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By Fatih Cemil Ozbugday

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**Exploring National Concerted Practices in an Open Small
Economy: What Does the Change in the Competition Law
in the Netherlands Reveal?**

Fatih Cemil Ozbugday

The CentER Graduate School & Tilburg Law and Economics Center (TILEC), Tilburg University,
Tilburg, the Netherlands.

Address: Room K 421, PO Box 90153, 5000 LE Tilburg

e-mail: F.C.Ozbugday@uvt.nl

Fax: + 31 13 466 3042

Telephone: +31 13 466 4037

Abstract

The present study examines the impact of several industry characteristics on the propensity to collude using a dataset on the existence of collusion across Dutch industries during the late 1990s and early 2000s. The results of the Probit model with sample selection indicate that our sample of Dutch concerted practices is non-random in the sense that it only consists of anti-competitive agreements that were subject of an antitrust immunity behavior. Our bivariate probit model with sample selection indicates that concerted practices are less likely to be seen in service industries relative to manufacturing industries. The results also show that it is more likely that firms engaged in concerted practices in unconcentrated industries. Furthermore, we could not find a non-linear relationship between concentration and the presence of collusion. There is also strong evidence from all the regressions that concerted practices are less likely in industries where entry is more possible. Interestingly, our estimation results indicate that there is a positive correlation between cartel prevalence and import penetration, which implies that import competition did not discipline firm behavior and foreign importers joined the cartel paradise in the Netherlands. As to the role of measures of asymmetry on concerted practice prevalence, the association between patenting activity and propensity to engage in collusion is ambiguous in the current setting, while advertising intensity, as the second measure of asymmetry, is associated with increased likelihood of collusion. Contrary to the previous empirical findings, market growth has been found to have a negative effect on the probability of a concerted practice in an industry. Furthermore, our proposition that growing demand might attract new entrants, which, in turn, hampers collusion, has been falsified in the current context.

Key Words: Cartels, Competition law, Overt collusion, Probit model with sample selection, the Netherlands

1. Introduction

Even though the benefits of unfettered competition have been well-documented and well-understood in economic theory, markets in daily life have been characterized by many forms of multilateral anti-competitive behaviors known as cartel formation or collusion. For instance, a study by Clarke and Evenett (2003) reports that during the 1990s, the European Commission and the United States Department of Justice between them prosecuted over 40 cross-border cartels that involved private firms. If one takes the within-border cartel cases and undetected cartels into account, the number is enormous.

More importantly than the number of cartel cases, the damage they give to the economy has made economists and policymakers worry about the phenomenon of collusion. A recent study by Connor (2004) reveals that the median increase in price resulting from collusion was about 25 %, which shows how effective these collective agreements among firms are. Similarly, Griffin (1989) finds that cartels in his sample charged a 45 % markup over marginal costs on average.

Given the enormity of cases, and the welfare transfers they have caused, the detection of cartels- which is a longstanding antitrust problem- is highly essential. In this respect, it is important for regulatory bodies to develop structural screens to forecast where and under which conditions cartels are more likely to be formed, which will help them allocate investigative resources where they would be most constructive. According to Harrington (2008), this *screening* process is the first stage of a multi-stage process of the detection of cartels, which is followed by *verification* and *prosecution*. Basically, the role of *screening* is to identify candidates that are worthy of closer scrutiny for *verification* process, which requires extensive analysis to distinguish competition and collusion.

Even though in most antitrust cases, detection process is initiated by complaints from competitors and/or buyers, and leniency programs; structural screens that combine economic theory with data can also serve as a *screening* function¹. Indeed, a considerable interest in the theory of collusion is reflected in the literature over the past few decades, which may serve as a guideline for developing screens. Yet, in spite of the vast theoretical literature on the factors facilitating or hampering collusion, empirical studies examining industry characteristics that affect the likelihood of observing a collusive practice using direct evidence are sparse.

When developing such structural screens in which industry characteristics bearing on the likelihood of collusion are assessed, the endogeneity of market structure and non-random sample problems should be taken into account. This study is the first empirical study on industry characteristics bearing on the likelihood of collusion which considers both endogeneity and sample selection problems. Since there is not a formal econometric procedure to handle both endogeneity and sample selection issues simultaneously, we have considered using lagged values of explanatory variables to alleviate the endogeneity problem, short of using instrumental variables. Having reviewed the empirical literature on industry characteristics bearing on the likelihood of collusion, in order to develop a variant of the structural screens mentioned above, the current study examines the impact of several industry characteristics on the propensity to collude using a dataset on the existence of collusion across Dutch industries during the late 1990s and early 2000s. The final sample employed for the econometric analysis of the presence of collusion in this paper contains 112 industries. The econometric results, *inter alia*, suggest that our sample of Dutch concerted practices is

¹ The difference between screening and verification is that screening identifies suspicious practice, but does not provide final evidence of collusion.

non-random in the sense that it only consists of anti-competitive agreements that were subject of an antitrust immunity seeking behavior. Our bivariate probit model with sample selection indicates that concerted practices are less likely to be seen in service industries relative to manufacturing industries. The results also show that it is more likely that firms engaged in concerted practices in unconcentrated industries, everything else being equal. The relevant explanation for this counter-intuitive finding is that cartels prevailed in unconcentrated industries thanks to the trade associations that brought all those firms together to involve in restrictive practices. Furthermore, we could not find a non-linear relationship between concentration and the presence of collusion.

There is also strong evidence from all the regressions that concerted practices are less likely in industries where entry is more possible. Interestingly, our estimation results indicate that there is a positive correlation between cartel prevalence and import penetration, which implies that import competition did not discipline firm behavior and foreign importers joined the cartel paradise in the Netherlands. As to the role of measures of asymmetry on concerted practice prevalence, the association between patenting activity and propensity to engage in collusion is ambiguous in the current setting, while advertising intensity, as the second measure of asymmetry, is associated with increased likelihood of collusion. This second counter-intuitive finding of the analysis can be explained by the fact that advertisement costs can also serve as entry barriers which increase the likelihood of collusion.

Contrary to the previous empirical findings, market growth has been found to have a negative effect on the probability of a concerted practice in an industry. Seemingly, the theoretical prediction that collusion is easier to sustain under higher rates of growth has been offset by other mechanisms that we cannot observe in the current setting. A possible explanation might be that higher demand uncertainties that are arising from fast growth might dominate the effect of growth

itself. Furthermore, our proposition that growing demand might attract new entrants, which, in turn, hampers collusion, has been falsified in the current context.

The remainder of the paper is as follows: Section 2 presents a review of prior empirical research on factors that facilitate or hinder collusion. Section 3 explains the institutional background and gives the details of data employed in this study. Section 4 introduces the econometric model and Section 5 presents the results. Finally Section 6 concludes.

2. A Review of Prior Empirical Research

Throughout the economic literature there have been various empirical studies examining the functioning of cartels. These empirical studies mostly rely on the details published by antitrust authorities on uncovered illegal cartels and the records of legal cartels survived in the past. For instance, Porter (1983) examines price wars in a railroad cartel in the late 1800s in the U.S. Genesove and Mullin (1998) study the American Sugar Industry cartel during the late 1800s and early 1900s. Recently, Röller and Steen (2006) have analyzed the Norwegian legal cement cartel for the period 1955-1968 to study the effectiveness of the cartel. However, for a more comprehensive overview of the workings of cartel, the reader might refer to Harrington (2006), in which details about cartels from about 20 European Commission decisions over 1999-2004 are examined, and to Levenstein and Suslow (2006), who study 19 case studies of various individual cartels

Apart from the studies focusing on the workings of cartels, another strand of the literature has focused on the factors having an impact on cartel stability on an aggregate level. This strand of the literature has mainly centered on characteristics influencing cartel duration and cartel formation, which are the most common measures of cartel effectiveness, since they are the

most easily gauged. As Levenstein and Suslow (2006) put, we would, ideally, like to compare the prices and profits that prevailed with what would have occurred absent the cartel. Nevertheless, this type of counterfactual analysis is barely undertaken in the literature. Instead, empirical cartel studies have revolved around factors impacting the stability of cartels using the information demonstrated in court decrees.

Theoretical foundations of the above-mentioned factors are firmly established in theories of collusion. The term “collusion” is basically understood as a cooperative agreement that is self-enforcing by nature as these agreements cannot be legally contracted most of the time. Thence, thanks to the self-enforcing nature of collusion, repeated interactions (over time and across markets) among firms provide the necessary incentives for colluding. Accordingly, theoretical scholars have invoked to the theory of repeated games to model the stability of collusion.

To illustrate this repeated game setting mathematically, let us consider the following condition necessary for a collusion to be sustained:

$$\sum_{t=0}^T \delta^t \frac{\Pi^J}{n} > \Pi^M$$

[1]

That is:

$$\sum_{t=0}^T \delta^t \frac{\Pi^J}{n} - \Pi^M > 0$$

where Π^J is the one-period profit jointly maximized, Π^M is the one-period monopoly profit, n is the number of firms in the industry, and δ is the discount rate (Tirole, 1988, p. 247-48). This condition ensures that the threshold discounted expected future profits net of one-period monopoly profit resulting from cheating must be positive so that collusion is sustainable.

As can be seen from the necessary condition stated in equations (1) and (2), to determine whether collusion is sustainable, the discount factor δ is of crucial importance. It actually shows how patient firms are. For instance, for impatient firms with a lower discount factor; that is, for firms putting a higher weight on current profits relative to expected future profits, it is harder to sustain collusion. Conversely, it is easier to sustain collusion for patient firms with a higher discount factor; that is, for firms putting a lower weight on current profits relative to expected future profits. However, all in all, the overall sustainability of collusion hinges on the critical threshold for the discount factor notwithstanding very high or very low discount factors firms have. Stated more precisely, the discount factors firms participating in a collusive agreement have must exceed the critical threshold for the discount factor in order for collusion to be maintained. Consequently, the lower this threshold is, the easier a collusion to be kept up.

As expressed by Ivaldi et al. (2003), the determination of this critical threshold provides a background for evaluating the extent for collusion. Stated more explicitly, in order to gauge the effect of the industry characteristics on the likelihood of collusion, we can eyeball how these industry characteristics would have an influence on this critical threshold. While a

collusion-hindering factor will raise this critical threshold, a facilitating factor will decrease it.

I review below the main characteristics associated with the (in)stability of collusion, chiefly by examining how these factors influence the above-mentioned threshold. In doing so, I refer to the empirical studies analyzing these factors. For theoretical studies, one can refer to the comprehensive review by Feuerstein (2005).

2.1. Factors Impacting Collusion

I draw on the classification made by Ivaldi et al. (2003) in identifying the relevant factors affecting the sustainability of collusion. First, there are some *structural variables* that are associated with the extent and characteristics of competition such as entry barriers, market transparency, and the number of competitors etc. Second, there are factors from the *demand side* that are associated with the evolution of demand in the market: how volatile is the market demand? Does the market have future growth prospects? Are there considerable business cycles in the market? Third, there are characteristics associated with the *supply side*, which are mostly related to the degree of asymmetry among firms in the market: Is there radical innovation in production technologies? Do firms have symmetric structures? To what extent does the product differentiation take place?

Based on the classification described in the previous paragraph, this section reviews the impact of various industry features that have been identified by previous empirical literature to have impact on the stability of collusion.

2.1.1. Structural Variables

The concept of market structure is central to industrial organization literature. It essentially stands on the factors that are believed to have an impact on the extent and characteristics of competition. Hence, these factors, which can also be entitled as structural variables, by nature, are the factors affecting the sustainability of collusion. Among these structural variables, the number of competitors, entry barriers, market transparency, and the degree of firms' interaction are the most noteworthy ones.

In what follows, I review the structural variables that the literature has singled out as being pertinent when evaluating the sustainability of collusion within a market. Nonetheless, one should bear in mind that these variables are neither necessary nor sufficient for a collusion to be maintained, but solely influence the likelihood that collusion is sustained. A final caveat is that these structural variables might be endogenous. That is, these characteristics may be the outcome of a collusive act by firms in the industry rather than being factors ex-ante affecting the likelihood of collusion.

2.1.1.1. Number of Firms

The number of competitors in the market is a crucial factor in determining the likelihood of collusion. Correspondingly, the concentration measures of the industry such as Hirschman-Herfindahl Index (HHI) are also important determinants of collusion. In general, a small number of firms in the industry, which corresponds to a high-level of concentration, is associated with a high probability of collusion. The main reason is that coordination is more difficult, the larger the number of participants involved. Accordingly, a large number of parties make deviations from the collusive contract harder to track. Furthermore, the larger the number of firms involved, the lower a share they get from the jointly-maximized profits,

which makes deviations from collusive agreements more attractive and punishments to these deviations by other competitors less costly.

Beyond what has been said, the participants can have different views about the optimal price, since their cost structures vary and/or their views about demand conditions might diverge. Consequently, as Hey and Kelley (1974) puts, the smaller the number of competitors, the less likely it is that these differences will appear.

Empirical evidence concerning the impact of the number of firms in the industry or the concentration on the likelihood of collusion conforms to the theoretical predictions with few exceptions. Hay and Kelley (1974) examined the violations prosecuted by the Antitrust Division and found that these cases appear to be in concentrated markets. Asch and Seneca (1975) analyzed a sample of 101 large manufacturing corporations- of which 51 are colluders and of which 50 are randomly selected non-colluders- for the period 1958-1967 in U.S. They concluded that firms in highly concentrated industries characterized by low entry barriers are more collusion prone. Likewise, Fraas and Greer (1977) analyzed the formal legal actions of the Antitrust Division of the U.S. Department of Justice against illegal (explicit) price fixing arrangements. Using non-parametric statistical techniques, they revealed that relatively small number of competitors is favorable to the presence of collusion. Grout and Sonderegger (2005) investigated cartel evidence using European Commission cases from 1990 to 2005 and the U.S. Department of Justice horizontal price fixing cases from 1994 to 2005, and found that concentration in the form of market share of the largest three firms is positively linked to cartel formation.

Contrary to the findings above, Asch and Seneca (1976) and Dick (1996) reported that industry concentration is negatively related to incidence of collusion. More specifically, Dick (1996) studied legal and privately enforced industry cartels that formed under the Webb-Pomerene Export Trade Act, and found that cartels are more apt to form in industries that had many small firms. However, it should be borne in mind that these so-called Webb-Pomerene cartels had been formed to enable groups of small manufacturers to economize on marketing costs by coordinating their export marketing activities. An efficiency-driven argument might also be at work in a case like this. That is, by colluding and raising prices, less efficient firms might be able to survive, resulting in a decline in concentration. As to the study by Asch and Seneca (1976), they examined the role of collusion in the profitability of American manufacturing corporations that were found guilty of cartel formation during the period 1958-1967. A possible shortcoming of their study- and in this regard of some studies mentioned above- is that the data originate from antitrust cases and might therefore be subject to selection bias. Alternatively, their study might be suffering from omitted variable bias as cartels might be prevalent in unconcentrated industries thanks to the coordinating role played by trade associations. More importantly, these studies do not address the endogeneity problem either. That is, the papers do not take into account the fact that the concentration ratio or the number of firms itself might be endogenous, as they are a function of the competitive regime.

Symeonidis's (2003) study was the first attempt to address this endogeneity problem by running a two-stage Probit model in which the concentration ratios have been replaced by the fitted values. His sample includes 151 industries, of which 71 are categorized as "collusive" (legal cartels registered under Britain's 1956 Restrictive Trade Practices Act) and of which 80 are classified as "competitive" that are chosen randomly. His main finding is that the

likelihood of collusion escalates with concentration but decreases with concentration squared. Therefore, this concentration (number of firms)-likelihood of collusion puzzle is said to be explained best by Symeonidis's (2003) finding of a concave relationship between cartel presence and concentration, since he takes into both selection and endogeneity issues.

2.1.1.2. Exclusionary Practices

Another important factor to have an impact on incidence of collusion is exclusionary practices such as entry barriers. Ivaldi et al. (2003) argue that collusion is hard to maintain if barriers to entry are low. Typically, any attempt to set prices above the competitive level to jointly maximize the profits would attract the potential competitors and thereby trigger entry absent entry barriers, which annihilates the profitability of collusion. Moreover, the possibility of future entry is associated with toning down the scope for retaliation, as it decreases the potential cost of deviation in terms of relinquished future profits.

Cartels are well aware of the fact that entry will attenuate their attempts to raise profits. Dick's (1996) study of Webb-Pomerene cartels revealed that these cartels were inclined to appear in industries characterized by high barriers to entry reflected in large amounts of fixed capital requirements. Likewise, Symeonidis (2003) reported a positive impact of capital intensity, which was interpreted as a proxy for barrier to entry, on the likelihood of collusion. Finally, Grout and Sonderegger (2005) unfolded that traditional entry barriers proxied as gross capital expenditure per firm, the level of stocks per firm, and the level of R&D per firm have marginal effects on cartel formation. They ascribe this lack of strong entry barrier evidence to the fact that their data are based on cartels that have been discovered and successfully prosecuted, and hence the data might not include the cases in which cartel members avoided raising entry barriers for the fear of being discovered and prosecuted.

Nonetheless; as stated by Levenstein and Suslow (2006), one should note that the most successful cartels do not basically take barriers to entry as exogenous; they vigorously try to create them. Therefore, the endogeneity of barriers to entry should be considered when modeling their impact on the likelihood of collusion.

2.1.1.3. Interaction Frequency among Firms

The conventional wisdom about the impact of frequency of interaction among firms on the likelihood of collusion puts that the more frequently firms interact, the more easily collusion will be expedited, as firms can react more swiftly to a deviation by any of them. That is, by reducing the reaction time to deviations from the collusive agreement, increased interaction frequency among firms facilitate collusion. Should the flock of time that must pass by before any deviation could be punished be long, the payoffs from deviation can be enjoyed longer, which makes deviation more tempting. Besides, a longer reaction time shifts possible retaliations further in the future, which makes punishment less daunting, since firms discount the future.

Empirically, it is almost impossible to keep track of interactions among cartel members. Nevertheless, interaction frequencies among firms can most officially and at best be proxied by a variety of regimental and disciplinary arrangements such as trade associations, single sales agencies etc. For example, by engaging in the collection and dissemination of information, industry associations often create an environment where firms are able to interact easily and frequently, which may abet collusion. However, empirical studies examining the effect of these on cartel formation have been scarce throughout the literature. For instance, Hey and Kelley (1974) documented that trade associations are positively

associated with incidence of collusion. Unequivocally, these arrangements can also be seen as devices to monitor behaviors of each cartel participants. However, in most general terms, this type of arrangements can be employed to proxy interaction frequencies.

Another marginal way to gauge the frequency of interaction among firms is to check how spatially they are encountered. By increasing the frequency of interaction between the firms, multi-market contact can promote collusion. Besides, Ivaldi et al. (2003) point out that by alleviating asymmetries that appear in individual markets, multi-market contact might enable firms to maintain collusion in markets where the industry characteristics alone would not allow such collusion. For instance, one firm might possess a competitive advantage in one market and its competitor might have its own competitive advantage in another market. Then, multi-market contact leads to an overall symmetry that expedites collusion even though a market-level approach might imply that collusion is hard to maintain. Unfortunately, empirical papers studying the impact of multi-market contact on collusion has been sparse, too. Being the only empirical work examining this relationship, Hey and Kelley (1974) reported that industries that are determined to be colluding in one local market are repeatedly to be found colluding in other local markets.

2.1.1.4. A History of Cartel Activity

Whether an industry has had a history of cartelization might be a relevant factor in assessing the likelihood of collusion. As stated by Dick (1996), should particular industries be structurally leaned towards cartelization, their past behavior should be a tenable predictor of their current and future behavior. Some earlier empirical research provides evidence for this proposition. Hey and Kelley (1974) concluded that industries colluding at one point in time often can be found to be colluding at later points in time. The upholding evidence by Suslow

(1988) and Marquez (1994) revealed that between 36 % and 64 % of international commodity cartels made multiple attempts at fixing price. On the other hand, Dick (1996) found only 19 out of the 125 so-called Webb-Pomerene cartels made repeated attempts to form a cartel agreement. The overall conclusion of the study was that cartel formation was consistently unrelated to the industry's cartel history. A relevant explanation for this finding is that most of the collapses in cartel agreements arose from enforcement problems that could not be resolved. Alternatively, cartels might have been abrogated forever just after they achieved their initial goals. In such cases, cartels are less likely to be formed in industries characterized by a history of cartelization.

Contrarily, a history of cartel activity in a certain industry might indicate the presence of a "culture of collusion" among firms in that industry, which promotes coordination. More interestingly, any prior attempt to form a cartel might help firms "learn" identifying a collusive equilibrium and coordinate on it. As stated more explicitly by Levenstein and Suslow (2006), what cartels can learn is how to monitor output and prices of individual cartel participants to detect cheating, how to configure incentives so that collusion is more preferable to cheating in the long run, how to impose punishments in response to cheating, and, how to design exclusionary practices to deter entry by nonparticipants.

In sum, there is not a clear-cut answer to the question of whether an industry has had a history of cartelization has a positive or negative impact on the likelihood of collusion.

2.1.2. Demand Side Variables

By and large, demand side variables are considered as factors associated with the evolution of demand in the market. Is the market demand growing, stagnating, or declining? Are there

substantial fluctuations in the market demand? By changing the level of expected future profits, and thereby the patience firms have, these variables can have influence on collusion formation either in a positive or negative way. Finally, the structure of the demanders in the market can also have an impact on the likelihood of collusion by changing the level of cartel enforcement costs. In what follows, I recapitulate the demand side variables associated with the likelihood of collusion.

2.1.2.1. Demand Growth

It is widely acknowledged that collusion is easier to maintain when short-term gains from cheating are relatively little in comparison to the cost of future retaliation. Naturally, this suggests that collusion is easier to sustain in growing markets in which discounted future profits to be enjoyed are larger relative to today's profits. Contrariwise, collusion is more difficult to sustain in markets characterized by declining demand, which implies that future profits are smaller compared to today's notwithstanding retaliation. However, this type of reasoning is invalid in the absence of a fixed number of market players. Stated more literally, growing demand might attract new entrants, which hampers collusion as explained in the subsection of "Exclusionary Practices" above. Ivaldi et al. (2003) argue that it is convenient to disengage the intrinsic impact of demand growth from the impact of entry and other factors, in order to evaluate the contribution of market demand growth to likelihood of collusion. In markets where entry barriers are low, demand growth invites entry, and the ultimate effect will be that it will thwart collusion. Oppositely, in markets characterized by high entry barriers, demand growth might facilitate collusion. Alternatively, a high level of demand growth might also be germane to higher demand uncertainty and, therefore, destabilize collusion, which will be discussed in the next sub-section.

The corollary evidence on the impact of demand growth on cartel formation is that growth has a positive impact on the likelihood of collusion. Dick (1996) reported that doubling the rate of demand growth raised cartel formation probability by 1 %. Along similar lines, Grout and Sonderegger (2005) found that growth in demand has an extremely robust positive effect on cartel formation. However, the conundrum is perhaps best explained by Symeonidis (2003). His results provided evidence of an inverted-U relationship between demand growth and the likelihood of collusion². He concluded that while a moderate growth rate is more favorable for stable collusion than a stagnant or declining demand, fast growth hampers collusion. All in all, each of the mechanisms described in the previous paragraph would lead to a non-monotonic relationship between demand growth and incidence of collusion. That is, the impact of demand growth on collusion will be positive for some positive values below a certain level while it will be negative for high levels of demand growth.

2.1.2.2. Business Cycles and Demand Fluctuations

As formally captured by Rotemberg and Saloner (1986) and Haltiwanger and Harrington (1991), and extended further by Bagwell and Staiger (1997), collusion is less sustainable in markets characterized by demand fluctuations. The underlying argument is that when the market is at a peak, short-term gains from cheating are greatest while the cost of retaliation is minimal. Consequently, collusion is more difficult to sustain during those times.

The empirical evidence on the above-mentioned corollary of the impact of demand fluctuations on collusion is mixed though. Gallet and Schroeter (1995) studied the U.S. rayon industry during the 1930s and tested the effects of demand volatility and expected future industry profits on collusion. They found that the degree of coordination fell when demand

² The coefficients of growth and growth-squared are positive and negative, respectively.

was high and when the expectation of future profits was lower. Likewise, Gallet (1997) studied the effects of market demand and import supply on the degree of oligopoly coordination in the U.S. steel industry since 1950. His results showed that coordination was weakest during periods of high market demand meaning that collusion among U.S. steel producers was countercyclical. On the other hand, Dick (1996) reported that cartel formation was unrelated to business cycle timing.

2.1.2.3. Buyer Concentration

It should be clear that powerful buyers make collusion harder to sustain owing to the fact that buyers might take advantage of price wars between cartel members. In an attempt to do so, buyers will use their power strategically, so as to vitiate any collusive agreement that might prevail among suppliers in the market. What is more, from cartel participants' perspective, cartel enforcement costs will be much higher when buyers are numerous and spread geographically. Nonetheless, the empirical evidence regarding the impact of buyer concentration on cartel formation is both scarce and unconvincing. Being the only empirical work examining this relationship, Dick (1996) found that cartel formation was unrelated to concentration among buyers.

2.1.3. Supply Side Variables

Among factors facilitating collusion, supply side variables loom large. These characteristics are mostly related to the extent of asymmetry among firms in the market. Do firms have similar cost structures and production facilities? Do firms supply similar products, or is there considerable product differentiation? What is the level of innovation and technology in the market? By altering the discount factors, δ , firms have, which is a gauge of the asymmetry among firms, the answers to these questions will clearly have an impact on the likelihood of

collusion. For instance, by investing in a superior technology, a firm might be able to reduce its costs, and thereby sell its products at a lower price, which may destroy the incentives for that firm to collude.

I review below the supply side variables of which impact on the likelihood of collusion have been studied throughout the empirical literature.

2.1.3.1. Cost Asymmetries and Quality Differences

Collusion is more difficult to sustain under cost asymmetries and quality differences of the products sold by different firms, as low cost and/or high quality firms are more difficult to discipline in this asymmetric setting. The reason comes from the fact that there is less room for the rival high-cost and/or low quality firms to trigger a price war. Among the factors affecting cost asymmetries and (perceived) quality differences, innovation and vertical differentiation are the most predominant ones.

2.1.3.2. Innovativeness

Innovativeness of an industry is expected to be of crucial importance in determining the likelihood of collusion in a market, since innovation fosters asymmetries in costs and/or qualities. As a result, collusion is less likely to be expected to occur in innovative markets. The empirical evidence accurately predicts this relationship despite being not strong.

Symeonidis (1999) studied U.K. manufacturing industries in the mid 1950s and found that there is a negative link between collusive pricing and R&D intensity, which is considered to be a proxy for innovativeness, even though the relationship is not very strong. Similarly, in his subsequent study of legal cartels registered under Britain's 1956 Restrictive Trade

Practices Act, Symeonidis (2003) found that there is a weak link between R&D intensity and collusion. Overall, the empirical evidence is in line with theoretical predictions in spite of being weak.

2.1.3.3. Vertical Differentiation

As previously mentioned, collusion is more difficult to sustain under (perceived) quality differences of the products sold by different firms, as high quality firms are more difficult to discipline in this asymmetric setting. In an attempt to offer better products and/or increase the quality differences between their products and their rivals' products, these high quality firms vertically differentiate their products. Empirically, advertising can be seen as a proxy to account for this vertical differentiation.

The empirical evidence on the impact of advertising on collusion is strong and convincing. Asch and Seneca (1975) found that the colluders are centered in industries characterized by low advertising intensity. Along similar lines, Symeonidis (1999) reported strong evidence that collusive pricing was much less common in advertising-intensive industries compared to industries without substantial advertising. Finally, Symeonidis (2003) revealed that incidence of price collusion is lower in advertising-intensive industries.

Alternatively, a related predisposition of a market to effective collusion is the level of product homogeneity. Hey and Kelley (1974) unfolded that conspiracy among competitors were most likely to occur when the product is homogenous. Similarly, Asch and Seneca's (1976) findings support the hypothesis that collusion is more likely to occur in the relatively homogeneous producer goods firms. In accordance with these results, in his analysis of Webb-Pomerene cartels, Dick (1996) found that differentiated products were 7.8% less likely

to be imported through a cartel, and durable products manufacturing industries, which were characterized by product heterogeneity, were 3.9% less likely to be cartelized.

In sum, there is a strong negative relationship between the degree of vertical integration and collusion, which has extensively been documented throughout the empirical literature.

3. The Enforcement of Dutch Antitrust Policy during the Last Two Decades

Netherlands' competition policy has evolved considerably over the past two decades. The old Economic Competition Act of 1956 (WEM: Wet Economische Mededinging), which was based on the so-called "abuse system", was replaced by the new Competition Act (Mededingingswet), which was based on "prohibition system". Concurrently, the new enforcement agency, the Nederlandse Mededingingsautoriteit (NMa) was established in 1998. There have been several amendments in the Competition Act since then. The Competition Act was first amended in accordance with the European Competition Law in 2004 as a result of European Regulation 1/2003. Another amendment took place on July 1st, 2005, when the NMa was given the status of Autonomous Administrative Authority. Finally, as of October 1st, 2007, the NMa has been awarded additional powers, as a result of the evaluation of the Competition Act.

Under the former Economic Competition Act, the enforcer, which was the Ministry of Economic Affairs (MEA), had to plead in each case that a behavior or agreement infringed the law. The MEA, as the enforcer, had the burden of proof, which is reversed under the new prohibition system, so that the firm should show that practices or agreements associated with the law's prohibitions are in conformity with the standard. Furthermore, the old Economic Competition Act's main touchstone was simply the "general interest", a concept lacking in

context or guidance for decisions. Firms with a restrictive agreement that was not against the “general interest” had to inform the MEA, which consequently registered the agreement in the Dutch “Kartel Register”. Deciding whether behavior was against the general interest or not required deliberation with other ministries, which were mostly concerned about other aspects of the general interest rather than competition policy. In a report by OECD (1998), it is stated that every case could turn out to be an opportunity for fundamental debate about the relative ascendancy of competition policy, and for many years competition policy undoubtedly lost. Accordingly, those choices about aspects of general interest led to the lax enforcement of the old Economic Competition Act.

Generally speaking, the lax enforcement of the previous competition law resulted in tolerance towards collusive business behavior in the Netherlands, which, in turn, increased the reputation of the Netherlands as “cartel paradise”. The government’s *confidential* register of cartels included 245 agreements to divide markets, around 270 agreements to fix prices, together with around 50 exclusive dealing agreements and more than 200 agreements to control competition in distribution (OECD, 1993, p. 60). The resilience of these restrictive agreements can be seen from details that the MEA (1989) released in 1989 on 109 horizontal price agreements active in September 1988. 40 per cent of these agreements had survived for more than twenty years and a further 20 per cent had already celebrated their tenth anniversary (Asbeek- Brusse and Griffiths, 1998, p. 24). As to the scale of these agreements, 77 % of them were at national level, while the remaining 23 % were operating locally. Strikingly, the majority of these agreements consisted of multiple provisions, as can be seen from Table I.

<INSERT TABLE I HERE>

In 1992, the MEA (1992) released details on the 201 market sharing agreements that were registered in existence in September 1991. In comparison to the previously mentioned horizontal price agreements, these were relatively younger. Only 14 per cent had been kept on the records for more than two decades and another 17 per cent had been on the register for more than ten years (Asbeek-Brusse and Griffiths, 1998, p. 25). Even within the general description of “market sharing”, 94 % of these agreements involved other forms of restrictive practices.

More dramatically, as reported by de Jong (1990), 21 of the total 55 incidences of serious restrictions to competition of a predominantly national character that have been the subject of an Order under Article 85(1) EEC Treaty during 1970-1989 (almost 40 % of the cases) involved the Netherlands.

Having shown that the Netherlands was a cartel paradise under the former Economic Competition Act, we can discuss more detailed explanations for the failure of the prosecution of restrictive practices. Indeed, most of the explanation lies within the nature of the legislation itself. First of all, the old Economic Competition Act postulated that cartels are not deleterious, unless the government showed the contrary, which left the burden of proof to the government. Second, the term “general interest”, a concept lacking in context or guidance for decisions, was not specified within the Act, which left the MEA a large margin of judgment. Finally, even though there was a cartel register, the Act did not propose provisions for busting unregistered cartels or for sanctions against non-registration. Consequently, the agreements kept under the register represented an incomplete depiction of cartels.

To summarize, the competition policy under the former Economic Competition Act was completely reactive. As other aspects of the general interest included macro-economic policy objectives in the form of price controls, or its industrialization and regional policies, or industrial subsidies supporting sectors during the first oil crisis, competition policy could not find much space to itself. Furthermore, as discussed by Asbeek-Brusse and Griffiths (1998), the conflicts were resolved within the deliberations between governmental officials and business representatives. More often than not, officials at the MEA worked concomitantly with business representatives. This intimacy resulted in a gentle stance towards collusive business behavior.

Given that the local legislative climate posed little threat to collusive business behavior, one might raise the question of whether trade dependence of the Dutch economy had an impact of a disciplining act on concerted practices. The answer of that question lies in the fact that three-fourths of Dutch consumers' purchases were domestic. Industries such as construction, utilities, financial transactions, transport, retail trade, and consumer and professional services, which constitute much of the economy, were isolated from imports. More importantly, since the market was small, competition in some of these sectors that are characterized economies of scale took place among a relatively small number of suppliers (OECD, 1998, p. 7).

As a second potential threat to collusive business behavior in the Netherlands, given the lax enforcement of the domestic competition law, one might also consider the involvement of European Commission (EC) and the European Competition Law. Indeed, the fact that the Dutch were among the last to have legislation that did not ban concerted practices utterly meant that Dutch cartels were under close scrutiny by the EC to a greater extent. The early impact of the EC competition law was on the behavior of firms rather than the enforcement of

the domestic competition law. For instance, while there were 125 registered collective exclusive dealing agreements in 1963, there were only 45 agreements registered in 1978 (Mok, 1978, p. 743-744). Part of this decrease might be ascribed to the closer scrutiny by the EC into Dutch cartels. This closer scrutiny had started in 1971, when the first EC decision conveying that a cartel among Dutch firms (the Dutch Cement Dealers' Association) had violated Article 81 TEC came^{3,4}, and it reached its peak in 1977, when the EC banned the system of collective exclusive dealing among Dutch bicycle dealers⁵, even though it had been allowed after some adjustments under the former Economic Competition Act. More dramatically, in 1992, the EC decided that the Dutch construction cartel, which was a purely national cartel by nature, was in violation of Article 81(1) TEC and imposed a fine of 22.498 million ECU⁶. This decision was later ratified by the European Court of First Instance. In addition to that the EC initiated a procedure against the Dutch government based on Article 226 TEC. More precisely, it argued that the Dutch competition law and administrative practices, inter alia the industry's agreements, impeded the proper functioning of the European competition rules (Drahos, 2001, p. 213).

The Dutch government's initial reaction was to invigorate the anti-cartel policy within the existing framework. Aside from a more active policy of handling cartel complaints, this included a sequence of general prohibitions on horizontal price agreements (effective from July 1993) and, on market sharing agreements and collusive tendering agreements (effective from June 1994). However, given the inapplicability of these early prohibitions due to the

³ Decision of 16 December 1971, JO 1972 L13/34

⁴ Case 8/72

⁵ *Centraal Bureau voor de Rijwielhandel*, OJ 1978 L20/18

⁶ *Building and construction industry in the Netherlands*, OJ 1992 L92/1

nature of the former “abuse system”; a new Competition Act (Mededingingswet), which was based on “prohibition system”, was launched in 1998, accompanied by the establishment of the new enforcement agency (NMa).

Article 6 of the new Competition Act conforms to Article 101 TFEU (ex Article 81 TEC and ex Article 85 EEC Treaty) in its prohibition of all kinds of anti-competitive agreements. As to exemptions, the Dutch competition law subsumes all of the EU block exemptions for general types of agreements, exemptions for specific sectors, and exemptions for specific agreements.⁷ This incorporation is dynamic in the sense that the Dutch law incorporates not only those exemptions already endorsed but also those that will be endorsed in the future.⁸

Furthermore, the new Competition Act allowed undertakings to apply for dispensation for agreements that were already in existence and that had begun in the era of “cartel paradise”. More specifically, firms were allowed to request exemption from Article 6 Mw via Article 17 Mw (which has been repealed later) of the Competition Act. However, one should note that not every anti-competitive practice would get antitrust-immunity. To be more specific, in Article 17 Mw it was stated: *“The director general may grant an exemption from the prohibition of Article 6(1) Mw for agreements, decisions or concerted practices, within the meaning of that Article, which contribute to improving the production or distribution or to promoting technical or economic progress, while allowing consumers a fair share of the resulting benefit, and which do not: (a) impose any restrictions on the undertakings concerned, ones that are not indispensable to the attainment of these objectives, or (b) afford such undertakings the possibility of eliminating competition in respect of a substantial part of*

⁷ The Competition Act, Articles 12-14 Mw.

⁸ The Competition Act, Article 12 Mw.

the products and services in question.” Thus, Article 17 Mw specified that undertakings would be exempted from Article 6 Mw if said agreements, decisions or conduct improved production/distribution or stimulated economic or technical progress, and, if a reasonable portion of the benefits accrued to consumers. In return for applying for an exemption, firms were obliged to provide data on several features of the planned cooperation: the number of firms involved, the duration of agreements, the total sales of all firms involved in cooperative agreement etc. The reaction was that the NMa was swarmed with dispensation requests – 1,100 at the deadline. Most of the agreements for which exemption is sought took place in health care industry, as a result of caution for agreements that would not be prohibited, and in construction industry, which was characterized by a long history of cartelization. The assessment of these exemption requests by the NMa literally took years (until 2004). Based on assessments, the NMa (i) rejected the request, as the agreement is not anti-competitive, or (ii) dispensation was granted for some other requests, even though the agreements were anticompetitive by nature, or (iii) dispensation was granted after altering or reformulating the initial agreements by the firms involved, or (iv) reached the decision that the Competition Act is not applicable.

Referring to the NMa’s verdicts on dispensation applications, of these dispensation requests, 47 % did not violate any of the new competition rules, whereas of the other 53 %, only 9 % were granted as dispensations by the NMa.

There were several different motives of parties to apply for dispensation. For some of them, the main motivation was legal certainty as in the case of health care industry. Firms wanted to avoid the blackbox about competition issues, since there had been drastic changes in the competition law and its enforcement, which left most of the companies hesitant about their

agreements with other undertakings. Even though general prohibitions on horizontal price agreements and, on market sharing agreements and collusive tendering agreements became effective as of July 1993, and of June 1994, respectively; there were not many prosecutions during the period of 1993-1998 (the period between the early prohibitions and the change in the competition law).

However, the motivation for firms with anti-competitive agreements was different. At the time of the change in the law, there were some “cartels” with large amounts of investments facing overcapacity problems. The members of those “cartels” wanted to divide overcapacity, and, in search of legal protection, they applied for exemption for their agreements⁹.

At this point, one might argue that hardcore cartels were not included in the subsample of the dispensations requests with anti-competitive agreements. That is, “dirty” cartels should not be expected to be on the original list in the first place, since one cannot expect cartels to be reported in 1998, as they had already been declared illegal in 1994. This view is partially correct, as there were very few price-fixing cases in these dispensation requests. Yet, the remaining dispensation requests with anti-competitive agreements include market sharing, bid rigging (which has always been a problem in the Netherlands, and not been seen as anti-competitive), joint production agencies (e.g. asphalt production) etc, which are notable violations of the competition law. Actually, these are typical Dutch cartels operating at national or local level. Besides, one should remember that even though there were general prohibitions under the former competition act, these provisions were laxly applicable and the enforcement was very weak in the sense that there were very few prosecutions during the period of 1993-1998. Nonetheless, the data generating process for our sample of multilateral

⁹ Interview with Prof. van Sinderen (the Chief Economist of the NMa)

anti-competitive practices is a bit different than the data generating process for an authority busting cartels or the data generating process for leniency applications.

4. Linking the Dutch Competition Authority's Decisions to Industry Characteristics in a Binary Probit Model with Sample Selection: Data and Empirical Specifications

4.1 Data Sources

We use different sources of data for the current analysis. These are Dispensation Requests Database, Production Survey (PS) and Community Innovation Survey (CIS). Below, we concisely describe these main sources of data in more detail.

Dispensation Requests Database

This database consists of original dispensation requests from the NMa archives. This database is confidential and is not publicly available to researchers. The database includes the names of companies with an agreement, the code of the industry in which they were operating at the time of application (SBI¹⁰ codes), the number of companies in an agreement, the total annual revenues of the companies involved in an agreement, and the duration of agreement.

In total, there are around 1,100 dispensation applications. For the minority of the dispensation applications for which the competition law was relevant, immunity was granted. More specifically, 37 concerted practices in various industries were exempted from the competition law. There is not a clear pattern for these industries that had antitrust immunity. As to the

¹⁰ De Standaard Bedrijfsindeling

length of the antitrust immunity, the average time period during which these multilateral restrictive practices were exempted from competition law was 5.39 years.

Referring back to the NMa's verdicts on dispensation applications, of these dispensation requests, 53 % had violated the Competition Act. For these agreements dispensation was either granted even though the agreements were anticompetitive by nature, or dispensation was granted after altering or reformulating the initial agreements by the firms involved. Thus, we know about the existence of collusion in an industry conditional on exemption application, and thence can specify our dependent variable as a binary variable taking value 1 for "collusive" industries, and 0 for non-collusive industries based on NMa's decisions. One can promptly raise the famous problem of sample selection. We will consider this problem, other econometric issues and possible objections in detail in the next section.

Besides, the data set can also be enriched, as the beginning dates of the collusive agreements are known from exemption requests. For instance, if NMa did not grant an exemption for a specific industry in 2001, and if the beginning of the cooperative agreement was in 1998, then it can be inferred that the industry was characterized as being collusive in 1999 and 2000 as well. The implied assumption here is that the nature of the collusive act was constant throughout the agreement and that the cartel did not break up during that period.

PS

Production Survey (PS) is conducted by the Dutch Bureau of Statistics (CBS) on a yearly basis. Data from PS is available for the period between 1993 and 2006.¹¹ The PS is a sampled survey; only firms with more than 20 employees are included in the sample each year. For

¹¹ Data for the industries transport and telecom only covers the period 2000-2006.

smaller firms, sampling fractions decrease, and consequently smallest firms will have gaps in the data for several years. Moreover, Statistics Netherlands apply a rotating sample method to reduce the administrative burden of (small) firms. This also reduces consecutive observations of firms.

CIS

Data on innovation activities has been collected from the Dutch section of Community Innovation Survey (CIS). CIS is a European harmonized questionnaire, held every two years, containing questions about innovative activities in companies. Our innovation data covers the period 1996-2006. In fact, we use six consecutive CIS-surveys: *i.e.* CIS2 for 1994-1996, CIS2, 5 for 1996-1998, CIS3 for 1998-2000, CIS3, 5 for 2000-2002, CIS4 for 2002-2004, and CIS2005 for 2004-2006. Moreover, firms with less than ten employees are not included in CIS.

<INSERT TABLE II HERE>

Yet, there are some shortcomings that limit the options for research. For instance, CIS contains industries that are not present in PS and vice versa. This reduces the number of industries that can be examined. Second, CIS suffers from lower response rates and the responses can be selective as it is most likely that innovative firms are more inclined to respond than firms that do not innovate. Moreover, since we do not have CIS data in odd years, we interpolate the innovation data. Finally, CIS does not capture all aspects of innovation. For example, information on human capital formation is not included in CIS.

Taking the caveats of our sources for granted, after aggregating firm level data to industry level data, we merged the two data sources at the 3 (and sometimes 4) digit SIC-code. Having juxtaposed the datasets provided by the CBS and the NMa, we have obtained a sample of 225 observations. However, as there are missing variables for some of the observations in the CBS dataset, the numbers of observations for various covariates are incomplete and different from each other. Subsequently, the final sample employed for the econometric analysis of the impact of several industry characteristics on the propensity to collude contains 112 industries.

4.2 Empirical Strategy and Variables

Before we proceed with the estimation strategy we will first discuss the potential problems in the dataset and the econometric setting. Firstly, as mentioned previously, one might object to the construction of dataset by arguing that hardcore cartels were not included in the subsample of the dispensations requests with anti-competitive agreements. That is, “dirty” cartels should not be expected to be on the original list in the first place, since one cannot expect cartels to be reported in 1998, as they had already been declared illegal in 1994. This view is partially correct, as there were very few price-fixing cases in these dispensation requests. Yet, the remaining dispensation requests with anti-competitive agreements include market sharing, bid rigging (which has always been a problem in the Netherlands, and not been seen as anti-competitive), joint production agencies (e.g. asphalt production) etc, which are notable violations of the competition law. Actually, these are typical Dutch cartels operating at national or local level. Besides, one should remember that even though there were general prohibitions under the former competition act, these provisions were laxly applicable and the enforcement was very weak in the sense that there were very few prosecutions during the period of 1993-1998. Yet, we should acknowledge that the data generating process for our sample of multilateral anti-competitive practices is a bit different

than the data generating process for an authority busting cartels or the data generating process for leniency applications.

The second objection is that these Dutch “cartels” are related to explicit collusion, but not to tacit collusion. Might it be the case that some of the industries characterized as being non-collusive were actually engaged in tacit collusion? The answer is “they might have”, and unfortunately there is no second source or whatsoever to validate this.

Thirdly, as a newly-established reputation-builder, the NMa might have over-reported and erred on the side of classifying non-serious coordination mechanisms as cartels. Translated into the econometrics language, this means that the NMa misclassified agreements in the dispensation requests, which might result in momentous measurement error in the dependent variable, and jeopardize the reliability of the inferences. Again, there is no validation data to cross-check the classification. We are dependent on the NMa’s verdicts on agreements.

Fourthly, it is recognized that these concerted practices or “cartels” are located in industries of which exogenous characteristics make collusion easier to maintain. Yet, it is also acknowledged that collusive agreements among firms have impact on industry structure (see for instance Symeonidis (2002)). That is, these characteristics may be the outcome of collusive acts by firms in the industry rather than being factors ex-ante affecting the likelihood of collusion. Thus, the industry features might be endogenous with respect to cartel presence. In order to alleviate this endogeneity problem, we will use predetermined lagged values of industry characteristics as explanatory variables.

Last but not the least; sample selection might be a huge problem in the current context, since non-application by firms for an exemption might result in significant bias in the present data. Stated differently, we only know about anti-competitive multilateral agreements conditional on dispensation applications. There are other cartels that continued to operate silently elsewhere without awareness and surveillance of the NMa. Arguably, our sample is not random in the sense that it only consists of anti-competitive agreements that were subject of an antitrust immunity seeking behavior. Thus, concerning the estimation technique, we have considered using Probit model with sample selection developed by van de Ven and van Pragg (1981). This model assumes that there is an underlying relationship in the form of

$$y_j^* = X_j\beta + \varepsilon_{1j}$$

[Latent equation] [3]

such that we are able to observe only the binary outcome, which is the presence of collusion in our setting

$$y_j^{probit} = (y_j^* > 0)$$

[Probit equation] [4]

Nonetheless, the dependent variable is not always observed. Instead, the dependent variable for observation j is observed only if

$$y_j^{select} = (Z_j\gamma + \varepsilon_{2j} > 0)$$

[Selection equation] [5]

where ε_1 and ε_2 are standard normally distributed (i.e. $\varepsilon_1 \sim N(0,1)$ and $\varepsilon_2 \sim N(0,1)$) and $\text{corr}(\varepsilon_1, \varepsilon_2) = \rho$. When $\rho \neq 0$, standard Probit techniques applied to the Probit equation results in biased estimates. However, the Probit model with sample selection yields consistent and asymptotically efficient estimates for all the parameters in this class of models. Furthermore, for the model to be identified, the selection equation should have at least one variable that is not in the Probit equation, which has been ensured in our case.

The log-likelihood function is defined as

$$\begin{aligned} \ln L = & \sum_{\substack{j \in S \\ y_j \neq 0}} w_j \ln \left\{ \Phi_2 \left(X_j \beta + \text{offset}_j^\beta, Z_j \gamma + \text{offset}_j^\gamma, \rho \right) \right\} \\ & + \sum_{\substack{j \in S \\ y_j = 0}} w_j \ln \left\{ \Phi_2 \left(-X_j \beta + \text{offset}_j^\beta, Z_j \gamma + \text{offset}_j^\gamma, -\rho \right) \right\} \\ & + \sum_{j \notin S} w_j \ln \left\{ 1 - \Phi \left(Z_j \gamma + \text{offset}_j^\gamma \right) \right\} \end{aligned}$$

[6]

where S is the set of observations for which y_j is observed, offset denotes for the variables of which coefficient is constrained to 1, $\Phi_2(\cdot)$ Is the cumulative bivariate normal distribution function (with mean $[0 \ 0]'$), $\Phi(\cdot)$ is the standard cumulative normal, and w_j is an optional weight for observation j .

In the maximum likelihood estimation of this model, ρ is not straightforwardly estimated. Instead, $\text{atanh } \rho$ is directly estimated:

$$\operatorname{atanh} \rho = \frac{1}{2} \ln \left(\frac{1 + \rho}{1 - \rho} \right)$$

[7]

Descriptive statistics for the whole sample, as well as separately for service and manufacturing industries are presented in Table II. As previously noted, the empirical model we will use is a Probit model with sample selection with the following specification:

$$\begin{aligned} COLLUSION_j = & \alpha_j + \beta_1 service + \beta_2 lag_hhi + \beta_3 lag_hhi_2 + \beta_4 lag_infotrade \\ & + \beta_5 lag_entry + \beta_6 lag_import + \beta_7 lag_patent + \beta_8 lag_advertising \\ & + \beta_9 lag_growth + \beta_{10} lag_growth \times lag_entry + TIME + \varepsilon_{1j} \end{aligned}$$

[8] [Probit Equation]

$$\begin{aligned} EXEMPTION_j = & \gamma_j + \gamma_1 service + \gamma_2 hhi + \gamma_3 infotrade + \gamma_4 entry + \gamma_5 import \\ & + \gamma_6 patent + \gamma_7 advertising + \gamma_8 growth + \gamma_9 cocompet + \varepsilon_{2j} \end{aligned}$$

[9] [Selection Equation]

In the present study, collusive behavior is modeled by the existence of a concerted practice in a given industry, which is a binary variable. We observe whether there is an anti-competitive concerted practice in an industry only if the parties involved applied for a dispensation. Thus, the dependent variable, y_j^{probit} , is the presence of a concerted practice (*collusion*). On the other hand, when choosing our explanatory variables, we pick up variables of which impact

on collusion is documented in theoretical studies and former empirical papers. The set of regressors X for the Probit equation, the industry characteristics, includes, first of all, *structural variables*. To begin with, *service* is a dummy variable which is equal to one for service industries, and zero for manufacturing industries. The concentration measure used is Hirshman-Herfindahl Index (*lag_hhi*). As mentioned in the review of prior empirical research, the concentration measures of the industry important determinants of collusion. Nevertheless, one might argue that if competition is region-wide instead of nation-wide, *lag_hhi* might be a poor measure for market structure. I made an effort to identify such cases and excluded a few observations from the sample¹². Furthermore, in order to see if there is a non-linear relationship between cartel prevalence and concentration as in Symeonidis (2003), we have also used HHI squared (*lag_hhi_2*). Elsewhere industry averages of the binary variables indicating if firms use trade associations as information resources (*lag_infotrade*) are also included in the analysis to check if those institutions facilitated concerted practices. Our hypothesis is that by engaging in the collection and dissemination of information, industry associations often create an environment where firms are able to interact easily and frequently, which may abet collusion. Besides, in order to proxy import competition, we have included *lag_import*, the shares of total imports in total sales in a given industry, to examine if foreign competition disciplined firms and disrupted their collusive behaviors. Finally, we have included the ratio of the new entrant firms to all the firms in the industry (*lag_entry*) as a proxy for entry barriers, in order to verify the hypothesis maintaining that collusion is harder to maintain if barriers to entry are low.

¹² Those excluded industries include Restaurants, Hospital Activities, Veterinary Activities, Taxi Operation etc, for which competition operates at regional level.

The second set of regressors includes *supply side variables*. It is intuitive to think that asymmetry deters collective behavior: for example, firms that are in a similar position would find it easier to reach an agreement which suits all of them. Thus, we have included measures of asymmetry to check if these have an impact on the presence of collusion. The first asymmetry measure is advertising intensity (*lag_advertising*), which is defined at the industry level as advertising expenditures divided by total sales. Empirically, advertising can also be seen as a proxy to account for vertical differentiation, under which collusion is more difficult to sustain, since high quality firms are more difficult to discipline in this asymmetric setting. Alternatively, advertisement costs can create entry barriers as proposed by Sutton (1991), since, for example, high advertisement expenditures may signal to potential entrants that they need huge amounts of advertisement to promote their products. Nevertheless, high advertisement expenses can also be an indicator of tough levels of competition in an industry. Companies try to make their products known to people and to promote their features via advertising, so consumers will prefer their products over the products of their competitors. Our analysis will show the final role of advertising on collusion prevalence. On the other hand, as a measure of innovative output that is another measure of asymmetry, we have included the ratio of firms with at least one patent application (*lag_patent*). We would expect that the probability of collusion decreases with this variable, since innovation fosters asymmetries in costs and/or qualities, which, in turn, makes collusion more difficult.

The final set of explanatory variables contains demand side variables. As *measures of market demand growth*, the percentage growth of sales in the relevant market (*lag_growth*) is also considered at industry level in the current analysis. It had been noted in the literature review that collusion is easier to sustain in growing markets in which discounted future profits to be enjoyed are larger relative to today's profits, and collusion is more difficult to sustain in markets characterized by declining demand, which implies that future profits are smaller

compared to today's notwithstanding retaliation. However, this type of reasoning is invalid in the absence of a fixed number of market players. Stated more literally, growing demand might attract new entrants, which hampers collusion. In order to test this proposition, we have interacted demand growth with the ratio of the new entrant firms to all the firms in the industry that proxies entry barriers ($lag_growth \times lag_entry$).

Since we know about the existence of collusion in an industry conditional on exemption application, which implies that our sample might be non-random, we should also specify a selection equation. In the selection equation, the dependent variable is a binary variable which is one if there has been an exemption application, and zero if there is no exemption application. As to the explanatory variables, instead of lagged values we include current values of the same variables except the interaction term. Moreover, we also include another variable, *cocompet*, which is the average of the binary variables for firms indicating whether they are involved in collaboration with their competitors for innovation. We argue that the more collaboration for innovation with competitors in an industry, the more likely that firms seek antitrust immunity via Article 17 Mw for their concerted practices.

Having explained the data and empirical strategy, we can now turn to estimation results which are displayed in the next section.

5. The Empirical Results

This section displays the results of the estimation of the models described above. In Table III, we present the results of both the Probit models with sample selection and the simple Probit models with various specifications to provide a baseline of comparison. We report the marginal effects, calculated at the sample means in Table IV.

First of all, the estimates of the correlation coefficient between error terms of the Probit equation and selection equation suggest that we should refer to selection models, since the correlation coefficient in all specifications are statistically significantly different from zero, which can be seen from $atanh(\rho)$ in Table III. This suggests that the parameter estimates in simple Probit models are plagued by sample selection bias, which indicates a major problem. Therefore, we restrict our attention to the results of the Probit model with sample selection when interpreting the estimation results.

<INSERT TABLE III HERE>

Having said that the results of the selection equation reveal that exemption application in Dutch industries is not random, we can promptly interpret the results. First of all, even though increased interaction in the market in the form of collaboration with their competitors for innovation (*cocompet*) seems to be associated with the increased likelihood of exemption application, its impact is imprecise. Similarly, it is also interesting to notice that there is no significant association between advertising intensity (*advertising*) and the propensity to ask for antitrust immunity. On the other hand, the less concentrated an industry is, the more likely that there is an exemption application, as *hhi* is statistically significant in all specifications (at 5 % and 1 % levels). Elsewhere, increases in import competition (*import*) reduces the expected probability of exemption application in an industry, so do the innovative output measured as the ratio of firms with at least one patent application (*patent*) and the percentage growth of sales in the relevant market (*growth*), as the coefficients on all these variables are statistically significantly negative in each specification (at 1 % level). Conversely, the coefficients on the usage ratio of trade associations as information resources (*infotrade*) and

the ratio of the new entrant firms to all the firms in the industry (*entry*) as a proxy for entry barriers are statistically significantly positive (at 1 % level) in each specification, implying that these variables appear to increase the likelihood of exemption application in an industry.

The results of the Probit equation provide strong evidence that concerted practices are less likely to be seen in service industries relative to manufacturing industries, since the coefficient of *service* is statistically significantly (at 1 % significance level) negative in all specifications. The marginal effects of *service* on the expected probability of collusion when there is no exemption application as demonstrated in Table IV imply that it is 22-34 % less likely to encounter a concerted practice in a service industry compared to manufacturing industry.

The results also suggest that the incidence of concerted practices is lower in concentrated industries: the coefficient on *lag_hhi* is negative and everywhere statistically significant (except model 3) at the 1 % level. This means that it is more likely that firms engaged in concerted practices in unconcentrated industries, everything else being equal. A potential explanation for this finding is that industries with a relatively smaller number of firms might have been able to coordinate tacitly without any necessity of overt collusion. Alternatively, cartels might have prevailed in unconcentrated industries thanks to the role played by trade associations. Indeed, the link between trade association and the presence of a concerted practice seems to be consistent with this latter interpretation: the coefficient on *lag_infotrade* is statistically significantly positive at the 1 % or the 5 % level in all specifications except model 3. The median of the concerted practice participants, which is 57, also indicates that trade associations were crucial to bring all those firms together to involve in restrictive practices.

Elsewhere, the coefficient on the square of concentration measure imply that there is no non-linear relationship between concentration and the presence of collusion, as it is statistically insignificantly positive (Model 1 and Model 5) or statistically significantly negative (Model 3) in various specifications.

There is also strong evidence from all the regressions that concerted practices are less likely in industries where entry is more possible: the coefficients on *lag_entry* are negative and significant at the 1 %, 5 % or 10 % levels. A potential explanation for the negative association between entry and collusion is that in contestable industries where barriers to entry are low firms might be less eager to collude, since their coordination would only invite entry by outsiders, which would make the incumbents worse off anyhow. On the other hand, a more reasonable explanation would be that absent any entry, the identities of main rivals do not change frequently, which makes coordination and monitoring among firms less difficult.

Interestingly, our estimation results indicate that there is a positive correlation between cartel prevalence and import penetration: *lag_import* enters statistically significantly (at the 1 % and 5 % levels) to all regressions with a positive sign. This implies that import competition did not discipline firm behavior. This finding is also consistent with the analysis of Konings et al. (2001), which revealed that import competition did not result in lower price cost margins, and concluded that foreign importers joined the cartel paradise in the Netherlands.

As to the role of measures of asymmetry on concerted practice prevalence, the association between patenting activity and propensity to engage in collusion is ambiguous in the current setting: the coefficient on *lag_patent* is statistically insignificant in all specifications in spite

of being negative. Thus, our hypothesis stating that the probability of collusion decreases with innovative output has not been confirmed. On the other hand, the coefficient on the second measure of asymmetry, *lag_advertising*, is statistically significantly positive at 10 % level in all specifications. This suggests that advertisement costs serve as entry barriers which increase the likelihood of collusion instead of being a proxy for vertical differentiation under which collusion is less likely.

Contrary to the previous empirical findings, market growth (*lag_growth*) has been found to have a negative effect on the probability of a concerted practice in an industry. Seemingly, the theoretical prediction that collusion is easier to sustain under higher rates of growth has been offset by other mechanisms that we cannot observe in the current setting. A possible explanation might be that higher demand uncertainties that are arising from fast growth might dominate the effect of growth itself. Furthermore, our proposition that growing demand might attract new entrants, which, in turn, hampers collusion has been falsified in the current context, as the coefficient on the interaction term consisting of demand growth and the ratio of the new entrant firms to all the firms in the industry that proxies entry barriers (*lag_growth X lag_entry*) is statistically significantly positive (at 1 % level) in all specifications where it is included.

<INSERT TABLE IV HERE>

In Table IV we also display the marginal effects of covariates on the probability of collusion when there is no exemption application $E[\text{collusion}=1, \text{exemption}=0]$ at sample means. This is the most interesting case, since it allows us to make inferences about industries where there might be concerted practices but no exemption application. In line with the results discussed above, the marginal effects indicate that increases in firms' usage of trade associations as

information resources (*lag_infotrade*) and increases in foreign competition gauged by the shares of total imports in total sales in a given industry (*lag_import*) is linked to the increased probability of finding a concerted practice in an industry where there is no exemption application. On the other hand, if entry, proxied by the ratio of the new entrant firms to all the firms in the industry (*lag_entry*), concentration, measured by Hirshman-Herfindahl Index (*lag_hhi*), and market growth, gauged by the percentage growth of sales in the relevant market (*lag_growth*) increase, it is less likely to encounter a concerted practice in these industries. Interestingly, the higher the advertising costs, the more likely to see concerted practices.

6. Conclusion

As stated by Harrington (2008), developing structural screens is a cost-effective method for identifying industries where practices by firms are sufficiently indicative of the presence of collusion. These structural screens might also be employed by regulatory authorities as a part of their activist policy of screening for collusion so that cartel detection process is initiated by these screens rather than complaints from competitors and/or buyers, and leniency programs.

When developing structural screens in which industry characteristics bearing on the likelihood of collusion are assessed, the endogeneity of market structure and non-random sample problems should be taken into account. Among former similar studies, Symeonidis (2003) is the only one which tackles the problem of endogeneity. However, in his analysis of restrictive agreements for which registration was mandatory under the 1956 Restrictive Trade Practices Act, he argues that non-registration of agreements would not result in sample selection bias, since collusive arrangements of all kinds were not enforceable in the court by then. Nevertheless, just as the former Dutch Economic Competition Act's main touchstone was the "general interest", the 1956 Restrictive Trade Practices Act's standard for the

restrictive agreements to be registered was “public interest”. Only the subset of restrictive agreements of which positive benefits outweighed the foreseen detriments or, agreements that were considered by the Registrar of Restrictive Trading Agreements as not substantially affecting competition were allowed to be retained. Even though he makes use of secondary information resources in his analysis to verify that sample selection does not pose a problem in his setting, he does not formally test it.

This study is the first empirical study on industry characteristics bearing on the likelihood of collusion which tackles sample selection problem. Since there is not a formal econometric procedure to handle both endogeneity and sample selection issues simultaneously, we have considered using lagged values of explanatory variables to alleviate the endogeneity problem, short of using instrumental variables. Having reviewed the empirical literature on industry characteristics bearing on the likelihood of collusion, in order to develop a variant of the structural screens mentioned above, the current study has examined the impact of several industry characteristics on the propensity to collude using a dataset on the existence of collusion across Dutch industries during the late 1990s and early 2000s. The final sample employed for the econometric analysis of the presence of collusion in this paper contains 112 industries. The econometric results, *inter alia*, suggest that our sample of Dutch concerted practices is non-random in the sense that it only consists of anti-competitive agreements that were subject of an antitrust immunity seeking behavior. Our bivariate probit model with sample selection indicates that concerted practices are less likely to be seen in service industries relative to manufacturing industries. The results also show that it is more likely that firms engaged in concerted practices in unconcentrated industries, everything else being equal. The relevant explanation for this counter-intuitive finding is that cartels prevailed in unconcentrated industries thanks to the trade associations that brought all those firms together

to involve in restrictive practices. Furthermore, we could not find a non-linear relationship between concentration and the presence of collusion.

There is also strong evidence from all the regressions that concerted practices are less likely in industries where entry is more possible. Interestingly, our estimation results indicate that there is a positive correlation between cartel prevalence and import penetration, which implies that import competition did not discipline firm behavior and foreign importers joined the cartel paradise in the Netherlands. As to the role of measures of asymmetry on concerted practice prevalence, the association between patenting activity and propensity to engage in collusion is ambiguous in the current setting, while advertising intensity, as the second measure of asymmetry, is associated with increased likelihood of collusion. This second counter-intuitive finding of the analysis can be explained by the fact that advertisement costs can also serve as entry barriers which increase the likelihood of collusion.

Contrary to the previous empirical findings, market growth has been found to have a negative effect on the probability of a concerted practice in an industry. Seemingly, the theoretical prediction that collusion is easier to sustain under higher rates of growth has been offset by other mechanisms that we cannot observe in the current setting. A possible explanation might be that higher demand uncertainties that are arising from fast growth might dominate the effect of growth itself. Furthermore, our proposition that growing demand might attract new entrants, which, in turn, hampers collusion, has been falsified in the current context.

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Appendix

The Chronology of the Developments in the Dutch Competition Law

1935: The Business Agreements Act (Ondernemersovereenkomstenwet)

- ⇒ The first Dutch national legislation
- ⇒ Main aim: to curtail the deleterious effects of excessive (domestic) competition on prices and employment. => it inclined the approbation of anti-competitive agreements and the government, if seen necessary, even made it compulsory to join an agreement for firms rejecting participation.

1941: Cartel Decree (Kartelbesluit) of 1941

- ⇒ Compelled by the Nazi government of occupation
- ⇒ Formed a confidential cartel register without providing any sanctions for non-acquiescence.
- ⇒ Remained intact for the following ten years

1951: The Suspension of Business Regulation Act

- ⇒ Interim legislation.
- ⇒ Fight against cartels operating against the public interest
- ⇒ Wijzen (1956) reports that over a period of six years the government litigated 36 cartels, in 14 of which it had acknowledged agreements to be unenforceable while in a further 19 cases it declared that the cartel had been amended convincingly.

1956: The Economic Competition Act (Wet Economische Mededinging)¹³

- ⇒ It maintained the cartel register and extended its coverage in a way to include banking, insurance and transport industries.
- ⇒ Liberal professions were excluded from the terms of the Act.
- ⇒ The Act still allowed the minister to compel a cartel agreement on the industry as a whole conditional on:
 - That participants of the agreement demand this. Namely, the government cannot commence such a procedure,
 - That participants of the agreement represent a “substantial majority” of the industry,
 - And that the extension to the agreement is in line with public interest and interests of the industry.

1971: The first EC decision conveying that a cartel among Dutch firms had violated Article 81 TEC came.

1977: The EC banned the system of collective exclusive dealing among Dutch bicycle dealers, even though it had been allowed after some adjustments under the Economic Competition Act of 1956.

1992: The EC decided that the Dutch construction cartel, which was a purely national cartel by nature, was in violation of Article 81(1) TEC and imposed a fine of 22.498 million ECU (5.2.1992, Building and construction industry in the Netherlands). This decision was later ratified by the European Court of First Instance. In addition to that the EC initiated a

¹³ became operative in 1958.

procedure against the Dutch government based on Article 226 TEC. More precisely, it argued that the Dutch competition law and administrative practices, inter alia the industry's agreements, impeded the proper functioning of the European competition rules.

1990s: strengthening of anti-cartel policy within the existing framework. Apart from a more alert policy of dealing with cartel complaints, this embraced a series of general prohibitions against:

1993: Prohibition on horizontal price agreements (effective from July 1993)

1994: Prohibition on market sharing agreements and collusive tendering agreements (effective from June 1994)

1998: The Competition Act (Mededingingswet)

2004: The amendment of the Competition Act

2005: The NMa was awarded the status of Autonomous Administrative Authority.

2007: The NMa has been granted additional powers.

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Tables

Table I: The Distribution of Provisions in the Horizontal Agreements of which Details were published by the MEA in 1989

The Provision(s) in the Horizontal Agreement	Percentages
Joint tendering with no other provisions	24%
Joint tendering + Conditions criteria	4%
Joint tendering + Exclusivity clauses	7%
Price fixing with no other provisions	4%
Price fixing + Market sharing	17%
Price fixing + Production, sales or marketing quotas	14%
Price fixing + Conditions criteria	12%
Price fixing + Exclusivity clauses	8%
Price fixing + Centralized purchasing and sales agencies	8%

Table II: Descriptive Statistics

<i>Variables</i>	Manufacturing		Service		All	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
<i>STRUCTURAL VARIABLES</i>						
service					0.4606	0.4985
lag_hhi	0.1598	0.1692	0.0514	0.0672	0.1331	0.1577
lag_hhi_2	0.0541	0.1337	0.0072	0.0209	0.0426	0.1183
lag_infotrade	0.0263	0.1195	0.0177	0.0786	0.0221	0.1016
lag_entry	0.0741	0.1127	0.1018	0.0828	0.0858	0.1021
lag_import	49.9900	22.9736	9.4491	13.7449	32.9113	28.0316
<i>SUPPLY SIDE VARIABLES</i>						
lag_patent	0.1677	0.1809	0.0300	0.1268	0.1009	0.1714
lag_advertising	0.0132	0.0168	0.0144	0.0256	0.0135	0.0194
<i>DEMAND SIDE VARIABLES</i>						
lag_growth	0.0727	0.4606	0.1004	0.5507	0.0797	0.4848
lag_growth X lag_entry	0.0083	0.1282	0.0095	0.0874	0.0085	0.1220
<i>SELECTION EQUATION VARIABLES</i>						
infotrade	0.1192	0.1164	0.0657	0.0797	0.0931	0.1037
hhi	0.1571	0.1812	0.0579	0.0606	0.1330	0.1660
entry	0.0909	0.0729	0.1114	0.0764	0.0994	0.0751
patent	0.1195	0.1124	0.0975	0.1057	0.1089	0.1098
advertising	0.0150	0.0173	0.0171	0.0266	0.0155	0.0200
growth	0.1225	0.6642	0.0717	0.2855	0.1099	0.5934
cocompet	0.0676	0.0961	0.0536	0.0901	0.0607	0.0935
import	50.3278	23.2852	9.3000	13.3477	33.1524	28.2757

Table III: The Results of the Probit Models with Sample Selection and the Simple Probit Models for the Impact of Industry Characteristics on the Likelihood of Concerted Practices

	Model (1)		Model (2)		Model (3)		Model (4)		Model (5)	
	Probit with Sample Selection	Simple Probit	Probit with Sample Selection	Simple Probit	Probit with Sample Selection	Simple Probit	Probit with Sample Selection	Simple Probit	Probit with Sample Selection	Simple Probit
collusion										
constant	3.0318*** (0.4983)	2.7256*** (0.8076)	2.9323*** (0.4680)	2.2361*** (0.7088)	2.3971*** (0.5473)	1.6367** (0.6808)	2.1452*** (0.4773)	1.3482** (0.6456)	3.0361*** (0.4950)	2.6783*** (0.8145)
STRUCTURAL VARIABLES										
service	-0.9880*** (0.3319)	-1.9068*** (0.4797)	-0.9626*** (0.3383)	-1.8137*** (0.4675)	-0.8509*** (0.2978)	-1.7335*** (0.4435)	-0.8657*** (0.3245)	-1.6964*** (0.4301)	-0.9957*** (0.3280)	-1.8891*** (0.4734)
lag_hhi	-18.7834*** (3.7413)	-27.0388*** (6.3020)	-15.6879*** (2.7759)	-17.4815*** (4.5994)	-5.1834 (4.2175)	-9.5924*** (3.1774)	-7.2135*** (2.3921)	-9.4105*** (2.8331)	-18.9947*** (3.5996)	-26.3165*** (6.3512)
lag_hhi_2	21.7955 (14.9772)	44.3835*** (12.1133)			-59.3403*** (19.4360)	-30.0499*** (11.5693)			22.0732 (15.2239)	42.4765*** (11.9842)
lag_infotrade	2.7450*** (1.0034)	3.8316** (1.6003)	2.6987*** (0.9821)	3.4212** (1.6097)	2.2161** (1.0124)	2.9045* (1.5622)	1.2163 (0.9700)	1.9501 (1.2834)	2.6989*** (1.0333)	3.7586** (1.6398)
lag_entry	-7.9937** (3.1911)	-9.0041* (4.8111)	-7.7711*** (2.9986)	-7.2443* (4.1340)	-6.3627** (2.9833)	-6.7987* (3.9385)	-6.8877** (3.3140)	-7.1942* (3.8058)	-8.0254** (3.2057)	-8.6627* (4.6505)
lag_import	0.0174*** (0.0066)	-0.0023 (0.0087)	0.0172*** (0.0067)	-0.0025 (0.0087)	0.0169** (0.0067)	0.0007 (0.0086)	0.0159** (0.0064)	0.0012 (0.0085)	0.0168*** (0.0060)	0.0003 (0.0071)
SUPPLY SIDE VARIABLES										
lag_patent	-0.1565 (0.5680)	0.6909 (1.3774)	-0.1320 (0.5675)	0.4851 (1.3604)	-0.5113 (0.6295)	-0.2503 (1.2968)	-0.8781 (0.5709)	-0.7666 (1.2284)		
lag_advertising	24.9647* (13.5053)	35.3521** (14.0898)	24.7238* (13.7970)	33.0771** (14.7681)	21.3226* (11.2027)	31.1506** (13.4525)	21.8342* (11.2728)	30.7617** (12.4766)	25.0370* (13.6544)	35.0668** (13.7660)
DEMAND SIDE VARIABLES										
lag_growth	-4.5845*** (1.2388)	-5.7882*** (1.5903)	-4.1314*** (1.2228)	-4.1657** (1.7382)	-0.0745 (0.2955)	-0.1006 (0.3077)	0.1208 (0.3792)	0.0822 (0.3322)	-4.6650*** (0.2023)	-5.5303*** (1.5819)
lag_growth X lag_entry	35.7363*** (8.9887)	49.6667*** (11.7753)	31.4440*** (8.0735)	33.5669*** (11.8005)					36.2866*** (8.8259)	47.7953*** (11.8617)
TIME	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table III: The Results of the Probit Models with Sample Selection and the Simple Probit Models for the Impact of Industry Characteristics on the Likelihood of Concerted Practices (Continued)

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
	Probit with Sample Selection	Probit with Sample Selection	Probit with Sample Selection	Simple Probit	Simple Probit
exemption					
constant	-1.4921*** (0.1994)	-1.5128*** (0.1981)	-1.6004*** (0.2027)	-1.5250*** (0.2037)	-1.4893*** (0.2002)
service	0.1781 (0.1916)	0.1866 (0.1897)	0.2356 (0.1851)	0.2216 (0.1823)	0.1792 (0.1911)
hhi	-2.9139** (1.1891)	-2.9105** (1.1795)	-3.1282** (1.2207)	-3.6101*** (1.3971)	-2.9048** (1.1814)
infotrade	3.1192*** (0.7142)	3.1562*** (0.7064)	3.1107*** (0.6743)	2.7241*** (0.7116)	3.0964*** (0.7025)
entry	6.1243*** (1.3854)	6.1595*** (1.4012)	6.4238*** (1.4461)	6.3456*** (1.4543)	6.0889*** (1.3702)
import	-0.0094*** (0.0031)	-0.0094*** (0.0031)	-0.0095*** (0.0031)	-0.0098*** (0.0030)	-0.0094*** (0.0031)
patent	-2.1922*** (0.5688)	-2.2195*** (0.5634)	-2.1376*** (0.5647)	-1.6614** (0.5837)	-2.1922*** (0.5711)
advertising	1.9136 (2.0934)	2.0253 (2.1115)	2.5251 (2.1486)	2.3746 (2.2521)	1.9256 (2.0902)
growth	-2.7543*** (0.5054)	-2.6856*** (0.4788)	-2.3091*** (0.5003)	-2.1282*** (0.5472)	-2.7579*** (0.5072)
cocompet	-0.0305 (1.1075)	0.1020 (1.0867)	0.7891 (0.9996)	0.5414 (0.9502)	0.0123 (1.0561)
atanh(rho)	-2.2313*** (0.3472)	-2.3092*** (0.3643)	-2.4754*** (0.5376)	-2.3424*** (0.6978)	-2.2053*** (0.3586)
Obs. Censored	107	107	107	107	107
Observations	112	112	112	112	112
Prob>Chi2	0.000	0.000	0.000	0.000	0.000
Pseudo-R2	0.37	0.34	0.26	0.21	0.36

• *: Significant at 10 % level, **: significant at 5 % level, ***: significant at 1 % level

• z-statistics are based on robust standard errors in parentheses.

Table IV: The Marginal Effects of the Covariates on the Expected Likelihood of Concerted Practice Occurrence When There is no Exemption Application at Sample Means (E[*collusion* = 1, *exemption* = 0])

	Model 1	Model 2	Model 3	Model 4	Model 5
	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
service	-0.3025 ** (0.1299)	-0.3366 *** (0.1296)	-0.3271 *** (0.1022)	-0.2199 * (0.1191)	-0.3069 ** (0.1261)
lag_hhi	-4.3700 *** (1.4689)	-4.6138 *** (1.5064)	-2.0394 (1.6826)	-1.3092 * (0.7098)	-4.4575 *** (1.3691)
lag_hhi_2	5.0707 * (3.0080)		-23.3474 *** (8.4421)		5.1799 * (3.0446)
lag_infotrade	0.6386 ** (0.3223)	0.7937 ** (0.3689)	0.8719 ** (0.4215)	0.2208 (0.2000)	0.6334 * (0.3244)
lag_entry	-1.8598 ** (0.9185)	-2.2855 ** (1.0666)	-2.5034 ** (1.2380)	-1.2501 * (0.7563)	-1.8833 ** (0.9090)
lag_import	0.0040 ** (0.0016)	0.0051 ** (0.0020)	0.0066 ** (0.0026)	0.0029 ** (0.0013)	0.0039 ** (0.0016)
lag_patent	-0.0364 (0.1305)	-0.0388 (0.1653)	-0.2012 (0.2447)	-0.1594 (0.1066)	
lag_advertising	5.8081 * (3.2316)	7.2713 * (4.0098)	8.3894 * (4.4937)	3.9628 * (2.3573)	5.8755 * (3.2492)
lag_growth	-1.0666 *** (0.3058)	-1.2150 *** (0.3959)	-0.0293 (0.1163)	0.0219 (0.0696)	-1.0947 *** (0.2772)
lag_growth X lag_entry	8.3141 *** (2.3927)	9.2477 *** (2.7927)			8.5154 *** (2.2052)

• *: Significant at 10 % level, **: significant at 5 % level, ***: significant at 1 % level

• z-statistics are based on robust standard errors in parentheses.