.299	-0.268	0.268	0.314	-0.288
	(0.50)	(-2.53)	(0.24)	(1.49)	(0.95)	(-1.41)	(2.19)	(1.74)	(-1.58)
cons	1.604	0.326	-0.068	-0.293	0.695	0.127	0.160	-2.258	1.796
	(2.91)	(0.41)	(-0.25)	(-0.44)	(0.78)	(0.18)	(0.33)	(-3.62)	(3.22)
N	15288	7149	17088	2584	3030	5779	5687	5268	5018
R^2	0.475	0.540	0.654	0.819	0.585	0.610	0.701	0.729	0.647
F	101.39	129.71	504.47	340.45	73.14	144.51	140.50	217.77	161.30

Table 4: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. Linear average multimarket contact control. Market definition: molecule (Robust Standard Errors by Corporation Clusters)

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	-0.044	-0.299	-0.183	-0.191	-0.298	-0.167	-0.192	-0.139	-0.194
	(-0.94)	(-4.51)	(-6.18)	(-2.69)	(-5.75)	(-3.67)	(-4.44)	(-3.02)	(-3.99)
Ln(Fsize)$_{t-1}$	0.219	0.288	0.202	0.109	0.199	0.164	0.156	0.298	0.152
	(14.87)	(10.45)	(14.48)	(4.37)	(9.50)	(8.62)	(7.00)	(12.20)	(6.81)
Ln(Molage)$_t$	-0.409	-0.175	-0.156	-0.101	-0.226	-0.197	-0.128	-0.074	-0.329
	(-6.27)	(-1.95)	(-4.57)	(-1.42)	(-2.22)	(-2.63)	(-2.29)	(-1.06)	(-4.57)
Censormol$_t$	-0.038	0.017	0.075	-0.054	-0.483	0.060	0.082	0.197	0.168
	(-0.51)	(0.15)	(1.42)	(-0.43)	(-2.20)	(0.44)	(0.69)	(0.83)	(1.05)
Censorlag$_t$	0.413	0.089	0.050	0.177	1.089	0.350	-0.142	-0.533	-0.108
	(1.75)	(0.20)	(0.49)	(1.53)	(3.16)	(1.66)	(-0.50)	(-1.21)	(-0.36)
ngenerics$_{t-1}$	0.000	-0.002	0.007	0.032	0.033	-0.008	-0.003	0.007	0.006
	(0.18)	(-0.51)	(3.74)	(4.01)	(1.65)	(-1.44)	(-1.07)	(1.41)	(1.33)
Ln(Priceg$_{t-1}$)	0.554	0.539	0.652	0.857	0.614	0.674	0.688	0.605	0.694
	(15.77)	(14.61)	(21.94)	(28.90)	(15.30)	(18.91)	(20.48)	(20.29)	(17.86)
Dupriceg$_{t-1}$	-1.132	-1.308	-1.445	-1.259	-1.216	-1.535	-1.080	-0.650	-0.838
	(-8.12)	(-8.53)	(-13.61)	(-1.91)	(-5.98)	(-7.54)	(-6.33)	(-3.11)	(-4.32)
HHI-corr$_{t-1}$	0.142	-0.572	-0.087	0.327	0.366	-0.309	0.309	0.140	-0.405
	(1.19)	(-2.54)	(-0.89)	(1.83)	(1.53)	(-2.15)	(2.45)	(1.04)	(-2.22)
Mshare$_{t-1}$	0.547	-0.083	0.521	0.671	0.521	0.091	0.131	0.583	-0.327
	(4.95)	(-0.34)	(4.87)	(3.90)	(2.10)	(0.65)	(1.11)	(3.61)	(-2.30)
Cshare$_{t-1}$	0.043	-0.511	0.025	0.426	0.299	-0.310	0.279	0.279	-0.359
	(0.47)	(-2.04)	(0.25)	(1.86)	(0.91)	(-1.74)	(2.32)	(1.51)	(-1.82)
AVMMC$_{t-1}$	-0.006	0.044	0.010	0.008	0.031	-0.019	0.030	0.010	-0.059
	(-0.30)	(2.68)	(1.39)	(1.41)	(1.70)	(-3.40)	(0.54)	(0.39)	(-0.85)
cons	1.669	-0.412	-0.253	-0.323	0.543	0.481	0.113	-2.316	1.879
	(3.21)	(-0.51)	(-0.90)	(-0.48)	(0.59)	(0.71)	(0.24)	(-3.71)	(3.41)
N	15288	7149	17088	2584	3030	5779	5687	5268	5018
R^2	0.474	0.546	0.657	0.819	0.586	0.619	0.701	0.730	0.646
F	97.17	135.80	454.58	324.08	70.86	141.26	131.79	203.82	147.48

Table 5: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. The effect of the MMC depends on concentration. Market definition: molecule (Robust Standard Errors by Corporation Clusters)

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	-0.043	-0.269	-0.185	-0.207	-0.297	-0.156	-0.193	-0.140	-0.186
	(-0.92)	(-4.41)	(-6.43)	(-2.90)	(-5.75)	(-3.32)	(-4.50)	(-2.99)	(-4.04)
Ln(Fsize)$_{t-1}$	0.220	0.297	0.204	0.114	0.199	0.165	0.156	0.298	0.151
	(15.00)	(10.85)	(14.87)	(4.61)	(9.60)	(8.67)	(7.05)	(12.18)	(6.95)
Ln(Molage)$_t$	-0.396	-0.125	-0.152	-0.097	-0.226	-0.175	-0.130	-0.076	-0.324
	(-6.04)	(-1.55)	(-4.41)	(-1.36)	(-2.22)	(-2.30)	(-2.29)	(-1.08)	(-4.51)
Censormol$_t$	-0.036	-0.085	0.087	-0.057	-0.467	0.022	0.085	0.189	0.182
	(-0.49)	(-0.71)	(1.65)	(-0.44)	(-2.01)	(0.16)	(0.71)	(0.80)	(1.15)
Censorlag$_t$	0.406	0.082	0.037	0.164	1.076	0.366	-0.143	-0.523	-0.123
	(1.73)	(0.18)	(0.37)	(1.37)	(3.09)	(1.75)	(-0.50)	(-1.20)	(-0.41)
ngenerics$_{t-1}$	0.001	0.001	0.009	0.036	0.035	-0.006	-0.003	0.007	0.006
	(0.54)	(0.34)	(4.63)	(4.38)	(1.73)	(-1.16)	(-1.10)	(1.42)	(1.16)
Ln(Priceg$_{t-1}$)	0.553	0.533	0.649	0.852	0.614	0.672	0.688	0.605	0.695
	(15.78)	(14.91)	(22.26)	(28.83)	(15.26)	(18.97)	(20.50)	(20.32)	(18.01)
Dupriceg$_{t-1}$	-1.145	-1.358	-1.458	-1.252	-1.218	-1.547	-1.076	-0.648	-0.849
	(-8.20)	(-8.98)	(-13.61)	(-1.91)	(-5.95)	(-7.58)	(-6.32)	(-3.10)	(-4.46)
HHI-corr$_{t-1}$	0.281	0.116	0.108	0.690	0.437	-0.014	0.258	0.124	-0.263
	(1.97)	(0.47)	(0.86)	(2.17)	(1.34)	(-0.08)	(1.70)	(0.66)	(-1.20)
Mshare$_{t-1}$	0.666	0.477	0.651	0.941	0.581	0.302	0.098	0.572	-0.239
	(5.35)	(1.93)	(5.98)	(3.89)	(2.03)	(1.91)	(0.73)	(3.12)	(-1.55)
Cshare$_{t-1}$	0.161	0.087	0.175	0.761	0.365	-0.048	0.234	0.266	-0.241
	(1.50)	(0.33)	(1.59)	(2.44)	(1.00)	(-0.23)	(1.70)	(1.10)	(-1.05)
AVMMC$_{t-1}$	0.037	0.150	0.031	0.035	0.063	0.020	-0.053	0.004	0.088
	(1.08)	(5.55)	(2.83)	(2.22)	(0.99)	(1.92)	(-0.62)	(0.09)	(0.78)
AVMMC$_{t-1}$*	-0.069	-0.192	-0.034	-0.040	-0.044	-0.089	0.164	0.012	-0.313
HHI-corr$_{t-1}$	(-2.00)	(-6.70)	(-4.15)	(-2.13)	(-0.43)	(-4.46)	(1.03)	(0.20)	(-1.13)
cons	1.450	-1.331	-0.415	-0.645	0.485	0.117	0.157	-2.295	1.760
	(2.76)	(-1.88)	(-1.38)	(-0.88)	(0.56)	(0.17)	(0.32)	(-3.60)	(3.15)
N	15288	7149	17088	2584	3030	5779	5687	5268	5018
R^2	0.475	0.557	0.658	0.820	0.586	0.621	0.701	0.730	0.647
F	101.14	124.56	451.58	367.29	69.16	136.81	126.93	196.39	143.67

Table 6: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. The effect of the MMC depends on concentration. MMC fixed within markets. Market definition: molecule (Robust Standard Errors by Corporation Clusters)

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	-0.038	-0.275	-0.183	-0.183	-0.296	-0.160	-0.193	-0.144	-0.198
	(-0.83)	(-4.42)	(-6.15)	(-2.71)	(-5.70)	(-3.30)	(-4.49)	(-3.12)	(-4.24)
Ln(Fsize)$_{t-1}$	0.221	0.292	0.203	0.108	0.201	0.166	0.158	0.299	0.150
	(15.18)	(11.42)	(14.83)	(4.79)	(9.58)	(8.38)	(7.16)	(12.28)	(6.97)
Ln(Molage)$_t$	-0.378	-0.130	-0.123	-0.088	-0.228	-0.169	-0.129	-0.085	-0.328
	(-5.71)	(-1.60)	(-3.44)	(-1.23)	(-2.24)	(-2.16)	(-2.31)	(-1.18)	(-4.54)
Censormol$_t$	-0.029	-0.046	0.123	-0.091	-0.444	0.022	0.087	0.214	0.175
	(-0.39)	(-0.38)	(2.35)	(-0.71)	(-1.97)	(0.16)	(0.73)	(0.91)	(1.10)
Censorlag$_t$	0.384	0.090	-0.001	0.201	1.060	0.416	-0.153	-0.543	-0.115
	(1.61)	(0.20)	(-0.01)	(1.65)	(3.14)	(2.00)	(-0.54)	(-1.24)	(-0.39)
ngenerics$_{t-1}$	0.002	-0.005	0.009	0.030	0.038	-0.005	-0.003	0.007	0.006
	(0.91)	(-1.63)	(4.57)	(5.04)	(2.00)	(-0.95)	(-1.06)	(1.39)	(1.27)
Ln(Priceg$_{t-1}$)	0.557	0.533	0.644	0.853	0.612	0.673	0.686	0.603	0.696
	(15.55)	(15.42)	(21.84)	(30.71)	(15.20)	(18.50)	(20.77)	(20.32)	(17.86)
Dupriceg$_{t-1}$	-1.127	-1.412	-1.455	-1.544	-1.168	-1.532	-1.079	-0.698	-0.847
	(-7.86)	(-9.65)	(-13.11)	(-3.47)	(-5.54)	(-7.32)	(-6.34)	(-3.33)	(-4.38)
HHI-corr$_{t-1}$	0.384	0.031	0.140	0.792	0.545	-0.034	0.274	0.089	-0.298
	(2.77)	(0.12)	(1.32)	(3.05)	(2.20)	(-0.19)	(2.00)	(0.58)	(-1.42)
Mshare$_{t-1}$	0.795	0.416	0.743	1.057	0.680	0.314	0.113	0.542	-0.264
	(5.74)	(1.49)	(6.60)	(5.08)	(2.98)	(1.92)	(0.93)	(3.20)	(-1.76)
Cshare$_{t-1}$	0.254	0.003	0.202	0.846	0.440	-0.096	0.270	0.249	-0.246
	(2.40)	(0.01)	(1.77)	(3.01)	(1.47)	(-0.43)	(2.20)	(1.29)	(-1.09)
AVMMC$_{t-1}$	0.118	0.128	0.045	0.201	0.154	0.021	-0.035	-0.033	0.055
	(4.18)	(5.99)	(6.95)	(4.09)	(2.27)	(2.08)	(-0.66)	(-0.61)	(0.42)
AVMMC$_{t-1}$* HHI-corr$_{t-1}$	-0.139	-0.172	-0.042	-0.223	-0.146	-0.069	0.119	0.037	-0.205
	(-2.59)	(-6.58)	(-4.63)	(-3.68)	(-1.52)	(-3.68)	(1.04)	(0.62)	(-0.71)
cons	1.169	-1.161	-0.711	-0.779	0.396	0.051	0.139	-2.183	1.821
	(2.15)	(-1.65)	(-2.29)	(-1.13)	(0.45)	(0.07)	(0.29)	(-3.35)	(3.24)
N	15288	7149	17088	2584	3030	5779	5687	5268	5018
R^2	0.476	0.555	0.658	0.829	0.585	0.618	0.701	0.730	0.646
F	102.98	124.37	423.96	357.33	67.17	129.02	115.54	193.11	148.72

Table 7: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. Without controlling for multimarket contact. Market definition: ATC4

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	0.006	-0.291	-0.199	-0.184	-0.202	-0.170	-0.313	-0.215	-0.284
	(0.13)	(-4.04)	(-5.18)	(-2.06)	(-3.11)	(-3.54)	(-5.45)	(-3.48)	(-4.36)
Ln(Fsize)$_{t-1}$	0.221	0.305	0.255	0.223	0.251	0.204	0.277	0.466	0.222
	(14.19)	(10.52)	(20.09)	(10.74)	(8.97)	(10.72)	(12.07)	(15.38)	(9.46)
Ln(Molage)$_t$	-0.548	-0.597	-0.510	-0.087	0.128	-0.035	-0.103	-0.153	-0.569
	(-3.66)	(-4.45)	(-5.74)	(-0.78)	(0.89)	(-0.25)	(-0.88)	(-0.99)	(-4.72)
Censormol$_t$	-0.119	0.009	-0.084	-0.052	-0.295	0.037	-0.171	0.240	0.360
	(-1.80)	(0.08)	(-1.48)	(-0.42)	(-1.28)	(0.33)	(-0.92)	(1.84)	(3.51)
Censorlag$_t$	0.306	-0.387	0.178	-0.120	0.908	0.378	-1.507	-1.390	-0.227
	(1.11)	(-0.83)	(1.40)	(-0.97)	(2.57)	(1.43)	(-3.17)	(-2.57)	(-0.49)
Ngenerics$_{t-1}$	-0.000	0.001	0.005	0.026	0.012	-0.004	-0.013	0.015	0.011
	(-0.53)	(0.45)	(6.04)	(6.78)	(1.06)	(-0.85)	(-3.97)	(3.99)	(3.50)
Ln(Priceg$_{t-1}$)	0.448	0.444	0.460	0.647	0.448	0.475	0.473	0.295	0.541
	(11.41)	(9.53)	(14.31)	(26.32)	(11.63)	(10.58)	(13.43)	(8.00)	(10.64)
Dupriceg$_{t-1}$	0.325	0.124	0.618	0.847	0.782	1.361	2.670	-0.303	0.662
	(1.93)	(0.65)	(5.13)	(2.80)	(1.51)	(1.61)	(7.29)	(-1.90)	(2.03)
HHI-corr$_{t-1}$	0.358	-0.196	0.347	0.113	0.298	0.099	-0.145	0.222	-0.507
	(2.55)	(-1.18)	(3.22)	(0.51)	(1.23)	(0.61)	(-0.60)	(1.30)	(-2.56)
Mshare$_{t-1}$	0.424	-0.100	0.467	0.591	0.467	0.520	-0.170	1.004	-0.536
	(2.52)	(-0.48)	(2.69)	(3.01)	(2.03)	(2.13)	(-0.96)	(4.28)	(-3.00)
Cshare$_{t-1}$	0.207	-0.431	-0.125	-0.099	-0.057	0.078	-0.375	-0.053	-0.489
	(1.71)	(-2.26)	(-0.76)	(-0.46)	(-0.22)	(0.37)	(-1.71)	(-0.23)	(-2.37)
cons	2.622	2.664	2.106	-0.673	-2.539	-1.611	-0.258	-3.371	3.423
	(2.07)	(2.32)	(2.81)	(-0.72)	(-1.98)	(-1.32)	(-0.26)	(-2.68)	(3.37)
N	15173	7127	16964	2579	3026	5767	5663	5249	5009
r2	0.390	0.460	0.498	0.667	0.475	0.460	0.518	0.585	0.516
F	66.19	45.02	152.07	86.20	77.71	116.91	62.32	114.52	57.17

Table 8: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. Linear average multimarket contact control. Market definition: ATC4

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	0.009	-0.290	-0.194	-0.186	-0.205	-0.171	-0.313	-0.221	-0.282
	(0.19)	(-4.03)	(-5.01)	(-2.08)	(-3.19)	(-3.66)	(-5.38)	(-3.51)	(-4.35)
Ln(Fsize)$_{t-1}$	0.222	0.312	0.255	0.224	0.252	0.203	0.277	0.466	0.222
	(14.29)	(10.71)	(20.05)	(10.80)	(8.92)	(10.65)	(12.12)	(15.40)	(9.34)
Ln(Molage)$_t$	-0.523	-0.586	-0.433	-0.088	0.153	-0.056	-0.107	-0.137	-0.566
	(-3.57)	(-4.16)	(-4.25)	(-0.78)	(1.04)	(-0.43)	(-0.89)	(-0.88)	(-4.76)
Censormol$_t$	-0.118	0.020	-0.053	-0.041	-0.289	0.034	-0.164	0.226	0.364
	(-1.78)	(0.16)	(-0.98)	(-0.32)	(-1.23)	(0.30)	(-0.88)	(1.70)	(3.51)
Censorlag$_t$	0.311	-0.397	0.160	-0.143	0.886	0.386	-1.507	-1.366	-0.228
	(1.13)	(-0.85)	(1.34)	(-1.08)	(2.51)	(1.45)	(-3.16)	(-2.49)	(-0.49)
Ngenerics$_{t-1}$	-0.000	0.002	0.006	0.026	0.014	-0.004	-0.012	0.013	0.011
	(-0.11)	(1.67)	(6.46)	(6.86)	(1.17)	(-0.96)	(-4.06)	(3.59)	(3.50)
Ln(Priceg$_{t-1}$)	0.450	0.451	0.456	0.646	0.451	0.474	0.472	0.293	0.538
	(11.41)	(9.78)	(14.25)	(26.46)	(11.53)	(10.71)	(13.49)	(8.06)	(10.82)
Dupriceg$_{t-1}$	0.328	0.158	0.609	0.846	0.794	1.369	2.668	-0.328	0.669
	(1.95)	(0.81)	(5.19)	(2.77)	(1.54)	(1.64)	(7.32)	(-2.09)	(2.06)
HHI-corr$_{t-1}$	0.364	-0.127	0.425	0.106	0.314	0.072	-0.118	0.179	-0.486
	(2.60)	(-0.77)	(4.13)	(0.49)	(1.31)	(0.43)	(-0.53)	(1.09)	(-2.39)
Mshare$_{t-1}$	0.463	0.073	0.580	0.595	0.524	0.477	-0.125	0.918	-0.503
	(2.74)	(0.37)	(3.37)	(3.01)	(2.21)	(2.28)	(-0.79)	(4.14)	(-2.75)
Cshare$_{t-1}$	0.219	-0.358	-0.060	-0.103	-0.036	0.049	-0.346	-0.098	-0.465
	(1.86)	(-1.84)	(-0.38)	(-0.48)	(-0.14)	(0.24)	(-1.70)	(-0.43)	(-2.33)
AVMMC$_{t-1}$	0.045	0.119	0.086	0.019	0.075	-0.015	0.136	-0.098	0.089
	(1.88)	(4.54)	(5.60)	(1.05)	(1.39)	(-0.70)	(1.16)	(-2.41)	(0.85)
Cons	2.320	2.232	1.252	-0.697	-2.822	-1.390	-0.276	-3.370	3.362
	(1.90)	(1.85)	(1.43)	(-0.75)	(-2.16)	(-1.23)	(-0.27)	(-2.69)	(3.40)
N	15173	7127	16964	2579	3026	5767	5663	5249	5009
r2	0.391	0.469	0.503	0.667	0.477	0.460	0.519	0.586	0.516
F	62.09	56.68	157.60	92.08	73.20	116.21	68.65	107.05	56.15

Table 9: Regression results by country. Independent variable Log (Price$_t$). Corporation fixed effects. The effect of the MMC depends on concentration. Market definition: ATC4

Variable	**US**	**CAN**	**GER**	**NETH**	**UK**	**FRA**	**ITA**	**JAP**	**SP**
New$_{t-1}$	0.010	-0.289	-0.195	-0.166	-0.207	-0.171	-0.313	-0.220	-0.282
	(0.20)	(-4.02)	(-5.01)	(-1.83)	(-3.21)	(-3.70)	(-5.34)	(-3.43)	(-4.35)
Ln(Fsize)$_{t-1}$	0.223	0.313	0.256	0.224	0.254	0.203	0.277	0.466	0.222
	(14.34)	(10.72)	(20.02)	(10.62)	(9.11)	(10.61)	(12.11)	(15.45)	(9.34)
Ln(Molage)$_t$	-0.498	-0.579	-0.435	-0.082	0.155	-0.056	-0.112	-0.134	-0.566
	(-3.54)	(-4.05)	(-4.31)	(-0.72)	(1.07)	(-0.42)	(-0.92)	(-0.87)	(-4.74)
Censormol$_t$	-0.124	0.020	-0.047	-0.049	-0.320	0.034	-0.156	0.226	0.365
	(-1.90)	(0.16)	(-0.86)	(-0.38)	(-1.35)	(0.30)	(-0.84)	(1.70)	(3.52)
Censorlag$_t$	0.310	-0.394	0.157	-0.145	0.897	0.386	-1.534	-1.368	-0.227
	(1.14)	(-0.84)	(1.31)	(-1.07)	(2.46)	(1.45)	(-3.22)	(-2.50)	(-0.49)
Ngenerics$_{t-1}$	0.000	0.002	0.006	0.026	0.012	-0.004	-0.012	0.013	0.011
	(0.25)	(1.77)	(6.45)	(6.97)	(1.09)	(-0.94)	(-4.04)	(3.63)	(3.26)
Ln(Priceg$_{t-1}$)	0.448	0.450	0.457	0.652	0.451	0.474	0.475	0.293	0.539
	(11.24)	(9.81)	(14.28)	(26.44)	(11.61)	(10.73)	(13.60)	(8.07)	(10.78)
Dupriceg$_{t-1}$	0.322	0.154	0.610	0.873	0.760	1.369	2.704	-0.330	0.663
	(1.88)	(0.79)	(5.17)	(2.92)	(1.49)	(1.64)	(7.54)	(-2.09)	(2.05)
HHI-corr$_{t-1}$	0.576	0.041	0.514	-0.258	0.081	0.078	0.131	0.222	-0.440
	(3.34)	(0.17)	(3.70)	(-0.87)	(0.31)	(0.30)	(0.57)	(0.96)	(-2.09)
Mshare$_{t-1}$	0.627	0.195	0.633	0.390	0.353	0.481	0.030	0.945	-0.474
	(3.05)	(0.78)	(3.67)	(1.70)	(1.44)	(1.98)	(0.20)	(4.06)	(-2.80)
Cshare$_{t-1}$	0.367	-0.235	-0.005	-0.378	-0.223	0.054	-0.156	-0.064	-0.431
	(2.40)	(-1.01)	(-0.03)	(-1.37)	(-0.87)	(0.22)	(-0.71)	(-0.24)	(-1.71)
AVMMC$_{t-1}$	0.116	0.155	0.104	-0.058	-0.059	-0.014	0.418	-0.082	0.140
	(1.99)	(3.92)	(4.82)	(-1.69)	(-0.78)	(-0.50)	(2.20)	(-1.12)	(1.03)
AVMMC$_{t-1}$* HHI-corr$_{t-1}$	-0.137	-0.080	-0.047	0.138	0.213	-0.002	-0.576	-0.033	-0.114
	(-1.67)	(-1.55)	(-1.36)	(2.59)	(1.90)	(-0.04)	(-2.45)	(-0.34)	(-0.36)
Cons	1.985	2.082	1.228	-0.538	-2.681	-1.397	-0.359	-3.420	3.342
	(1.72)	(1.66)	(1.40)	(-0.57)	(-2.12)	(-1.20)	(-0.35)	(-2.80)	(3.37)
N	15173	7127	16964	2579	3026	5767	5663	5249	5009
r2	0.391	0.470	0.504	0.670	0.479	0.460	0.521	0.586	0.516
F	65.60	52.56	151.46	101.45	69.44	116.64	66.44	108.50	56.35

Table 10: Regression results for the pooled sample. Independent variable Log (Price$_t$). MMC varies across firms. Corporation fixed effects. Linear average multimarket contact control. Market definition: Molecule

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln(Fsize)$_{t-1}$	0.186	0.186	0.186	0.186	0.185	0.185
	(20.12)	(20.08)	(20.13)	(20.11)	(19.82)	(19.91)
New$_{t-1}$	-0.130	-0.130	-0.129	-0.130	-0.127	-0.125
	(-5.76)	(-5.64)	(-5.61)	(-5.75)	(-5.47)	(-5.39)
Ln(Molage)$_t$	-0.224	-0.224	-0.220	-0.224	-0.230	-0.225
	(-8.07)	(-8.12)	(-8.01)	(-8.19)	(-8.80)	(-8.60)
Censormol$_t$	0.012	0.012	0.015	0.011	0.010	0.014
	(0.29)	(0.29)	(0.37)	(0.28)	(0.25)	(0.34)
Censorlag$_t$	0.175	0.176	0.162	0.176	0.181	0.168
	(2.30)	(2.30)	(2.13)	(2.31)	(2.36)	(2.19)
Ngenerics$_{t-1}$	0.000	0.000	0.001	0.000	-0.001	-0.000
	(0.15)	(0.18)	(0.60)	(0.04)	(-0.47)	(-0.03)
composite	-0.027	-0.027	-0.027	-0.027	-0.028	-0.029
	(-0.91)	(-0.91)	(-0.91)	(-0.91)	(-0.95)	(-0.96)
Ln(Priceg$_{t-1}$)	0.661	0.661	0.660	0.660	0.660	0.659
	(35.14)	(35.24)	(35.06)	(35.10)	(35.36)	(35.17)
Dupriceg$_{t-1}$	-1.223	-1.223	-1.231	-1.223	-1.220	-1.230
	(-15.75)	(-15.74)	(-15.83)	(-15.73)	(-15.62)	(-15.74)
HHI-corr$_{t-1}$	0.029	0.031	0.143	0.029	0.013	0.155
	(0.43)	(0.48)	(2.14)	(0.43)	(0.21)	(2.30)
Mshare$_{t-1}$	0.311	0.314	0.394	0.312	0.292	0.391
	(4.30)	(4.81)	(6.32)	(4.36)	(4.71)	(6.51)
Cshare$_{t-1}$	0.034	0.036	0.132	0.035	0.020	0.140
	(0.51)	(0.57)	(2.02)	(0.52)	(0.32)	(2.16)
AVMMC$_{t-1}$		0.001	0.022		0.004	0.026
		(0.19)	(2.84)		(0.84)	(3.27)
AVMMC$_{t-1}$*HHI-corr$_{t-1}$			-0.038			-0.039
			(-4.46)			(-4.28)
Dreg$_t$*Ngenerics$_t$				0.001	0.002	0.003
				(0.21)	(0.78)	(0.88)
Dreg$_t$*AVMMC$_{t-1}$					-0.026	-0.005
					(-1.86)	(-0.34)
Dreg$_t$*AVMMC$_{t-1}$*HHI-corr$_{t-1}$						-0.068
						(-3.73)
cons	0.444	0.437	0.335	0.441	0.502	0.372
	(1.92)	(1.93)	(1.48)	(1.95)	(2.39)	(1.75)
N	66891	66891	66891	66891	66891	66891
R^2	0.607	0.607	0.607	0.607	0.607	0.608
F	566.29	534.83	563.53	570.90	522.15	507.85

Table 11: Regression results for the pooled sample. Independent variable Log (Price$_t$). Corporation fixed effects. Linear average multimarket contact control. Market definition: Molecule. Country Dummies included (not shown)

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Ln(Fsize)$_{t-1}$	0.186	0.185	0.186	0.186	0.185	0.186
	(20.12)	(20.02)	(20.14)	(20.11)	(19.72)	(19.96)
New$_{t-1}$	-0.130	-0.127	-0.126	-0.130	-0.126	-0.125
	(-5.76)	(-5.51)	(-5.47)	(-5.75)	(-5.41)	(-5.38)
Ln(Molage)$_t$	-0.224	-0.218	-0.210	-0.224	-0.223	-0.213
	(-8.07)	(-7.81)	(-7.43)	(-8.19)	(-8.26)	(-7.90)
Censormol$_t$	0.012	0.018	0.026	0.011	0.019	0.026
	(0.29)	(0.45)	(0.62)	(0.28)	(0.47)	(0.63)
Censorlag$_t$	0.175	0.170	0.158	0.176	0.173	0.161
	(2.30)	(2.24)	(2.09)	(2.31)	(2.26)	(2.12)
Ngenerics$_{t-1}$	0.000	0.000	0.001	0.000	-0.001	-0.001
	(0.15)	(0.23)	(0.57)	(0.04)	(-0.51)	(-0.40)
composite	-0.027	-0.026	-0.026	-0.027	-0.028	-0.028
	(-0.91)	(-0.87)	(-0.87)	(-0.91)	(-0.93)	(-0.93)
Ln(Priceg$_{t-1}$)	0.661	0.661	0.661	0.660	0.660	0.659
	(35.14)	(35.05)	(34.96)	(35.10)	(35.08)	(34.96)
Dupriceg$_{t-1}$	-1.223	-1.223	-1.233	-1.223	-1.220	-1.231
	(-15.75)	(-15.71)	(-15.85)	(-15.73)	(-15.57)	(-15.71)
HHI-corr$_{t-1}$	0.029	0.044	0.171	0.029	0.034	0.167
	(0.43)	(0.67)	(2.59)	(0.43)	(0.51)	(2.59)
Mshare$_{t-1}$	0.311	0.341	0.436	0.312	0.328	0.429
	(4.30)	(4.89)	(6.58)	(4.36)	(4.86)	(6.81)
Cshare$_{t-1}$	0.034	0.052	0.161	0.035	0.042	0.157
	(0.51)	(0.79)	(2.45)	(0.52)	(0.65)	(2.47)
AVMMC$_{t-1}$		0.010	0.036		0.014	0.043
		(2.86)	(4.65)		(3.90)	(5.12)
AVMMC$_{t-1}$*HHI-corr$_{t-1}$			-0.049			-0.053
			(-4.37)			(-4.17)
Dreg$_t$*Ngenerics$_t$				0.001	0.003	0.005
				(0.21)	(1.08)	(1.50)
Dreg$_t$*AVMMC$_{t-1}$					-0.025	-0.028
					(-2.65)	(-1.65)
Dreg$_t$*AVMMC$_{t-1}$*HHI-corr$_{t-1}$						0.005
						(0.18)
cons	0.444	0.364	0.212	0.441	0.409	0.246
	(1.92)	(1.58)	(0.90)	(1.95)	(1.86)	(1.10)
N	66891	66891	66891	66891	66891	66891
R^2	0.607	0.607	0.608	0.607	0.607	0.608
F	566.29	544.15	536.52	570.90	530.04	486.39