## Discussion paper

# Anatomy of Cartel Contracts

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# Anatomy of Cartel Contracts[*]

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## Abstract

We study cartel contracts using data on 18 contract clauses of 109 legal Finnish manufacturing cartels. One third of the clauses relate to raising profits; the others deal with instability through incentive compatibility, cartel organization, or external threats. Cartels use three main approaches to raise profits: Price, market allocation, and specialization. These appear to be substitutes. Choosing one has implications on how cartels deal with instability. Simplifying, we find that large cartels agree on prices, cartels in homogenous goods industries allocate markets, and small cartels avoid competition through specialization.

*JEL*: L40, L41, K12

*Keywords*: cartels, contracts, antitrust, competition policy, industry heterogeneity.

# 1    Introduction

For competition policy to be effective, we need to understand how cartels work. To this end, it is of first order importance to analyze what issues cartels aim to solve and how. Our understanding of cartel organization and operation remains inadequate even though it has improved through both in-depth analyses of individual cartels (Genesove and Mullin 1998, Asker 2010), game-theoretic modeling of cartel contracts observed in some of the recent exposed cartels (Harrington and Skrypacz 2007, 2011) and qualitative analyses of cartel contracts (Harrington 2006). A key factor inhibiting further progress has been lack of data that would allow a quantitative analysis of cartel contracts: that is, how do the contracts look like? Are contracts very similar, or not? What contracting features are used most often? Do some features of contracts appear together often? How do the contract features vary with observable cartel and industry characteristics, and macroeconomic conditions? To address these questions calls for detailed data on the contracts of a large number of cartels, operating preferably in a shared institutional environment. We offer such an analysis and provide an anatomy of cartel contracts, i.e., a list of their stylized facts.

An anatomy of cartel contracts is important in two ways: First, it provides information both to researchers and competition authorities on how different cartels operate, possibly helping e.g. in designing where to allocate resources for the detection of cartels. Second, it provides a basis for further development of cartel theory along the lines initiated by Harrington and Skrypacz (2007, 2011) towards models that are in line with such stylized facts. Such models are instrumental in pushing further our understanding of how cartels operate, and what types of policies are likely to be effective against them.

Cartels have to solve two fundamental issues: How to raise profits?; and, How to deal with the inherent instability of the cartel agreement? To better understand how

these problems are solved and how the cartel contracts look like, we follow a three-step research approach.

In the first step, we pin down which kind of contracting approaches cartels use. To this end, we resort to the received cartel literature (e.g., Harrington 2006) and economic theory to identify 18 potential contract clauses. One third (6) of these clauses relate to how the cartel affects the market outcome – raises profits. The remaining two-thirds (12) of the clauses relate to the instability of cartels. To systematically analyze these remaining clauses, we group them into three economic dimensions: How does the cartel seek to solve the incentive compatibility constraint on which economic research has very much concentrated?; How does a cartel organize itself and settle internal disputes?; and, How does a cartel deal with external threats? We expect cartels to only use those dimensions which address problems they can anticipate to emerge and whose benefits exceed the costs of including them into the contract. Viewed from this perspective, cartels end up economizing on contract completeness and, thereby, following an incomplete contracting approach.

In the second step, we scrutinize how the design of cartel contracts relates to the size of the cartel in terms of the number of members and to whether the industry produces homogenous or differentiated products.[1] Our motivation to consider the number of cartel members is the attention it has received in the prior literature (see, e.g., Levenstein and Suslow, 2006, for a review). In particular, the supergame-models of collusion suggest that the incentive compatibility constraint is a function of the number of firms in the cartel (industry), with more firms leading to the incentive compatibility condition

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[1] We also explore how the design of cartel contracts is correlated with other type of industry heterogeneity and the state of the business cycle at the time the cartel is formed. The latter is motivated by the old question of whether collusion is more likely to be sustained and initiated during booms or busts (see, e.g., Green and Porter 1984, Rotemberg and Saloner 1986, Marquez 1994 and Suslow 2005).

being harder to satisfy.[2] We focus on product differentiation because almost nothing is known empirically about how this industry feature is associated with the organization and workings of cartels. Indeed, most of the theoretical literature either studies models of homogenous goods, or does not take an explicit stand on product differentiation. Moreover, the empirical literature suggests that collusion mostly occurs in homogenous goods industries, but the small theoretical literature on the effects of product differentiation on collusion is divided on the issue.[3]

In the third step, we provide an exploratory analysis of the complexity and stability of cartel contracts. As far as we are aware, the prior literature is largely silent about them, but they are potentially important in informing policy (e.g., can relatively simple and short contracts sustain collusion?) as well as in furthering the economic theory of cartel contracts (e.g., how often are contracts updated?). A notable exception is Taylor (2007), who finds little relation between industry characteristics and use of individual clauses, or length of the contract. The exception is that he reports that cartels in homogenous goods industries use systematically differently some contracting possibilities afforded by the National Industrial Recovery Act.

To implement this three-step research approach, we have collected detailed information on the contracts of 109 Finnish legal manufacturing cartels. These cartels covered the whole national market and were registered between 1959 and 1988 by a predecessor of the Finnish Competition Authority due to a Finnish law. We use information from this Registry to establish which kind of contracting clauses the cartels had adopted. The strengths of these data are twofold: first, the cartels operated in the same institutional environment, removing one potentially large source of heterogeneity (in con-

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[2] The reason for this is that each firm gets a smaller share of the collusive profits and has also a greater incentive to deviate.

[3] For instance, while Chang (1991) and Ross (1992) find that product differentiation makes collusion easier, Thomadsen and Rhee (2007) find the opposite.

tracts). Second, unlike illegal cartels, legal cartels do not have to worry about the consequences of explicitly writing down their agreements. We can thus "observe an unobservable", i.e. what illegal cartels would write down, if doing so would not have adverse legal consequences. Indeed, the very fact that cartels are illegal leads to endogenous incompleteness of cartel contracts, because the contracting parties have a strong incentive both to reduce the ability of a legal court to verify the contracted actions and to make unverifiable what is observable.[4] Bar for this difference, legal and illegal cartels have similar incentives to economize on contract completeness in their attempt to coordinate on actions and meet the incentive compatibility constraint.

Our analysis of the anatomy of cartel contracts confirms some previous findings in the literature and generates a number of new insights. First of all, we find – consistent with Harrington (2006), Levenstein and Suslow (2006) and Harrington and Skrzypacz (2011) – that cartels coordinate on pricing, allocate the market (and/) or coordinate on the positioning in the product space (i.e., who specializes on what). We also find that many, but not all, cartels contract on the incentive compatibility constraint, some aspect of their internal organization as well as on how to deal with external threats.

Looking more closely at the anatomy of the contracts, we find that while essentially all cartels agree on some mechanism to raise joint profits, they differ in how they approach this. By and large, we find three basic *contracting approaches*: cartels agree on prices, allocate markets, or use some type of non-competition/specialization clause. Further, we find that choosing one of these has implications to the rest of the contract. Cartels agreeing on prices do not necessarily use the contract to solve the incentive compatibility problem, but agree on organizational issues. Cartels that use allocation of

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[4] The cartels that we study were legal, but apparently they hardly ever used the legal system to enforce their cartel contracts. Thus, there were few reasons at the initial contracting stage to consider the degree of verifiability of the various clauses in the court of law. Had there been such reasons, it could have led to endogenous contract (in)completeness; see Kvaløy and Olsen (2009), who argue that if the contracting parties can manipulate the ability of a legal court to verify contracted actions, verifiability becomes a strategic choice variable.

markets to raise profits make heavy use of contractual clauses designed to affect the incentive compatibility constraint. If cartels use some type of non-competition/specialization clause they are less likely to have clauses both for incentive and for organizational purposes. More generally, it seems that the use of different incentive and organizational clauses go hand in hand: either a cartel uses several (of both) of them, or few. Clauses designed to deal with external threats are the least correlated with the other clauses.

We also find that cartel contract design is related to the size of the cartel and depends on whether the industry produces homogenous or differentiated products. The size of the cartel is significantly associated with how the cartel seeks to raise profits: the number of cartel members is positively correlated with agreeing on prices, and negatively correlated with using non-competition/specialization clauses. Cartel size is also positively associated with the use of (more) instability clauses. In contrast to the results on cartel size, we find that cartels in homogenous goods industries are more likely to use market allocation to raise profits. Clauses relating to the incentive compatibility constraint and external threats are also more likely to be used by cartels in homogenous goods industries. Furthermore, several of the correlations between how a cartel raises profits and how it deals with instability are affected by the number of members and homogeneity of products.

Finally, we find some evidence that larger cartels use more complex contracts (measured by the number of pages and the number of clauses), as do cartels in industries with product differentiation. While both pricing and market allocation cartels seem to have more complex contracts, pricing cartels also change them more often. Industry characteristics beyond the level of product differentiation do not affect contract complexity, but cartels formed in boom years write shorter contracts and have subsequently more contract changes.

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The rest of the paper is organized as follows: first, we relate our analysis to the previous economic literature on cartels and contracts in section 2. The institutional environment in which our cartels operated and the 18 contracting clauses on which we have collected information are described in section 3. We then proceed in section 4 to explore how cartels seek to raise profits and how they address the instability of the cartel arrangement. We extend this analysis in section 5, where we look at how observable cartel- and industry characteristics, such as the size of cartels and whether the industry produces homogenous or differentiated goods, correlate with the design of cartel contracts. In section 6, we analyze the complexity and stability of cartel contracts both by relating them to observed cartel and industry heterogeneity and through three case studies. Section 7 discusses the extent to which our empirical findings generalize. Using less complete data on 902 Finnish legal cartels from the same era, we show therein that manufacturing cartels are somewhat *different* from cartels outside manufacturing: the latter use for example market allocation as a way of increasing profits clearly less often than manufacturing cartels. Section 8 concludes.

## 2    Related literature

Our paper is at the intersection of two main strands of the economics literature. First, our analysis is related to the economics of cartels, in particular the research that explores their internal workings, organization and specific determinants, such as the number of cartel members and product differentiation. Second, our analysis has connections to the economics of (incomplete) contracts, which for our purposes can be defined to include both empirical work on contracts as well as theoretical analyses of incomplete contracts and relational contracting.

## 2.1 Internal workings and organization of cartels

An interesting nascent empirical literature studies the internal workings of a cartel.[5] Genesove and Mullin (1998) study the U.S. sugar cartel by analyzing a rich source of information, the documents from the meetings of the cartel.[6] Asker (2010) studies the operations of a New York-based stamp collector's cartel and finds that despite their very refined operations, the damage they caused was limited. Insightful studies on individual cartels, like the ones mentioned, show that there is heterogeneity in both cartel design and performance that depend on the environment in which the cartels operate. We seek to bridge the gap between a deeper understanding of the detailed workings of an individual cartel and the need to observe stylized facts that pertain to a larger sample of cartels, both of which are crucial e.g. in designing the right policies.

Another strand of the empirical cartel literature studies samples of cartels. Suslow (2005) studies the relation between formal cartel contracts and the structure and durability of cartels using a sample of legal cartels, finding that uncertainty in the operating environment is inversely related to the stability of cartels. Taylor (2007) analyses the cartel codes from the National Industrial Recovery Act for cartels registering between 1933 and 1935 in the US and finds that high complexity of cartel codes (contracts) were correlated with slower output growth, indicating that cartels were successful in restraining output. He also briefly touches on the determinants of cartel contracts; we will comment on this part of his work in section 7. Levenstein and Suslow (2011) are closer to us in having collected information on the contract characteristics of cartels; in their case, of a relatively large sample of illegal international cartels. Instead of analyzing those characteristics, they, as Taylor (2007), consider them as determinants of cartel

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[5] A much larger literature studies the behavior of individual cartels. Prominent examples are Pesendorfer (2000), Porter and Zona (1993, 1999) and Röller and Steen (2006).

[6] Genesove and Mullin find in particular that the cartel resorted to negotiations in the face of contract violations rather than (directly) going for a punishment (e.g. price war). The cartel also came up with contractual remedies to the problems that surfaced.

duration.[7] We contribute to this literature by bringing new data on legal cartels that share a common institutional environment, to bear on a new aspect of the phenomenon, namely cartel contract anatomy.

Harrington and Skrypacz (2007, 2011), while studying cartel contracts, offer a different approach. They build a theoretical model, derive an equilibrium whose properties match qualitatively the key dimensions of observed cartel agreements in certain markets and show under what conditions an equilibrium with those properties exists. Our aim is to advance this literature by providing a deeper analysis of cartel contracts than has been possible hereto-fore, thereby providing more (and more robust) stylized facts that need to be explained and understood. One could, for example, use our results to first build a model that in equilibrium delivers the type of cartel contract observed in our data under the assumption that there is no competition authority. The environment can thereafter be changed (by, e.g., introducing a competition authority, modelled as a detection probability and an associated fine) to study what type of a cartel agreement arises in the new equilibrium. Viewed from this point, Harrington and Skrypacz model a legal cartel, or tacit collusion, rather than an illegal cartel, as their model does not include a competition authority.

The received theoretical literature suggests that cartel formation and stability should typically be inversely related to the number of market participants and cartel members, but empirically that seems not to always be the case (Levenstein and Suslow, 2006). Even less is known about how product differentiation is associated with the organization and workings of cartels. The empirical literature does suggest that collusion mostly occurs in homogenous goods industries (see e.g., Levenstein and Suslow, 2006), but the theoretical literature addressing the same question portray a more mixed picture.

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[7] See also the earlier literature consisting that includes among others Frass and Greer (1977), Hay and Kelley (1974) and Posner (1970).

Chang (1991), studying collusion in a Hotelling model, and Ross (1992), studying two different models of product differentiation, find that differentiation makes collusion easier, while Raith (1996) and Häckner (1994) find the opposite. In early papers, Deneckere (1983) and Majerus (1988) study the related question of whether collusion is easier to sustain with price or quantity competition in a differentiated goods market when collusion yields monopoly profits. Deneckere finds that for complements and very close substitutes, collusion is easier (the minimum discount factor lower) with price than with quantity competition. For moderate to poor substitutes, the situation is reversed. Majerus finds that price competition is (weakly) more efficient (and hence collusion harder) than quantity competition. Rotschild (1992) also combines the analysis of product differentiation with an analysis of price versus quantity setting. He finds that with price setting, product differentiation makes cartels less stable, while the opposite is true with quantity setting. Lambertini and Schultz (2003) generalize the analysis by allowing for lower than monopoly profits due to collusion and find that for substitutes (complements), profits are maximized by choosing quantities (prices) in the collusive phase.[8]

## 2.2    Economic analysis of (incomplete) contracts

Our research has connections to the empirical work on contracts. Lerner and Merges (1998) study the allocation of control rights in alliances between US bio-technology companies and firms sponsoring them financially. Chiappori and Salanie (2000) use French insurance data to test for the existence of asymmetric information in contractual relationships. Ackerberg and Botticini (2002) explore the econometric consequences of endogenous matching in the context of a contracting relationship using historical Italian

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[8] In more recent work Schultz (2005) studies the effect of market transparency on collusion in a Hotelling model and shows that an increase in transparency makes collusion harder with product differentiation, but that the effect disappears when goods become homogenous. Thomadsen and Rhee (2007) study how the effect of product differentiation on collusion is affected by costs of maintaining collusion (e.g., monitoring, communication, negotiations). Thomadsen and Rhee show that such costs increase the difficulty of sustaining collusion more for firms in industries with product differentiation.

data on contracts between landlords and tenants. Finally, in a paper that is close in spirit to ours, Kaplan and Strömberg (2003) use venture capital contracts in the US to investigate how well their dimensions map to the predictions of financial contracting theory. A difference between our paper and theirs is that while they could confront their empirical regularities with a rich theoretical literature on financial contracting, the existing theoretical literature on cartel contracts is rather thin. As a substitute, the existing theoretical literature on cartel performance is rich.

When outlawed, cartels have to rely on self-enforcing relational contracts, i.e., they cannot rely on contracts that require court enforcement. However, even illegal cartels have to agree explicitly at least on something, as otherwise collusion would just be tacit. That is, illegal cartels have to explicitly outline which contract dimensions their formal collusive contract includes and, due to the ensuing greater verifiability of intended actions, face the associated increases in the risk of being exposed in future and having to possibly pay penalties and damages. Alternatively, a cartel needs to deliberate on the same issues and just informally agree on how a cartel contract would look like, if it was actually written. In either case, the theory of endogenously incomplete contracts suggests that like legal cartels, illegal cartels are likely to make use of (only) those contract dimensions whose benefits exceed the costs of including them into the (actual or virtual) contract. The benefits are related to the increased collusive profits and greater stability (see Harrington and Skrypacz 2007, 2011), whereas the costs can be cognitive (Tirole 2009), informational (Spier 1992) or plain ink costs (e.g. Dye 1985, Anderlini and Felli 1994, Battigalli and Maggi 2002, 2008), or some combination of the three. The theory also predicts that if cartel contracts fall into the category of incomplete con-

tracts, cartels should mostly agree on control rights, discretion and decision-making rules (Bolton and Dewatripont 2004, pp. 37).[9]

# 3 The institutional environment and data

This section describes both the institutional environment in which our cartels operated, our sources of data, and the 18 contracting clauses on which our analysis builds.

## 3.1 The institutional environment

The development of Finnish competition policy after the Second World War follows closely developments in other European countries, and Sweden in particular. In practice, there was no competition policy before the war (see Fellman 2008). After the war, a committee was set up in 1948 to draft a framework for competition legislation. This work resulted in the first cartel law which took effect in 1958. The central idea was to collect information on rather than deter collusive activities. For this purpose, a (predecessor of the) Finnish competition authority (CA) was set up and given the task to register cartels.

The CA was active, sending out thousands of inquiries and registering several hundred cartels in the first three years of its operation. Registration in the Registry was contingent on the CA contacting the cartel. This changed in 1964 when the law was revised. Now cartels with a formal organization (such as an association) had to register. In 1973 the registration requirements were again somewhat tightened. It was only in the 1980s that Finland finally edged towards a modern competition law, as the work of a committee established in 1985 resulted in a new law taking effect in 1988. This law

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[9] The theory that treats the completeness of contracts as endogenous has not yet settled on key determinants; see, e.g., Bolton and Dewatripont (2004) for a textbook treatment and Tirole (2009) and Kvaløy and Olsen (2009) for some more recent advances.

made void possible sanctions in cartel agreements. Cartels became illegal only in the beginning of 1993.[10]

Our understanding of the past regime, based on written accounts and discussions with people familiar with the era, is that the costs of registering were minor. There were costs of not registering; in particular, not registering could have made enforcement of the contract more difficult, though taking contract breaches to the court was very rare, if not effectively non-existent.[11] It also seems that there were other benefits tied with registering. The former and current Director Generals of the Finnish CA (Purasjoki and Jokinen, 2001) sum up the environment prior to the 1988 law: "*Time was such that there seemed no need to intervene even in clear-cut cases, especially if they had been registered. Registration had been transformed into a sign of acceptability of the [cartel] agreement, at least for the parties involved [in the cartel]*".

## 3.2    Data sources

Our data consist of information on cartel contracts, industrial statistics and macroeconomic variables. They come from three sources.

All the data on cartel contracts is based on archive work in the Registry. For each registered cartel, the Registry established a folder, and gave an identification number. The folder contains all the correspondence between the Registry and the cartel. The Registry also always asked for the actual cartel contract. Once a cartel was registered, basic information on it was published in the Official Journal of the Finnish government. Thus, the Registry (in a somewhat limited way, given the small circulation of the Journal) made cartels public. All our data on the contracts and cartels are based on the information available in the Registry.

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[10] In the Appendix we provide graphs of the rate of Registry entries and exits, and of the cumulative number of entries and exits.

[11] We have interviewed people with a long working history in the Finnish Competition Authority. They could recall one case from the early 1980s. According to Juhani Jokinen (private exchange), this case lead to the law change in 1988 making sanctions in cartel contracts void.

The Registry contains a total of some 900 cartels. As archive work is time consuming and expensive, we could not include all of them in our sample as the objective was to collect detailed information on each of the cartel contracts we include in our sample. We decided to concentrate on nationwide manufacturing cartels, and chose to include the first cartel(s) in a given (3-digit) industry. This resulted in us going through the folders of 109 cartels in a very detailed (and time-consuming) way.

We used a semi-structured approach to collect information on 18 potential contract clauses. After initial discussions of how to interpret contracts, we first randomly chose eight cartels and had four researchers go through each of them independently. We then checked for any differences in interpretation, and decided on a common approach. We thereafter followed a written protocol with the 109 cartel contracts. We will discuss the 18 clauses and other information we collected shortly. In addition to this information on contract clauses we collected information on the length (in pages) of the contract, the number of contract changes and the number of members in the cartel.

To this data we have matched 4-digit industry statistics from Statistics Finland. In doing so we needed to decide what year's industrial statistics to match. We use the statistics of the year prior to registration. To measure product differentiation we have constructed an index (*homogenous_d*) that indicates whether an industry primarily produces homogenous goods (=1) or not (=0). We followed the existing literature (Rauch 1999, Foster, Haltiwanger, Syverson 2008) and studied the characterization of each 4-digit industry, and the description of the goods produced by the cartel devised by the Registry to determine whether the cartel was producing homogenous goods or not.[12] Finally, our source for macroeconomic variables is the database of the Research Institute of the

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[12] To give a couple of examples, the cartel producing cardboard was classified as a homogenous goods cartel, while the cartel producing dairy products was classified as producing differentiated goods. We sought to be conservative in classifying an industry (cartel) to produce homogenous goods. An inspection of the industries and the classification suggests that many of the industries we classified as producing homogenous goods are upstream industries selling to other firms rather than directly to consumers.

Finnish Economy (ETLA). We describe the industry- and macrovariables in greater detail in section 5, where we condition the design of cartel contracts on them.

## 3.3 The economic dimensions of the cartel contracts

We collected information on 18 potential contract clauses, basing our work on Harrington (2006) and economic theory. One third of these contract clauses relate to how the cartel affects the market outcome – raise profits. The remaining two thirds relate to cartel instability. To systematically analyze these latter 12 clauses we group them further into to three economic dimensions.

This leaves us with four economic dimensions: i) market power attributes (MPA), which describe what a cartel agrees upon to increases its profits, and three instability dimensions; ii) the incentive compatibility constraint (ICC), which is about the different contractual ways of dealing with incentive compatibility; iii) the internal cartel organization (ICO) of the cartel, and iv) the external cartel contract (ECC), which is about dealing with external threats.

In what follows, we give brief descriptions of the 18 contract clauses and describe the economic dimensions of cartel contracts to which they match.

**MPA – Market Power Attributes**

Six of 18 contract clauses have to do with MPA and thus how the cartel coordinates its actions to increase profits. This category includes the following measures: *Pricing*, *Market allocation*, *Efficiency*, *Technology*, *Non-price clauses* and *Non-competition/specialization*. The first one, *Pricing*, takes the value one if the contract mentions agreements on prices, pricing rules, discount rules and/or rules of delivery and

payment.[13] The *Market allocation* variable takes the value one if the contract specifies sales quotas or market shares, the cartel uses exclusive territories, or the contract allocates customers among the members. It takes the value one also if the contract stipulates that the members follow a "home-market principle", i.e., they refrain from entering each other's (geographic) "home" markets.[14] The variable *Efficiency* takes on the value one if the contract has a section stipulating that sales and/or production should be allocated according to efficiency. As an example, some contracts stipulate that the member whose facility is closest to a given customer should deliver the goods. *Technology* in turn takes value one in the case the contract has a clause about sharing of technological knowledge (such as patents or blueprints). The *Non-price clauses* -variable is given the value one if the contract mentions any non-price restrictions.[15] These include things like add-ons, bundling, and quality. Finally, the *Non-competition/specialization* variable takes the value one if the contract stipulates that the members are to specialize in one way or the other, as well as if the cartel members simply agree to "not compete" in a given market.[16]

The difference between a cartel having the *Non-competition* clause and having the *Market allocation* clause is that the former includes the parties agreeing e.g. on parti-

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[13] *Pricing* takes the value one if the cartel agrees on any of the following: Price, pricing rule, discounts, terms of delivery. Of the 63 contracts that use *Pricing*, 78% agree on price, 10% specify a pricing rule, 50% rules on discounts, and 48% terms of delivery. These clauses turn out to be mostly substitutes: All other correlations but that between discount rules and terms of delivery (0.33, p-value 0.01) are negative. Only two however are statistically significant. Price and pricing rule have a correlation of -0.61 (p-value 0.00) and discounts and pricing rule a correlation of -0.21 (0.10).

[14] Sales quotas are used by 66% of the 29 (27% of) cartels using *Market allocation*, territories by 28% and the home-market principle by 10%. With only 29 cartels using *Market allocation*, an analysis of correlations is at best suggestive: Keeping that in mind we find that all correlations are negative and large in absolute value: -0.21 (the home-market principle and territories), -0.47 (sales quotas and the home market principle) and -0.69 (sales quotas and territories), and all but that of the home-market principle and territories statistically significant.

[15] We also collected qualitative evidence information on the MPA contract clause *Non-price*. We didn't find much, and the most frequent were different ways of minimizing product differentiation. For example, cartels could agree on standardizing products, or packages.

[16] *Non-competition/specialization* was used by 42 (39% of) cartels. The two parts of this clause, a non-competition clause and a clause on specialization are used by 79 and 83% of those 42 cartels. The correlation between the two is negative (-0.23) but statistically insignificant (p-value 0.14).

tioning the production of goods,[17] whereas the latter has no (direct) impact on production, only on distribution. The cartels using *Non-competition/specialization* are not the standard textbook cartel because, after implementation, often only one of the parties remains active. Despite this we feel that it is justified to regard these as cartels as first, the transaction ensures that joint profits can be maximized and as second, the contracts almost invariably include non-competition clauses where the party ceasing production is not allowed to re-enter, nor to sell its knowledge to third parties.

**ICC – Incentive Compatibility Constraint**

The second economic dimension of the contracts, ICC, consists of different contractual ways of dealing with the incentive compatibility constraint. We looked for four ways of dealing with this problem. The variable *Monitoring* takes value one if the contract has a clause on how the members monitor each other. As an example, the plywood cartel had a clause whereby "all information on sales, deliveries and production must be given to the Association twice a month; twice a year a certified auditor's statement of the correctness of previous notifications is required". *Enforcement* takes value one if the contract stipulates how to handle situations where a member has deviated. Such instances include the mention of price wars of some type, retaliation, and compensations. An example is the clause used by the glass cartel: "The delegation has the right to order production reductions or temporary closing of a plant. Compensation must then be paid". The variable *Expel* takes the value one if the cartel has rules on how to expel a member if rules are broken. Similarly, the variable *Fine* takes the value one if the contract includes a clause on monetary fines for a company that violates the contract. Fines were usually either a percentage of some measurable activity (like sales), or a  minimum fine in monetary terms was defined.

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[17] As an example, as part of a cartel on the production of bicycle parts, one of the parties agreed to cease production of certain bicycle parts.

## ICO – Internal Cartel Organization

The third economic dimension of cartel contracts, ICO, is about the internal organization of the cartel and is captured by five measures. The variable *Meeting* takes the value one if the contract stipulates whether, and if so, how often, the members are to meet. *Dispute-resolution* in turn takes the value one if the contract specifies a way in which disputes among members are to be resolved. There were two primary ways in which disputes resolution was specified in the contracts: either an internal mechanism, or an external mechanism (court, arbitration). *Structure* takes the value one if the cartel has a formal structure such as an association or a limited liability company to organize itself. *Vote* is a variable that takes the value one if a voting procedure is specified in the contract.[18] Finally, *Sales* association takes the value one if the cartel has formed either a trade or a sales association.

## ECC – External Cartel Contract

The fourth and final economic dimension of cartel contracts, ECC, has to do with how the cartel deals with outsiders and external threats. We searched for three contractual characteristics: the *New members* -variable takes the value one if the contract specifies a policy on how to accept new members. *Non-cartel supply* indicates whether or not the cartel members have a clause on how to deal with supply from non-member rivals. Finally, *Entry* takes value one if the contract stipulates how to react to entrants into the industry.

In the rest of the paper, we systematically make use of these four dimensions, $d \in$ {MPA, ICC, ICO, ECC} to organize the contracts and to sketch their anatomy.

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[18] Those cartels that use the ICO clause *Vote* often specify the voting rules: Voting power is distributed according to (sales) quotas or sales (billing), using the 1-share-1-vote-rule, as relative to wages paid, or as a function of the size of the members. As an example, the cardboard cartel used the following voting rule: "Voting power is based on production (volume)".

## 3.4 Descriptive statistics of MPA, ICC, ICO and ECC

We present the first descriptive statistics in Table 1. The panel on the L.H.S. reports figures for the extensive margin, i.e., how prevalent it is for a given cartel to have at least one clause covering economic dimension $d$ in its contract. As can be seen, almost all cartels (105 out of 109, or 96%) include at least one contractual measure in the MPA dimension, i.e. on how to increase profits.[19] This prevalence is probably not very surprising given the objective of cartels: they must agree on at least one way to increase the joint profits of their members.

[TABLE 1 HERE]

There is much more variation in the ICC, ICO and ECC dimensions. About half (52%) of cartels have one or more contractual clauses for ICC, which are designed to deal with the incentive compatibility constraint. This is relatively low percentage, at least relative to the amount of attention that the economic literature has devoted to the incentive compatibility of cartel agreements. A high percentage (85%) of cartels has at least one contractual clause designed to detail cartel organization (i.e., in the ICO dimension). Finally, some three quarters (73%) of cartels went through the trouble of taking into account external threats (ECC) in their contract.

The panel on the R.H.S. of Table 1 reports descriptive statistics on the intensive margin, which here refers to the fraction of all possible contractual clauses (that we consider) that cartels use in a given economic dimension of the contract, conditional on usage. Thus, the first row tells us that those cartels that include at least one MPA-related clause in their contract use on average 30% (i.e., roughly two out of the six possible) clauses to specify how profits are to be increased. The fraction of clauses in the ICC dimension, conditional on usage, is 40% out of four possible clauses. Those cartels that

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[19] Of the four who do not have an MPA clause, two are in publishing, one in pharmaceuticals, and the last in jewelry/goldsmith products. For the pharmaceuticals cartel, agreeing on how to raise profits was probably unnecessary given that the industry was heavily regulated (including prices), although one could think that they could have used a *Non-competition/specialization* clause for example.

contractually specify something about how the cartel is organized use roughly half of the available five measures. Finally, we find that cartels use, on average, less than half of the three contractual clauses available (identified by us) to deal with external threats.

In sum, Table 1 is consistent with cartels economizing on contracting and adopting an incomplete contracting approach. Cartels appear to use the four economic dimensions selectively. Further, the intensity of usage is not particularly high in any of the four economic dimensions, suggesting that a few contractual clauses in a given economic dimension are deemed enough. However, this does not mean, say, that the 48% of cartels not using an ICC clause would not have taken care of the incentive compatibility of their cartel arrangement. It may merely mean that they found the costs of using an explicit contractual clause for the incentive compatibility higher than the benefits such a clause would bring. It is also possible that other dimensions of the contract made having an explicit incentive compatibility clause unnecessary.[20]

[TABLE 2 HERE]

Table 2 takes a first shot at shedding light on the question of how popular the different types of contracts are. Before moving to the analysis where we look at the 18 contract clauses, we here consider a cartel contract to be a four-tuple {MPA, ICC, ICO, ECC}, where each element takes the value 1 if the contract of a cartel has at least one contractual clause that belongs to the corresponding economic dimension $d$ (i.e., the extensive margin). We call a specific combination of the different contracting dimensions a contract type and note that there are at most 15 distinct contract types that we

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[20] The cement cartel in the data may serve as an example: the two firms agreed on geographical market allocation. Given the locations of their production facilities, this may have made the use of explicit incentive compatibility clauses unnecessary as (apart from maybe at the border of their allocated regions), the only way to cheat on the contract on a large scale would be to open a production facility in the other firm's territory. This of course would be easy to verify.

*could* observe.[21] As the first column of the table reveals, only ten contract types can be identified from our data. The second and third columns show, in turn, that 39% (42 out of 109) cartels use the most popular contract type and 27% (29 out of 109) the second most popular one. The distribution of contract types is thus skewed. Indeed, 90% of the cartels use one of the five most common contract types, as spanned by the four economic dimensions. We easily reject the null hypothesis of cartels randomly covering some combination of the four economic dimensions

As the panel displaying the extensive margins shows, the most popular contract type is the one where each of the four economic dimensions is covered. Somewhat surprisingly, given the emphasis economic research has put on the incentive compatibility conditions of cartels, the second most popular contract type covers all other dimensions *but* the ICC dimension. The three most popular contract types which are chosen by 73% (80 out of 109) of the cartels are all fairly comprehensive, covering at least three of the four economic dimensions.

The last columns of Table 2 show the intensive margins of the contract types (i.e., the fractions of the various contractual clauses in economic dimension *d* that are used in each contract type). When we look at the intensive margin of covering the different economic dimensions we find, on the one hand, surprisingly little variation over the contract types. On the other hand, we find – as we already inferred from Table 1 – that intensity of usage is not particularly high in any of the four economic dimensions, suggesting that a few contractual clauses in a given economic dimension are deemed enough. This is especially true if we concentrate on the five most common contract types.

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[21] This means that we view the cartels as having the choice of choosing any of the 15 possible combinations of economic dimensions available to them. We exclude the possibility of not choosing any – this would result in there not being a contract. Note that the space of the contract types is conditional on the number of underlying metrics. That is, here the potential space is defined by the four economic dimensions: $2^4 - 1 = 15$.

In sum, the descriptive statistics of Table 1 and 2 show that almost all contracts have at least one profit (MPA) clause, making it – unsurprisingly – a fundamental building block of cartel contracts. However, we observe that there is a lot of concentration (only a small fraction of all potential contract types is used) and that cartels use the remaining three economic dimensions – ICC, ICO and ECO – quite selectively. This means that there is a lot of potentially interesting heterogeneity in how cartels deal with instability. Taken together, these features of the contract data suggest that we should take a closer look at the MPA, i.e., how cartels try to raise profits and, in particular, whether this choice has implications to the rest of the contract.

# 4 Analysis of contract structure

This section starts with the most fundamental issue: How do cartels choose to raise profits? If we observe a pattern in this, the next step is to relate this pattern with the various ways in which the cartels solve instability issues.

## 4.1 How do cartels raise profits?

We start by taking a look at how prevalent the various MPA clauses are (Table 3) and at their unconditional correlations (Table 4).

Table 3 shows that *Pricing*, *Market allocation*, *Non-competition/specialization* and *Technology* are more common than *Efficiency* and *Non-price clauses* in our sample. Table 4 shows, in turn, that out of these more common clauses, *Pricing* is negatively (and mostly significantly) correlated with the other, more common MPA clauses. *Market allocation* is not correlated the other more common clauses. Finally, *Non-competition/specialization* and *Technology* are positively correlated.[22]

[TABLES 3 AND 4 HERE]

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[22] Of the 63 cartels using *Pricing*, 22% use also *Market allocation* and 10% *Non-competition/specialization*; of the 29 cartels using Market allocation, 48% use *Pricing* and 41% *Non-competition/specialization*; and of the 42 cartels using *Non-competition/specialization*, 14% use *Pricing* and 29% *Market Allocation*.

These patterns suggest the existence of three MPA-driven *contracting approaches* − as we will call them henceforth. The three contracting approaches are built around the most prevalent MPA clauses, with their cores referring to *Pricing* (often together with *Non-price*), *Market allocation* and the amalgam of *Non-competition/specialization* and *Technology,* which are highly correlated with each other (we will refer to this amalgam as *Non-Comp-Tech*). This view is strengthened when one compares the use of *Pricing*, *Market allocation* and *Non-competition/specialization* to the use of the other three MPA clauses. Of the 105 cartels that use at least one MPA clause, 99% (=104/105) use at least one of *Pricing*, *Market allocation* and *Non-competition/specialization*, whereas only 47% (= 49/105) use at least one of the remaining three.

Seen this way, we find that that while all cartels agree on some mechanism to raise joint profits, they largely use three different approaches that appear to be substitutes. As we will show below, the data indeed support this emerging anatomy: it can be found also via a graphical cluster analysis (see below) and once we condition on observable cartel characteristics. Perhaps as importantly, we find that choosing any one of the three most prevalent MPA clauses has implications to the rest of the contract. This means that there appears to be three main contracting approaches that cluster around the most prevalent MPA clauses.

## 4.2    How do cartels deal with instability?

Table 5 explores whether the various clauses via which cartels try to deal with instability are systematically associated with the MPA clauses. This we do by displaying the unconditional correlations of the various MPA clauses both with the three economic dimensions (ICC, ICO and ECC) and also with the individual clauses of which they consist.

Focusing on the extensive margin w.r.t. ICC, ICO and ECC, it seems that the three MPA contract types have a particular correlation structure with the rest of the con-

tract. *Pricing* and *Market allocation* are positively correlated with the use of ICC and ICO and negatively, or not at all, with the use of ECC. The amalgam *Non-Comp-Tech*, on the other hand, is negatively correlated with the use of ICC and ICO but positively with the use of ECC. The unconditional correlations of the various MPA clauses with the individual clauses of ICO, ICC and ECC reveal more heterogeneity, but are broadly consistent with these patterns.[23] These findings imply that choosing one of the (more common) three MPA clauses has implications to the rest of the contract. This leads to the three basic contracting approaches to which we alluded above.

[TABLE 5 HERE]

To check that the findings that we have documented so far are not an artifact of how we have approached the data, we change the level of analysis and go from the four economic dimensions to the 18 contract clauses. This means that the size of the space of possible contract types now grows to 262 143 (= $2^{18} - 1$).

Before we take a graphical look at how the data are clustered in the larger contracting space, we make three observations. First, it turns out that in our data, only 77 unique contract types can be observed in the larger 18-dimensional contracting space. If anything, this confirms that only a small fraction of all potential contract types is used and, thus, that there is concentration and clustering in the data. Second, the most popular contract type in the space of 18 contract clauses is used by 8% (9/109) cartels. In line with the analysis along the four economic dimensions, it spans all four of them. The second most popular contract type spans three of the four economic dimensions and is

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[23] To be more precise, the table shows the following: i) *Pricing* is correlated positively and significantly with ICC clauses *Monitoring* and *Expel*; positively with the ICO clauses *Structure*, *Vote* and *Association*, but negatively with *Dispute*; and negatively with the ECC clauses *Non-cartel supply* and *Entry* but positively with *New members*. It is worth pointing out that the positive correlation between *Pricing* and *Monitoring* is in line with the stylized facts underpinning the model of Harrington and Skrypacz who highlight that the cartels they study agree on prices, and have a monitoring scheme. ii) *Market allocation* is positively correlated with three of the four ICC clauses (*Monitoring*, *Enforcement*, *Fine*), but only with one ICO clause (*Dispute*) and one ECC clause (*Non-cartel supply*). iii) *Non-competition/specialization* on the other hand is negatively correlated with all four ICC clauses. It is also negatively correlated with three ICO clauses (*Structure*, *Vote*, *Association*), and positively with one (*Dispute*). In the ECC dimension, it is negatively correlated with *New members*, but positively with the other two.

used by 5% (5/109) of the cartels. Again, in line with our previous results, but surprisingly given the existing literature, it contains no ICC clauses.[24] Defining contracts to be close when they differ in at most the use of two clauses, we find that 31% (34/109) of the cartels use one of the two most popular contracts, or contracts close to them. Finally, the most complicated contract uses 78% of the contract clauses (i.e., 14 out of 18) on which we collected information. On the other hand, the simplest ones use only one of the MPA clauses.[25]

[FIGURE 1 HERE]

Figure 1 displays the contract data in a three-dimensional graph. The columns are the 77 contract types observed in the data and the rows the 18 contract clauses. Thus by taking a column and reading the rows one can find out what clauses that particular cartel contract uses. The height refers to the number cartels that use a given contract clause combination. The figure confirms the existence of three basic contracting approaches. Two of them are easier to identify from the graph: the group of contracts that use *Pricing* cluster in the South-East corner and the group of contracts that are associated with the amalgam of *Non-Comp-Tech* clusters in the North-West corner. The third group that

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[24] We can also look at how many contracts are "one step" away from the two most popular contracts in that they use at most one additional clause, or at most one fewer clauses. It turns out that there are three cartels that use a contract type that is otherwise similar to the most popular contract type, but utilizes one more ICO clause. When we look at contract types that are one step away from the second most popular contract, we find two. They both utilize one clause less (either *Technology* or *Non-cartel supply*) and are both used by two cartels. We define being "two steps away" similarly: Two contracts are at most two steps away from each other if either contract $i$ uses all the clauses that contract $j$ uses, and at most 2 others; or $i$ uses all but one of the clause that $j$ uses, and at most one other.

[25] The cartel with 14 clauses was a joint sales organization of plastics manufacturers. The four clauses this cartel did not use are *Non-price*, *Monitoring*, *Meeting* and *Entry*. The six cartels with only one clause are: a cement cartel that used *Market allocation* (geographic territories); a cartel on manufacturing of bicycle parts (*Non-competition/specialization*); a cartel on steam boiler production (*Pricing*); a cartel on manufacturing of metallic construction items (*Pricing*); a cartel on manufacturing of leather bags and other leather apparel (*Pricing*); and a cartel on manufacturing of made-up textile goods except wearing apparel (*Pricing*).

uses *Market allocation* is harder to identify visually, as it is more scattered across the contracting space.[26]

## 4.3     Summary

In sum, we find that that all cartels agree on some mechanism to raise joint profits, but use different approaches. The most commonly used MPA-clauses appear to be substitutes. Perhaps as importantly, we find that choosing any one of the three most prevalent MPA clauses has implications to the rest of the contract. Thus, there appears to be three main contracting approaches that cluster around the most prevalent MPA clauses.

# 5     Contract heterogeneity

In this section we study how observable cartel- and industry characteristics, such as the size of cartels and product homogeneity/differentiation, correlate with the design of cartel contracts. We do it in two ways. First, we consider the observable determinants of the 18 contractual clauses. Second, we redo the correlation analysis of the previous section to check the extent to which the unconditional correlation structure between the various contract clauses can be explained away by the observables.

## 5.1     Observable heterogeneity in contract anatomy

We report here results from Probit models where the dependent variables are the four economic dimensions and the 18 contractual clauses of which they consist. These esti-

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[26] The figure can be reproduced by using cluster analysis, though the match is not perfect. Cluster analysis typically suggests the existence of three clusters, though this depends somewhat on the method of clustering. Another way to identify the contracting clusters is to condition on, say, *Pricing* and to ask what the most popular contracts (that use this clause) are and what other clauses such contracts have in common. One can also explore how many contracts are "one step away" from the most popular contract that uses *Pricing*. Doing this would result in a picture very similar to Figure 1.

mations allow us to directly study how the use of a certain contract clause is associated with observable industry and cartel characteristics.[27]

The key explanatory variables are the number of cartel members and the indicator that measures product differentiation (*homogenous_d*) in the industry. We also control for other industry characteristics and the state of the macroeconomy at the time of writing the contract. The industry characteristics are the gross value of production (GVP), the (raw) material cost divided by GVP, the ratio of blue-collar hours to GVP, and the number of plants in the industry, all measured at the 4-digit industry classification of the cartel. All industry variables are measured one year prior to the cartel registering. We include the following macro variables: HP-filtered GDP and positive and negative shocks to GDP.[28] By using these three variables we can separately identify the effect of the level of GDP, and of positive and negative shocks to GDP, on cartel contracts. We also include the year of registration to capture unobserved time-specific determinants of cartel contract design.[29] The estimations use a sample of 107 cartels, as we lack information on the number of members for two cartels.[30]

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[27] We estimate individual probits instead of following the standard discrete choice approach (e.g. McFadden and Ruud 2000) of treating the different potential cartel agreements as different "products" in a choice set, from which each cartel chooses the one that maximizes its utility. The main reason is the size of the choice set (relative to the number of cartels we observe). An auxiliary reason is that in that approach we should include into our sample industries without cartels. As registration was not compulsory we cannot be sure that an industry without a registered cartel did not actually have one. In Hyytinen, Steen and Toivanen (2011) we study the determinants of cartel births and deaths with a model that takes this ignorance into account.

[28] Detrending was done using a smoothing index of 100. Note that both deviations are defined in absolute terms.

[29] For 12 industries, we miss one or the other industry characteristic. We then use an imputed value, which is the predicted value of the 4-digit value, the prediction taken from a regression of the 4-digit value of the industry characteristic on the 2-digit value, measured in the same year. For those couple of observations where we lack the 2-digit information, we use the 4-digit mean. We include a separate dummy (*replace_d*) for these observations in all but those equations where the outcome variable has no variation conditional on *replace_d* taking value one (or zero). Our results are robust to excluding the observations with missing industry characteristics.

[30] These are both *Pricing* cartels, one in shoe manufacturing, the other in manufacturing of furniture.

Tables 6 and 7 present the average marginal effects for cartel size and the homogenous industry dummy for the MPA clauses and the ICC, ICO, EEC clauses, respectively.[31]

[TABLES 6 and 7 HERE]

**Cartel size**

Out of the six MPA clauses, only one (*Market allocation*) is not significantly correlated with cartel size. Four of the significant marginal effects are negative, and only *Pricing* is positively correlated with cartel size. Interestingly, cartel size is differently associated with the three, most commonly used MPA clauses: *Market allocation* is uncorrelated, *Pricing* positively correlated and *Non-Comp-Tech* negatively associated with cartel size. This suggests that the way in which a cartel decides to increase profits and, by implication, its chosen contracting approach, is related to the number of cartel members.[32]

Turning to the instability clauses, we find (from the R.H.S. of Table 6) that the extensive margin of the three economic dimensions (ICC, ICO, ECC) are significantly and positively affected by cartel size. As Table 7 shows, the picture is somewhat richer at the level of individual clauses.[33]

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[31] The marginal effects for the macro- and industry heterogeneity controls are for brevity presented in Tables A3 and A4 in the Appendix.

[32] The median number of members using *Pricing* is also larger (7) than those using either *Non-Comp-Tech* (2) or *Market allocation* (3). (See Table A1).

[33] To be more concrete, we find the following: The marginal effects of cartel size for clauses on internal cartel organization (ICO) are either significantly positive (3), positive (1) or very close to zero (1), clearly suggesting that cartel size is positively correlated with the use of organizational ICO clauses. For ICC and ECC the disaggregated effects are of both signs and thus more difficult to interpret, but the results suggest that the predominant aggregate effect is that the use of instability clauses is positively correlated with cartel size.

**Product differentiation**

The homogenous goods-dummy is significantly positively associated with the use of two of the six MPA clauses (Table 6): *Market allocation* is more likely and the *Efficiency* clause less likely to be used by cartels in homogenous goods industries.[34]

We find that the homogenous goods-dummy is positively associated with the extensive margin of ICC, ICO and ECC (Table 6). However, only the last (ECC) is statistically significant. This nevertheless suggests marginally increased usage in homogenous industries. Echoing this, we find from Table 7 three statistically significant positive marginal effects and no negative and significant ones: one of the positive and significant marginal effects is for an ECC clause (*Entry*), while the other two are for ICC clauses (*Monitoring, Enforcement*).

**Macro- and industry heterogeneity**

While not reported here (see the Appendix, Tables A3 and A4, for details), it is worth pointing out two things about how industry characteristics and macroeconomic variables are associated with the four economic dimensions. First, both industry characteristics and macro variables primarily affect use of profit (MPA) rather than instability (ICC, ICO, ECC) clauses.[35] Second, there are some clear differences among the most common MPA clauses: *Market Allocation* is not much affected by industry and cartel

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[34] Moreover, we see from from Table A1 that as many as 77% of the *Market allocation* cartels are found in homogenous goods industries, but only 33% of the cartels choosing *Efficiency* are in homogenous goods industries.

[35] Of 52 MPA parameters, 25 are significant, whereas only 32 out of 130 instability clause-parameters are significant. More generally, the most significant industry characteristics are gross value added (*gvp*) and material share divided by gross value added (*material share*). Of the seven significant *gvp* parameters, five are positive suggesting increased contract clause usage with increased *gvp*. Of the seven significant *material share* parameters, five are negative suggesting that as (inverse) productivity increases, contract clause usage is (reduced) increased. The most significant macro controls are the shock variables. The marginal effect from positive shocks are negative in five out of eight significant cases, whereas for negative shocks six out of eight significant marginal effects are positive.

heterogeneity, *Pricing* is sensitive to macro shocks, and *Non-Comp-Tech* is correlated with changes in both macro- and industry heterogeneity.[36]

## 5.2 Unobservable heterogeneity in contract anatomy

Here we redo the correlation analysis of the previous section (i.e., Tables 4 and 5) by studying the matrix of correlation coefficients between the *generalized residuals* of the estimated Probit models. This conditional correlation analysis allows us to check the extent to which the unconditional correlation structure between the various contract clauses can be explained away by the observables.

The correlations of the generalized residuals are displayed in Table 8. We have two main findings. First, the relationship across the MPA clauses stays more or less the same when we compare these correlations to the unconditional ones in Tables 4. Second, the relationship between the MPA clauses and the instability clauses changes. The unconditional correlations (reported earlier in Table 5) told us that there was a pattern across each of the three most commonly used MPA clauses and the instability clauses. Now this pattern mostly disappears or gets weaker. In particular, the correlation between MPA clauses and ECC and ICC disappears.[37] The relationship between ICO and the MPA clauses are also weakened, but not by as much. It is important to note that when we *exclude* the number of members and *homogenous_d* from the Probit specifications, the correlations between the generalized residuals are again close to the unconditional correlations.

[TABLE 8 HERE]

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[36] *Market Allocation* is significantly positively correlated with gross value added only, and *Pricing* is significantly decreasing in both GDP shocks and the HP trend but correlated only with one industry characteristics (*plants*). For *Non-Comp-Tech* three of the four macro-shock parameters come in significant and positive and five out of eight industry characteristics' parameters are significant. Of the three MPA contract types, only *Pricing* is affected (positively) by the year of entering the Registry.

[37] Looking at the relationship between MPA and the instability clauses (individual clauses and extensive margins) we find for ECC that 13 of the 24 unconditional correlation coefficients were significant, now only seven are significant. For ICC were the number of significant correlations is reduced from 13 to five out of 30. Finally, while 18 of 36 the unconditional correlations between MPA and ICO were significant, the number is now reduced to 14.

To be a bit more specific, we find that after conditioning, i) *Pricing* is no longer correlated with ICC, ICO and ECC;[38] ii) the *Market allocation* contract clause correlations do not change much, mirroring the finding that *Market Allocation* contracts were less affected by industry- and macro heterogeneity than the two other more commonly used MPA clauses;[39] and iii) *Non-competition/specialization* is still negatively correlated with ICO, but is not correlated with ICC and ECC anymore.

## 5.3    Summary

Summing up the results on observed heterogeneity we find that the size of the cartel is associated with the choice of how to raise profits, being positively correlated with the use of *Pricing*, negatively with the use of *Non-Comp-Tech*, and uncorrelated with *Market Allocation. Market Allocation* is positively correlated with the cartel operating in a homogenous goods industry. Cartel size and being in a homogenous goods industry are both (mostly) positively associated with the use of instability clauses in ICC, ICO and ECC.

The relationship between the three most commonly used MPA clauses is robust to cartel-/industry heterogeneity and business cycle conditions. However, the relationship between the three most commonly used MPA clauses and the instability clauses gets weaker. It is thus the observables, in particular the number of members and the homogenous goods -dummy, that drive many of the unconditional correlations.

Although our results are correlations instead of causal results, one may want to speculate about the mechanisms bringing them about. The positive correlation between

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[38] After conditioning on observables, *Pricing* is significantly correlated with no ICC, three ICO (negatively with *Dispute*, positively with *Vote* and *Association*) and one ECC clause (negatively with *Non-cartel supply*) whereas without conditioning it was correlated with two out of four ICC, four out of five ICO and all three ECC clauses.

[39] The positive correlations between *Market allocation* and ICC and ICO clauses are actually strengthened in terms of statistical significance. Note also that now all ICC clauses and two additional ICO clauses (*Vote*, *Structure*) positively and significantly correlate with *Market allocation* in addition to *Dispute*. Note though that the sizes of those correlations that were significant without conditioning are slightly decreased.

*Pricing* and cartel size may be explained by the fact that large cartels would find it harder to e.g. allocate markets than agree on prices; similarly, coming up with ways of avoiding competition through specialization may become increasingly hard as the number of members increases, along the lines discussed in the literature on endogenously incomplete contracts. A possible reason for the correlation between *Market Allocation* and the homogenous goods -dummy could be that it is easier to divide markets (e.g. geographically) when the product is homogenous.[40] Another potential explanation for the positive correlation could be that many homogenous goods industries sell to other firms instead of consumers. In such markets prices aren't necessarily observed, making coordination on prices harder to monitor.[41]

# 6 Complexity and stability of contracts

While the above results already speak to the variation in the complexity of contracts, we have not explored complexity directly. In this section we first regress the complexity and stability of cartel contracts on a set of cartel and industry variables. We then study three cartels in more depth and find that these analyses support our earlier findings.

## 6.1 Regression analysis

We employ two measures of "complexity": the number of clauses used by the cartel, and the length of the contract, measured in pages.[42] Our measure of contract stability is the number of times the cartel registered a change of contract with the Registry. This measure is related to contract complexity and mirrors how stable the contracts were

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[40] This could be so as when buyers have heterogenous tastes, allocating markets among producers of differentiated products leads to a reduction in the choice set of individual customers, and thereby to reduced social surplus (and firm profits).

[41] In such circumstances it may be easier to monitor an agreement on market allocation. Supporting the latter argument, transport costs may play a bigger role in many homogenous goods markets (as customers have no reason to pay a premium for their most preferred product), making (geographic) market allocation more attractive as the opportunity cost of "giving" up more distant customers to a fellow cartel member is lower than in a differentiated goods industry.

[42] Taylor (2007) also applies the number of pages as a measure of complexity in his study of the cartel codes from the National Industrial Recovery Act.

from a contracting point of view, i.e., how the characteristics of the cartel, the initial contract, and the environment at the time the initial contract was registered affect the number of times the contract was changed.

Table 9 presents eight Poisson regressions that shed light on the complexity of cartel contracts. There are three dependent variables in the table: the number of clauses in a contract, the number of pages of the contract and the number of contract changes.[43] The explanatory variables include the number of members and the homogenous goods, as well as the same industry and macroeconomic variables as used in the Probit models earlier. In addition to these, we include the MPA clause indicators and the extensive margin for the instability clauses (ICC, ICO and ECC) in some of our regressions.[44]

[TABLE 9 HERE]

Table 9 generates three main findings. First, the number of clauses is positively correlated with the number of members, suggesting that large cartels have more comprehensive and complex contracts (columns 1 and 2). The number of pages is also positively correlated with the number of members, but this coefficient becomes insignificant when we include controls (columns 3, 4 and 5). A potential explanation for the positive association between contract complexity and number of members is that an increase in the number of members raises the cost of relying on informal agreements as opposed to relying on formal contract (clauses). Second, the degree of product differentiation is not correlated with the number of clauses, but we do find that cartels in homogenous goods industries have shorter contracts.[45] While not entirely conclusive, these findings could be explained by homogenous goods industries having less need to contract on product characteristics and quality. Third, we find that cartels using *Pricing* and *Market Alloca-*

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[43] The distributions of the number of clauses and the number of contract changes are presented in Table A6. The mean number of contract clauses (pages, contract changes) is 5.60 (3.32, 1) and the standard error 2.48 (1.99, 1.40).

[44] The control variable coefficients are tabulated in Table A6 in the Appendix.

[45] None of the industry- and macro characteristics are significant (Table A6, column 2).

*tion* contracts write longer contracts.[46] Cartels using ICC and ICO clauses also have longer contracts.[47]

Turning then to columns 6, 7 and 8 of Table 9, we find that the number of contract changes seems initially positively correlated with both cartel size and the homogenous goods-dummy. These results however disappear when we include controls. *Pricing* cartels have significantly more contract changes and *Non-Comp-Tech* cartels fewer contract changes. The first result is not entirely surprising, as some of the contract changes are about changes of prices. *Market Allocation* cartels are no different from the other MPA contract types.

Looking at the industry- and macro controls in Table A5 we find that both the GDP level (*HP-trend*) and positive macro shocks (at the time of registering the cartel) affect the number of contract changes positively. This suggests that cartels that are formed during a boom experience more contract changes during their lifetime. (See Table A5, column 8).

## 6.2    Case studies

In this sub-section we provide short case studies of three cartel contracts: one *Pricing*, one *Market allocation*, and one *Non-comp-Tech* cartel case. Our choice rule was to choose the earliest registered cartel in a homogenous goods industry that uses (only) one of the three aforementioned MPA clauses. This resulted in us presenting here the match producers cartel (Case #1), the cement cartel (Case #2), and the plywood box cartel (Case #3).

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[46] This corresponds with the median length of contracts (Table A1): *Pricing* and *Market Allocation* contracts have medians of three and four pages respectively; the *Non-Comp-Tech* contracts a median of two (*Non-competition/specialization*) or three (*Technology*).

[47] The business cycle movements seem to matter in that the coefficient of HP-trend is significant and negative. One should note however that there is also a positive trend through the positive significant effect from the registry birth parameter (Table A6 column 5).

It turns out that all these cartels used relatively short and simple contracts. This is consistent with the above regression results, as they all have a small number of members and are in homogenous goods industries.

**Case #1: The match producers cartel**

Finnish match producers formed a pricing cartel as early as 1927. The cartel consisted of an informal (unregistered) association and the Match Industry's Price Committee, as it was called. All Finnish match producers participated in this collaborative effort, but the number of members appears to have varied a little over time; at the time of the cartel was registered, it had 7 members (see below). The cartel agreed on prices, discounts to wholesale customers and cash purchases. It also agreed on the size of match boxes, and on prices of different labels on the boxes, and therefore also *Non-price* takes values one. The cartel also decided that the contract would continue on a calendar year basis unless some of the parties discontinue it. As the original contract contained no further issues on which the cartel agreed, all the remaining 16 clauses are given value zero. When the cartel was contacted by the Registry in 1961, they stated as the objective the "organization of domestic sales of matches". They also announced some changes to the earlier agreement that had to do with the pricing of different labels. The organizational form changed in 1971 when the Finnish Match Association was formed – thus the value of *Structure* would have changed from zero to one in 1971.[48] The Association took over the duties of the Price Committee. The cartel continued to fix prices, but now also had a written contract which is 3.5 pages long. The contract lists the members, states that there is to be an annual meeting, and has rules on voting and exit. Moreover, the contract has a clause on dispute resolution; in case of a dispute the members would resort to arbitration by the Finnish Chamber of Commerce. All of these are features included in

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[48] Recall that in our data we have coded the clauses in the original contract or the contract in place at the time of registration. Thus the clauses added in 1971 for the match producers do not enter our data.

our data. The final correspondence between the cartel and the Registry is in 1986. A member of the cartel has sent a letter stating that the Finnish Match Association has not had any activities "for a number of years". The Registry therefore decides to remove the cartel from the Registry as of 1986.

The match producers cartel is an example of a relatively small pricing cartel in a homogenous goods industry. They got by for more than 40 years with a relatively simple and informal organization, and by only using a few clauses. What is notable is that they did not agree on any type of monitoring at any point, not even in 1971 when they changed for a much more formal organization and added several clauses to their contract.

**Case#2: The cement cartel**

The cement cartel is an example of a market allocation cartel in a homogenous goods market. The two Finnish cement producers' cartel was registered in 1959. The firms announced that they had agreed to divide Finland geographically, with the smaller firm (whose market share was given as 35%) concentrating on the area that in the south was round the capital Helsinki, and which extended to the north to a couple of municipalities (called Haapajärvi and Vieremä; see map in the Appendix). The production facility of the smaller member was located (in 1959) west of Helsinki in the town of Lohja. Both to west and east of this area, as well as north of it was the designated area of the larger member (with market share of 65%). The reason for this particular split of the market was the location of production facilities. The larger competitor had in 1959 a production facility in the south-eastern town of Lappeenranta, which allowed it to service eastern Finland with the lowest possible transportation costs (as lake transport was readily available). The other production facility of the larger member was in 1959 in the south-west town of Parainen on the coast. This location allowed relatively cheap sea transport to the northern port of Oulu and thereby northern Finland was allocated to this mem-

ber.[49] The firms also produced quicklime with 1959 market shares of 20-50% for the larger firm and 20-40% for the smaller, depending on the type of quicklime.

There was further correspondence between the Registry and the cartel in 1966. The cartel declared that no essential changes in their operation had taken place, but notifies the Registry that in parts of southern Finland both producers' cement is offered. The declared market shares were now "circa 64%" and "circa 35%". There is further correspondence in 1979. Now the declared market shares are "circa 64%" and "32-36%", which is indicative of a stable arrangement. The larger cartel member states in its letter that "the marketing areas of cement are determined by customer choices, driven largely by transport costs". This cartel has the simplest contract observed by us, as they only agreed on geography-based market allocation.[50]

**Case #3: The plywood box cartel**
Two manufacturers of plywood boxes made an agreement in 1964 whereby one of them ceased the production of these products altogether. It also committed itself to not re-enter the business for 15 years, and to neither sell nor allow the use of its machinery. Also, it committed to not reveal its knowhow of plywood box production to any domestic competitor. We therefore coded this cartel to use two more clauses besides *Non-competition/specialization*: *Non-cartel supply* and *Entry*. As compensation the firm continuing production promised to pay a royalty on its plywood box revenues to the firm ceasing production. In the correspondence with the Registry the firms stated that this agreement did not result in a monopoly,[51] and also asked for the Registry not to publish the clause on royalties. In 1981 the Registry approached the firms and they declared that

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[49] Lohja, the town where the other member had its sole production facility, is not on the coast.

[50] It turns out that in separate contracts, given different entry numbers by the Registry, the two firms agreed on discounts with their downstream retailers. In effect, they ensured a price-cost margin to their retailers through these contracts without agreeing on a final price for their products.

[51] Unfortunately we could not establish the market shares of these two firms.

the contract had not been extended, and that also the other firm had ceased production of plywood boxes. The cartel was therefore removed from the Registry.

## 6.3    Summary

In sum, we find that smaller cartels use less complex contracts and that cartels in industries producing homogenous goods appear to write shorter contracts. In terms of contract dynamics, contract changes are seen more often in *Pricing* cartels and less often in *Non-Comp-Tech* contracts. The cases support these results, as all the three case cartels use relatively short and simple contracts. The case studies thus support the view that in certain circumstances, even quite simple cartel contracts appear to be sufficient to sustain collusion.

# 7    Discussion

In this section, we discuss briefly three issues: first, do our results generalize to beyond the sample of 109 manufacturing industries and cartels? Second, how do our results compare to what is known about cartel contracting in other institutional environments and countries? Third, we discuss the relationship between legal and illegal cartel contracts.

Our analysis has focused on the 109 nationwide manufacturing cartels that were the first registered cartels in a given (3-digit) industry. To check how representative this sample is, we use more limited information from a larger sample of 902 legal cartels from the same era.[52] This sample covers both manufacturing and non-manufacturing industries. The sample contains information on the use of *Pricing*, *Market-allocation*, and *Non-competition/specialization*. We find that 37% of the manufacturing cartels in the large sample use *Pricing* when the 58% of cartels in our sample do; 27% use *Market-allocation* (27% in our sample) and 52% use *Non-competition/specialization* (39%

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[52] In the large data, 480 (345) out of 541 (361) manufacturing (other) cartels use at least one of these three clauses, i.e. 89% (96%).

in our sample). As in the smaller sample, these MPA-clauses are negatively correlated. The differences to the cartels *outside* manufacturing are larger: These use *Pricing* clearly more often (78%), and *Market-allocation* and *Non-competition/specialization* less often than the manufacturing cartels (6% and 22%). There is thus a reason to think that non-manufacturing cartels use different contracts than manufacturing cartels, but that our sample seems representative of the larger sample.

Our findings augment those of Suslow and Levenstein (2011): in their sample of international illegal cartels 81% use market allocation compared to 27% in our data. Note though that according Levenstein and Suslow (2011, Table 3), earlier studies looking at legal cartels report numbers very similar to ours. Further, in Levenstein and Suslow's sample, 72% of cartels use monitoring and 39% have a hierarchy where the comparable figures for us are 24% (*Monitoring*) and 42% (*Structure*). 29% of their cartels involve a trade sales association where for us the figure is 52%. Comparing the characteristics of the cartels in our sample to those studied by Harrington (2006) we find more heterogeneity. For example all cartels in Harrington's sample agree on prices, and, though this is more difficult to judge, it seems cartels in Harrington's sample used more complex organizations than the average cartel in our sample. The former could be the result of the international illegal cartels being unable to use market allocation as it could have lead to a higher detection probability. The latter may be explained by the very fact that international cartels need a more complex organization than national cartels.

Our contract characteristics are not easily compared to those recorded by Taylor (2007). Our results on the complexity of cartel contracts are however in line with his, as Taylor also found, using data on U.S. legal cartels from the 1930s (the National Industrial Recovery Act), a positive but insignificant correlation between size and number of pages, and no significant relationship between pages and degree of differentiation.

It seems clear that the need of illegal cartels to conceal their agreements and behavior will lead to further endogenous incompleteness of contracts, compared to legal cartels. From this point of view one could think that the contracts we've studied are the type of contracts illegal cartels would like to have, were it possible. This would mean that observed differences between contracts of legal and illegal cartels could be assigned to the competition law regime that the latter face. The reasoning behind this statement is that the profit, incentive and organizational issues illegal cartel face, as well as those relating to changes in the external environment, are similar to those faced by legal cartels.

# 8    Conclusions

We find that while essentially all cartels agree on some mechanism to raise joint profits, they differ in how they do this. By and large, we find three basic contracting approaches: cartels either agree on prices, allocate markets, or use some type of non-competition/specialization clause to raise profits. These are substitutes. Choosing one of these has implications to the rest of the contract when considering the unconditional data. For example, unconditionally, the *Market allocation* cartels use more incentive compatibility (ICC) and organizational (ICO) clauses, whereas *Pricing* is positively correlated with ICC and ICO, but negatively with clauses on external threats (ECC). In contrast, the *Non-Comp-Tech* contracts are negatively associated with ICC, ICO and positively with ECC in the unconditional analysis.

These correlations are however largely explained by the number of members in the cartel, and the industry producing homogenous goods. To be more specific, we find that *Pricing* contracts are positively and *Non-Comp-Tech* contracts negatively associated with the number of cartel members, but *Market allocation* contracts are not affected by cartel size. In contrast, only *Market Allocation* is correlated (negatively) with the degree of product differentiation. The conditional analysis also shows that the correla-

tion structure across the MPA clauses stays more or less the same (when compared to the unconditional one), but that the relationship between the MPA clauses and the instability clauses changes (becoming weaker, in general). Thus, taken together, one could argue that large cartels tend to agree on prices, cartels in homogenous goods industries raise profits by allocating markets, and small cartels agree to avoid competition through specialization.

There are further differences: larger cartels use more complex contracts and cartels in industries producing homogenous goods appear to write shorter contracts. *Pricing* and *Market Allocation* contracts are the most complex in terms of page length. In terms of contract dynamics, contract changes are seen more often in *Pricing* cartels and less often in *Non-Comp-Tech* contracts. We also find that cartels formed during an economic boom write simpler (shorter) contracts, but subsequently have more changes to the contract.

What is clear is that cartel contract characteristics are systematically chosen, and that even legal cartels appear to economize on what clauses they use. It is unclear whether this is due to pre-contractual (and if so, of what type; see, e.g., Battigalli and Maggi 2008, Tirole 2009) or *ex po*st costs. The observed contracts of (detected) illegal cartels are likely to be even more incomplete, because the contracting parties have a strong incentive to reduce the ability of a legal court to verify the contracted actions ness of observed cartel contracts; see, Kvaløy and Olsen (2009). How this endogenous contract incompleteness affects cartel formation and collusive behavior and the ability of competition authorities to detect them (and courts to make a ruling) deserves further scrutiny.

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**Tables**

| Table 1: Usage | | | | |
|---|---|---|---|---|
| | Extensive margin | | Intensive margin | |
| | Number of cartels | freq. | # clauses | freq. |
| MPA | 105 | 0.96 | 6 | 0.30 |
| ICC | 57 | 0.52 | 4 | 0.39 |
| ICO | 93 | 0.85 | 5 | 0.49 |
| ECC | 80 | 0.73 | 3 | 0.43 |

**Table 2: Extensive- and intensive margins for contract dimension usage**

| Contract Type | n | freq. | homog. | Extensive margin | | | | Intensive margin | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MPA usage | ICC usage | ICO usage | ECC usage | MPA usage intensity | ICC usage intensity | ICO usage intensity | ECC usage intensity |
| 1 | 42 | 0.39 | 0.50 | 1 | 1 | 1 | 1 | 0.30 | 0.38 | 0.58 | 0.38 |
| 2 | 29 | 0.27 | 0.48 | 1 | 0 | 1 | 1 | 0.32 | . | 0.39 | 0.46 |
| 3 | 9 | 0.08 | 0.56 | 1 | 1 | 1 | 0 | 0.30 | 0.50 | 0.49 | . |
| 4 | 9 | 0.08 | 0.11 | 1 | 0 | 1 | 0 | 0.33 | . | 0.36 | . |
| 5 | 9 | 0.08 | 0.44 | 1 | 0 | 0 | 0 | 0.22 | . | . | . |
| 6 | 4 | 0.04 | 0.25 | 1 | 0 | 0 | 1 | 0.29 | . | . | 0.58 |
| 7 | 3 | 0.03 | 0.00 | 0 | 1 | 1 | 1 | . | 0.33 | 0.73 | 0.44 |
| 8 | 2 | 0.02 | 1.00 | 1 | 1 | 0 | 0 | 0.25 | 0.25 | . | . |
| 9 | 1 | 0.01 | 0.00 | 1 | 1 | 0 | 1 | 0.33 | 0.25 | . | 0.67 |
| 10 | 1 | 0.01 | 0.00 | 0 | 0 | 1 | 1 | . | . | 0.60 | 0.33 |

| Table 3. Prevalence of MPA clauses | | | |
|---|---|---|---|
| | Mean | | |
| Variable | All | Homog. | Non-homog. |
| pricing | 0.578 | 0.525 | 0.646 |
| market allocation | 0.266 | 0.131 | 0.438 |
| efficiency | 0.083 | 0.098 | 0.063 |
| technology | 0.284 | 0.344 | 0.208 |
| non price | 0.147 | 0.115 | 0.188 |
| non comp spez | 0.385 | 0.426 | 0.333 |

| Table 4. Unconditional correlations of MPA clauses | | | | | |
|---|---|---|---|---|---|
| | pricing | market allocation | efficiency | technology | non price |
| market allocation | -0.116 | 1 | | | |
| efficiency | -0.216** | 0.272*** | 1 | | |
| technology | -0.532*** | 0.082 | 0.180* | 1 | |
| non price | 0.302*** | 0.044 | -0.124 | -0.147 | 1 |
| non comp spez | -0.698*** | 0.035 | 0.310*** | 0.546*** | -0.222** |
| NOTES: ***, **, and * refer to statistical significance at the 1, 5, and 10% levels. | | | | | |

| Table 5. Unconditional correlations between MPA clauses and other economic dimensions | | | | | | |
|---|---|---|---|---|---|---|
| | pricing | market allocation | efficiency | technology | non price | non comp spez |
| ICC | 0.236** | 0.448*** | 0.022 | -0.151 | -0.002 | -0.368*** |
| monitoring | 0.173* | 0.443*** | -0.012 | -0.114 | 0.011 | -0.266*** |
| enforcement | 0.085 | 0.483*** | 0.198** | -0.044 | 0.087 | -0.175* |
| expel | 0.215** | -0.002 | -0.058 | -0.117 | -0.111 | -0.289*** |
| fine | 0.09 | 0.279*** | -0.030 | -0.089 | 0.048 | -0.169* |
| ICO | 0.317*** | 0.226** | 0.05 | -0.236*** | -0.012 | -0.370*** |
| meeting_new | -0.014 | 0.121 | 0.152 | -0.115 | -0.124 | 0.036 |
| dispute | -0.357*** | 0.339*** | 0.233** | 0.278*** | 0.001 | 0.304*** |
| structure | 0.316*** | 0.074 | -0.054 | -0.251*** | -0.145 | -0.371*** |
| vote | 0.436*** | 0.082 | -0.070 | -0.284*** | 0.042 | -0.412*** |
| association | 0.486*** | 0.076 | -0.047 | -0.334*** | 0.137 | -0.565*** |
| ECC | -0.293*** | 0.086 | 0.028 | 0.293*** | -0.111 | 0.263*** |
| new member | 0.395*** | -0.082 | -0.095 | -0.406*** | -0.055 | -0.500*** |
| non cartel supply | -0.529*** | 0.212** | 0.155 | 0.587*** | -0.032 | 0.561*** |
| entry | -0.380*** | -0.015 | -0.030 | 0.313*** | -0.099 | 0.417*** |
| NOTES: ***, **, and * refer to statistical significance at the 1, 5, and 10% levels. | | | | | | |

| Table 6. Marginal effects of MPA contract clause and other economic dimension probit regressions | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | pricing | market allocation | efficiency | technology | non price | non comp spez | ICC | ICO | ECC |
| log(members) | 0.066** | -0.070 | -0.102** | -0.109*** | -0.069** | -0.156*** | 0.262*** | 0.186*** | 0.146*** |
| | (0.032) | (0.043) | (0.046) | (0.037) | (0.030) | (0.055) | (0.043) | (0.057) | (0.042) |
| homogenous_d | 0.027 | 0.219*** | -0.118** | -0.059 | -0.040 | -0.028 | 0.120 | 0.021 | 0.128** |
| | (0.065) | (0.066) | (0.060) | (0.070) | (0.064) | (0.089) | (0.095) | (0.058) | (0.056) |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |
| NOTES: The numbers presented are marginal effect and (s.e.).***, **, and * refer to statistical significance at the 1, 5, and 10% levels. | | | | | | | | | |

| | ICC | | | | ICO | | | | | ECC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | monit | enf. | expel | fine | meeting | dispute | structure | vote | assoc. | new member | non cartel supply | Entry |
| log(members) | -0.049 | -0.058** | 0.294*** | -0.019 | -0.004 | 0.010 | 0.273*** | 0.220*** | 0.115** | 0.219*** | -0.131*** | -1.470*** |
| | (0.031) | (0.024) | (0.036) | (0.022) | (0.015) | (0.022) | (0.040) | (0.050) | (0.052) | (0.033) | (0.043) | (0.197) |
| homogenous_d | 0.181*** | 0.083** | -0.046 | -0.040 | -0.053 | 0.053 | -0.100 | -0.027 | -0.110 | -0.089 | 0.078 | 0.142*** |
| | (0.044) | (0.041) | (0.065) | (0.058) | (0.056) | (0.090) | (0.076) | (0.057) | (0.100) | (0.064) | (0.069) | (0.047) |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

**Table 7. Marginal effects of ICC, ICO and ECC contract clauses**

NOTES: The numbers presented are marginal effect and (s.e.). ***, **, and * refer to statistical significance at the 1, 5, and 10% levels.

**Table 8. Correlations of generalized residuals of MPA clauses and other economic dimensions**

| | Pricing | market allocation | efficiency | technology | non price | non comp spez |
|---|---|---|---|---|---|---|
| market allocation | -0.231** | 1.000 | | | | |
| efficiency | -0.075 | 0.255** | 1.000 | | | |
| technology | -0.256*** | 0.214** | 0.050 | 1.000 | | |
| non price | 0.214** | -0.041 | -0.060 | 0.024 | 1.000 | |
| non comp spez | -0.359*** | 0.080 | 0.178* | 0.269*** | -0.159* | 1.000 |
| ICC | -0.019 | 0.327*** | 0.048 | 0.061 | 0.005 | -0.133 |
| monitoring | 0.030 | 0.334*** | 0.048 | -0.027 | -0.021 | -0.102 |
| enforcement | 0.020 | 0.395*** | 0.048 | -0.027 | -0.021 | -0.102 |
| expel | -0.136 | 0.195** | 0.021 | 0.134 | 0.061 | 0.080 |
| fine | 0.051 | 0.283*** | -0.019 | -0.016 | 0.059 | -0.097 |
| ICO | 0.062 | 0.185* | 0.097 | -0.090 | -0.025 | -0.303*** |
| meeting_new | 0.138 | 0.063 | 0.185* | -0.156 | -0.076 | -0.104 |
| dispute | -0.321*** | 0.223** | 0.109 | 0.241*** | 0.040 | 0.102 |
| structure | 0.135 | 0.198** | 0.116 | -0.056 | -0.209** | -0.207** |
| vote | 0.221** | 0.181* | 0.168 | -0.036 | 0.047 | -0.186* |
| association | 0.192** | 0.072 | 0.063 | -0.026 | 0.087 | -0.265*** |
| ECC | -0.124 | 0.248*** | -0.023 | 0.132 | 0.026 | 0.085 |
| new member | 0.139 | -0.043 | 0.072 | -0.192** | 0.060 | -0.215** |
| non cartel supply | -0.201** | 0.285*** | -0.005 | 0.387*** | -0.003 | 0.225** |
| entry | -0.019 | -0.042 | -0.084 | 0.044 | -0.109 | 0.044 |

NOTES: ***, **, and * refer to statistical significance at the 1, 5, and 10% levels.

**Table 9. Contract complexity and stability**

| VARIABLES | (1) #clauses | (2) #clauses | (3) #pages | (4) #pages | (5) #pages | (6) #changes | (7) #changes | (8) #changes |
|---|---|---|---|---|---|---|---|---|
| log(members) | 0.086*** | 0.097*** | 0.132*** | 0.070 | 0.066 | 0.261*** | 0.075 | -0.105 |
| | (0.018) | (0.025) | (0.042) | (0.057) | (0.089) | (0.082) | (0.139) | (0.143) |
| homog_d | 0.106 | 0.065 | 0.019 | -0.172** | -0.198** | 0.437** | 0.145 | 0.042 |
| | (0.084) | (0.076) | (0.074) | (0.077) | (0.085) | (0.176) | (0.224) | (0.261) |
| pricing | - | - | - | 0.349** | 0.242* | | 1.271*** | 1.197*** |
| | | | | (0.151) | (0.126) | | (0.461) | (0.446) |
| mkt_allocation | - | - | - | 0.333*** | 0.340*** | | 0.241 | 0.272 |
| | | | | (0.123) | (0.114) | | (0.290) | (0.354) |
| efficiency | - | - | - | 0.186 | -0.046 | | 1.038*** | 1.410** |
| | | | | (0.119) | (0.132) | | (0.399) | (0.606) |
| technology | - | - | - | -0.049 | -0.157 | | 0.196 | 0.118 |
| | | | | (0.110) | (0.125) | | (0.314) | (0.452) |
| non_price | - | - | - | 0.197 | 0.144 | | -0.511 | -0.892** |
| | | | | (0.129) | (0.123) | | (0.326) | (0.421) |
| non_comp_spez | - | - | - | -0.026 | 0.021 | | -1.130** | -1.398** |
| | | | | (0.111) | (0.123) | | (0.559) | (0.624) |
| ICC_1 | - | - | - | 0.176** | 0.164* | | 0.220 | -0.231 |
| | | | | (0.088) | (0.104) | | (0.559)... | (0.624) |
| ICO_1 | - | - | - | 0.130 | 0.268* | | -0.214 | 0.079 |
| | | | | (0.153) | (0.138) | | (0.337) | (0.423) |
| ECC_1 | - | - | - | -0.058 | -0.072 | | -0.346 | -0.215 |
| | | | | (0.137) | (0.133) | | (0.288) | (0.219) |
| | | | | | | | | |
| Controls | No | Yes | No | No | Yes | No | No | Yes |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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**Appendix Tables**

| Table A1. Conditional medians/means of cartel characteristics | | | | | | |
|---|---|---|---|---|---|---|
| Conditioning variable | members | duration | pag-es | homogenous goods | #contract_changes | #clauses |
| All | 4 | 5 | 3 | 0.44 | 1 | 6 |
| MPA | 4 | 5 | 3 | 0.457 | 1.029 | 6 |
| Pricing | 7 | 2 | 3 | 0.492 | 1.524 | 6 |
| market alloca-tion | 3 | 5 | 4 | 0.724 | 1.138 | 8 |
| Efficiency | 2 | 5 | 4 | 0.333 | 0.889 | 7 |
| Technology | 2 | 5 | 3 | 0.322 | 0.452 | 5 |
| non price | 4 | 1.5 | 4 | 0.556 | 0.938 | 6.5 |
| non comp spez | 2 | 5 | 2 | 0.381 | 0.286 | 5 |
| ICC | 7.5 | 5 | 3 | 0.491 | 1.333 | 7 |
| ICO | 5 | 5 | 3 | 0.441 | 0.968 | 6 |
| ECC | 4 | 5 | 3 | 0.45 | 0.863 | 6 |
| NOTES: the numbers presented are the medians of the column variables, conditional on the row variable taking the value one for all but homogenous goods and #contract changes, for which we report the mean | | | | | | |

| Table A2. Unconditional correlations of available MPA clauses for all cartels (n=902) | | | |
|---|---|---|---|
| | pricing | market allocation | non comp spez |
| All cartels | | | |
| pricing | 1 | | |
| market allocation | -0.147*** | 1 | |
| non comp spez | -0.488*** | -0.089*** | 1 |
| Manufacturing cartels | | | |
| pricing | 1 | | |
| market allocation | 0.034 | 1 | |
| non comp spez | -0.624*** | -0.334*** | 1 |
| Other cartels | | | |
| pricing | 1 | | |
| market allocation | -0.131*** | 1 | |
| non comp spez | -0.226*** | 0.003 | 1 |

**Table A3. Marginal effects of MPA contract clause and other economic dimension probit regressions**

| | pricing | market allocation | efficiency | technology | non price | non comp spez | ICC | ICO | ECC |
|---|---|---|---|---|---|---|---|---|---|
| log(members) | 0.066** | -0.070 | -0.102** | -0.109*** | -0.069** | -0.156*** | 0.262*** | 0.186*** | 0.146*** |
| | (0.032) | (0.043) | (0.046) | (0.037) | (0.030) | (0.055) | (0.043) | (0.057) | (0.042) |
| homogenous_d | 0.027 | 0.219*** | -0.118** | -0.059 | -0.040 | -0.028 | 0.120 | 0.021 | 0.128** |
| | (0.065) | (0.066) | (0.060) | (0.070) | (0.064) | (0.089) | (0.095) | (0.058) | (0.056) |
| hp_trend | -0.566** | -0.300 | | -0.290 | -0.036 | 0.021 | -0.112 | 0.718 | 0.029 |
| | (0.247) | (0.418) | | (0.222) | (0.300) | (0.297) | (0.342) | (0.448) | (0.262) |
| gdp_neg | -0.882** | 0.165 | 0.423* | 0.832*** | -1.722*** | 1.523*** | 0.239 | -0.018 | 1.073** |
| | (0.394) | (0.571) | (0.220) | (0.244) | (0.401) | (0.498) | (0.504) | (0.329) | (0.474) |
| gdp_pos | -0.547* | -0.289 | -0.126 | 1.118*** | -0.546*** | -0.013 | 0.187 | -1.017** | 1.585*** |
| | (0.307) | (0.303) | (0.185) | (0.188) | (0.150) | (0.246) | (0.250) | (0.471) | (0.576) |
| mat. share | -0.087 | -0.361 | 0.339** | -0.365** | -0.242* | 0.439** | -0.169 | -0.446* | -0.216 |
| | (0.264) | (0.275) | (0.145) | (0.156) | (0.130) | (0.217) | (0.283) | (0.238) | (0.297) |
| hours | -0.034 | 0.017 | -3.572* | 0.176*** | -0.188** | 0.169*** | -0.095* | 0.072 | 0.029 |
| | (0.079) | (0.083) | (1.872) | (0.066) | (0.088) | (0.057) | (0.054) | (0.100) | (0.067) |
| gvp | 0.011 | 0.025*** | 0.006 | 0.008 | -0.007 | -0.030** | 0.034 | -0.002 | -0.008 |
| | (0.011) | (0.009) | (0.006) | (0.006) | (0.008) | (0.012) | (0.021) | (0.005) | (0.011) |
| plants | -0.084** | -0.039 | 0.011 | 0.008 | -0.027* | 0.073 | -0.094 | 0.061 | 0.067 |
| | (0.037) | (0.055) | (0.024) | (0.013) | (0.016) | (0.050) | (0.069) | (0.052) | (0.043) |
| reg. birth | 0.118* | 0.072 | -0.012* | 0.087 | -0.014 | 0.027 | 0.025 | -0.148 | 0.010 |
| | (0.065) | (0.113) | (0.006) | (0.062) | (0.075) | (0.074) | (0.090) | (0.112) | (0.072) |
| replace_d | 0.822*** | 0.062 | 1.183* | 0.122 | | -0.931*** | 0.468 | -0.604* | -0.708** |
| | (0.254) | (0.392) | (0.631) | (0.115) | | (0.317) | (0.471) | (0.338) | (0.304) |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

NOTES: The numbers presented are marginal effect and (s.e.).

***, **, and * refer to statistical significance at the 1, 5, and 10% levels.

| | Table A4. Marginal effects of ICC, ICO and ECC contract clauses | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ICC | | | | ICO | | | | | ECC | | |
| | monit. | enf. | expel | fine | meeting | dispute | structure | vote | assoc. | new member | non cartel supply | entry |
| log(members) | -0.049 | -0.058** | 0.294*** | -0.019 | -0.004 | 0.010 | 0.273*** | 0.220*** | 0.115** | 0.219*** | -0.131*** | -1.470*** |
| | (0.031) | (0.024) | (0.036) | (0.022) | (0.015) | (0.022) | (0.040) | (0.050) | (0.052) | (0.033) | (0.043) | (0.197) |
| homogenous_d | 0.181*** | 0.083** | -0.046 | -0.040 | -0.053 | 0.053 | -0.100 | -0.027 | -0.110 | -0.089 | 0.078 | 0.142*** |
| | (0.044) | (0.041) | (0.065) | (0.058) | (0.056) | (0.090) | (0.076) | (0.057) | (0.100) | (0.064) | (0.069) | (0.047) |
| hp_trend | -0.093 | -0.446** | -0.403 | 0.001 | -0.102 | -0.585** | 0.260 | 0.686** | -0.140 | -0.130 | -0.228 | -0.768** |
| | (0.359) | (0.223) | (0.265) | (0.305) | (0.182) | (0.290) | (0.313) | (0.271) | (0.345) | (0.371) | (0.260) | (0.372) |
| gdp_neg | -0.339 | -0.165 | 0.495 | -0.168 | 0.195 | 0.935** | -0.257 | -0.275 | 0.474 | 0.044 | 0.654** | -0.417 |
| | (0.671) | (0.276) | (0.340) | (0.370) | (0.270) | (0.440) | (0.540) | (0.488) | (0.434) | (0.399) | (0.302) | (0.259) |
| gdp_pos | -0.219 | -0.418 | 0.513** | -0.019 | -0.589** | -0.467 | -0.579 | -0.692 | -0.360 | -0.149 | 1.684*** | 0.167 |
| | (0.385) | (0.373) | (0.228) | (0.343) | (0.258) | (0.515) | (0.432) | (0.437) | (0.371) | (0.353) | (0.395) | (0.210) |
| mat. share | -0.222 | -0.314** | 0.085 | -0.151 | -0.235 | -0.357 | -0.385* | -0.143 | -0.298 | -0.148 | -0.169 | 0.019 |
| | (0.311) | (0.124) | (0.239) | (0.244) | (0.162) | (0.326) | (0.226) | (0.279) | (0.360) | (0.204) | (0.204) | (0.210) |
| hours | 0.099*** | 0.034 | 0.030 | 0.030 | 0.073 | -0.046 | -0.171 | -0.211 | -0.142 | -0.079 | 0.072 | -0.010 |
| | (0.035) | (0.059) | (0.088) | (0.081) | (0.072) | (0.092) | (0.137) | (0.156) | (0.117) | (0.099) | (0.090) | (0.196) |
| gvp | 0.043*** | 0.019*** | -0.018* | 0.016** | 0.010** | 0.011 | -0.031** | -0.014 | 0.005 | 0.003 | -0.013 | -0.007 |
| | (0.009) | (0.006) | (0.010) | (0.007) | (0.005) | (0.012) | (0.015) | (0.010) | (0.008) | (0.009) | (0.011) | (0.005) |
| plants | -0.025 | -0.012 | -0.076** | -0.020 | -0.119* | -0.021 | -0.015 | -0.026 | -0.038 | -0.050** | 0.049* | 0.007 |
| | (0.030) | (0.013) | (0.035) | (0.021) | (0.064) | (0.039) | (0.019) | (0.030) | (0.050) | (0.020) | (0.028) | (0.007) |
| reg. birth | 0.008 | 0.105* | 0.118 | -0.009 | 0.035 | 0.179** | -0.064 | -0.187** | 0.010 | 0.030 | 0.076 | 0.222** |
| | (0.095) | (0.059) | (0.072) | (0.082) | (0.050) | (0.082) | (0.086) | (0.074) | (0.089) | (0.098) | (0.073) | (0.108) |
| replace_d | | | 0.449** | | | -0.197 | 0.159 | 0.361 | -0.089 | | -0.481** | 0.164* |
| | | | (0.195) | | | (0.318) | (0.182) | (0.309) | (0.373) | | (0.201) | (0.089) |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

NOTES: The numbers presented are marginal effect and (s.e.).

***, **, and * refer to statistical significance at the 1, 5, and 10% levels.

**Table A5. Correlations of generalized residuals of contract clauses**

| | ICC | | | | ICO | | | | | ECC | | |
| | monitoring | enforcement | expel | fine | meeting | dispute | structure | vote | association | new member | non cartel supply | Entry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ICC** | 0.472*** | 0.492*** | 0.287*** | 0.634*** | -0.022 | 0.289*** | -0.022 | 0.238 | 0.141 | 0.052 | 0.159 | 0.02 |
| enforcement | 0.2459** | 1 | | | | | | | | | | |
| expel | -0.0556 | -0.0148 | 1 | | | | | | | | | |
| fine | 0.2705*** | 0.5614*** | 0.0321 | 1 | | | | | | | | |
| **ICO** | 0.004 | 0.267* | 0.118 | 0.129 | 0.155 | 0.180* | 0.358*** | 0.371*** | 0.261*** | 0.260*** | 0.033 | 0.037 |
| meeting | 0.1721* | -0.1298 | 0.0203 | -0.0177 | 1 | | | | | | | |
| dispute | 0.1978* | 0.228** | 0.1358 | 0.2565** | -0.1932* | 1 | | | | | | |
| structure | -0.2255** | 0.0514 | 0.3299*** | 0.0628 | -0.0182 | 0.0736 | 1 | | | | | |
| vote | -0.0445 | 0.084 | 0.3362*** | 0.2027** | 0.0488 | 0.1389 | 0.6082*** | 1 | | | | |
| association | -0.1196 | 0.1898* | 0.2201** | 0.177* | 0.0067 | 0.1568 | 0.5367*** | 0.5788*** | 1 | | | |
| **ECC** | 0.194** | 0.271** | 0.282*** | 0.377*** | -0.024 | 0.267** | 0.254*** | 0.303*** | 0.254*** | 0.348*** | 0.457*** | 0.516*** |
| new member | -0.162 | -0.0244 | 0.2898*** | 0.0374 | -0.0594 | 0.1235 | 0.5163*** | 0.6199*** | 0.5983*** | 1 | | |
| non cartel supply | 0.0711 | 0.0599 | 0.1137 | 0.1068 | -0.0715 | 0.0291 | 0.2153** | 0.0306 | -0.0237 | -0.1285 | 1 | |
| entry | 0.0683 | 0.0852 | -0.128 | 0.0208 | -0.0826 | -0.0535 | -0.0835 | -0.1039 | -0.1339 | -0.0645 | 0.1944* | 1 |

NOTES: ***, **, and * refer to statistical significance at the 1, 5, and 10% levels.

**Table A6. Contract complexity and stability**

| VARIABLES | (1) #clauses | (2) #clauses | (3) #pages | (4) #pages | (5) #pages | (6) #changes | (7) #changes | (8) #changes |
|---|---|---|---|---|---|---|---|---|
| hp_trend_t_1 | - | -0.247 | - | - | -1.440** | - | - | -5.023** |
|  |  | (0.429) |  |  | (0.592) |  |  | (2.281) |
| gdp_neg_t_1 | - | 0.504 | - | - | 0.676 | - | - | 3.332 |
|  |  | (0.647) |  |  | (0.588) |  |  | (3.224) |
| gdp_pos_t_1 | - | -0.102 | - | - | 0.478 | - | - | 5.957** |
|  |  | (0.293) |  |  | (0.491) |  |  | (3.022) |
| material_share4 | - | -0.422 | - | - | -0.253 | - | - | -1.069 |
|  |  | (0.289) |  |  | (0.402) |  |  | (0.909) |
| hoursbc_gvp4 | - | -0.007 | - | - | -0.145 | - | - | -0.820** |
|  |  | (0.122) |  |  | (0.137) |  |  | (0.384) |
| gvp4_t_1d | - | 0.009 | - | - | -0.007 | - | - | 0.004 |
|  |  | (0.007) |  |  | (0.010) |  |  | (0.017) |
| plants4_t_1 | - | -0.022 | - | - | 0.012 | - | - | 0.159 |
|  |  | (0.024) |  |  | (0.066) |  |  | (0.104) |
| reg_birth | - | 0.067 | - | - | 0.363** | - | - | 1.124** |
|  |  | (0.117) |  |  | (0.154) |  |  | (0.544) |
| d_replace | - | -0.010 | - | - | -0.044 | - | - | -2.089** |
|  |  | (0.253) |  |  | (0.607) |  |  | (0.952) |
| Constant | 1.518*** | -129.368 | 0.950*** | 0.631*** | -704.566** | -0.725*** | -0.763 | -2,182.120** |
|  | (0.074) | (227.157) | (0.108) | (0.129) | (300.158) | (0.258) | (0.561) | (1,056.670) |
| Observations | 107 | 107 | 107 | 107 | 107 | 107 | 107 | 107 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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| | # cartels | |
|---|---|---|
| count | clauses | contract changes |
| 0 | - | 58 |
| 1 | 6 | 17 |
| 2 | 5 | 19 |
| 3 | 10 | 11 |
| 4 | 16 | 3 |
| 5 | 15 | 0 |
| 6 | 21 | 0 |
| 7 | 15 | 0 |
| 8 | 9 | 0 |
| 9 | 5 | 1 |
| 10 | 4 | |
| 11 | 1 | |
| 12 | 1 | |
| 13 | 0 | |
| 14 | 1 | |

**Table A7. The distribution of #clauses and # contract changes**

Note: column two displays the number of cartels with a given number of clauses (as given in column 1). Column three displays the number of cartels with a given number of contract changes

Figure 1
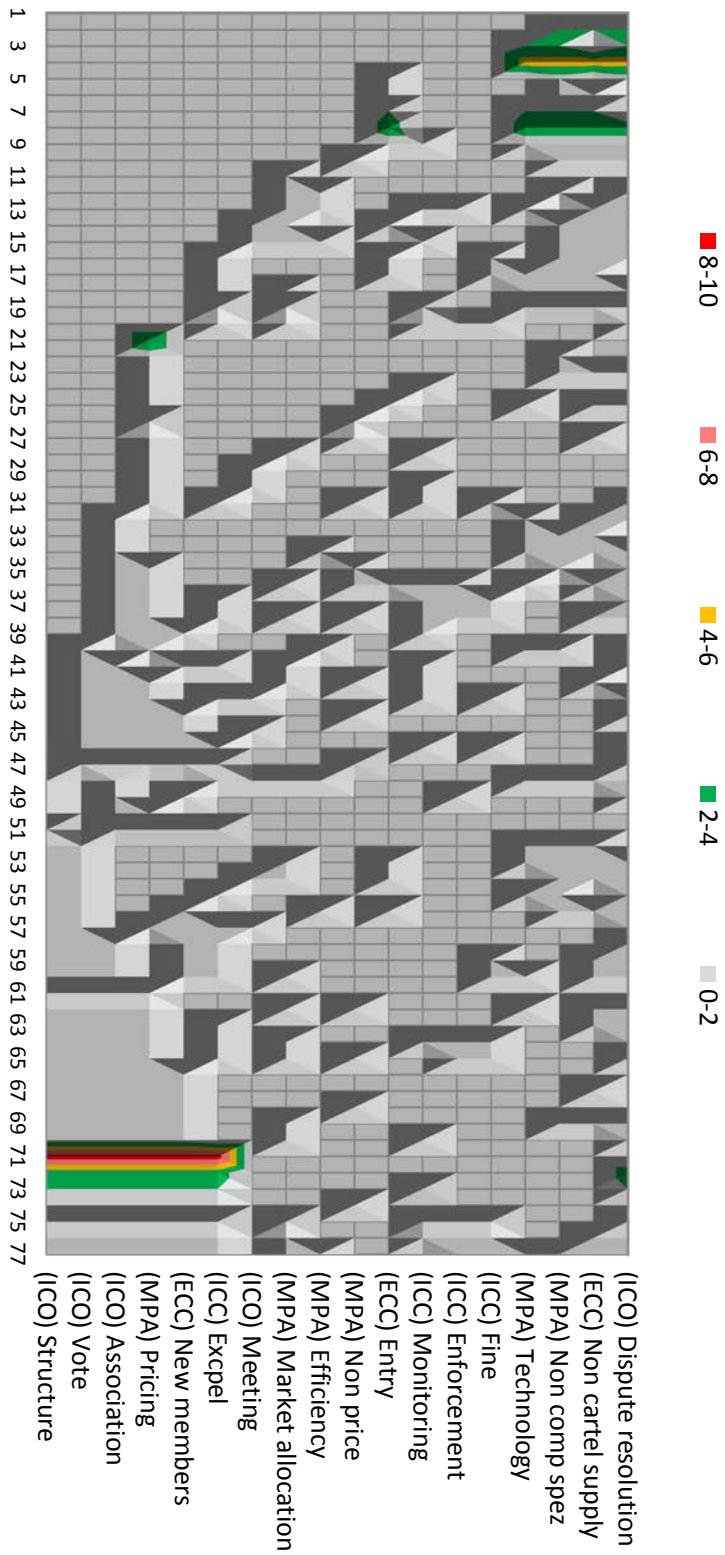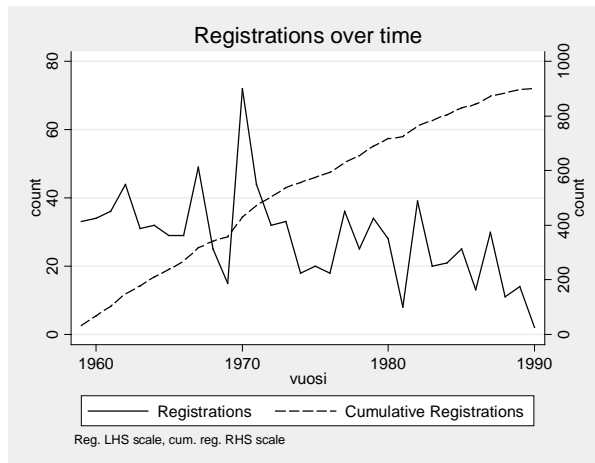
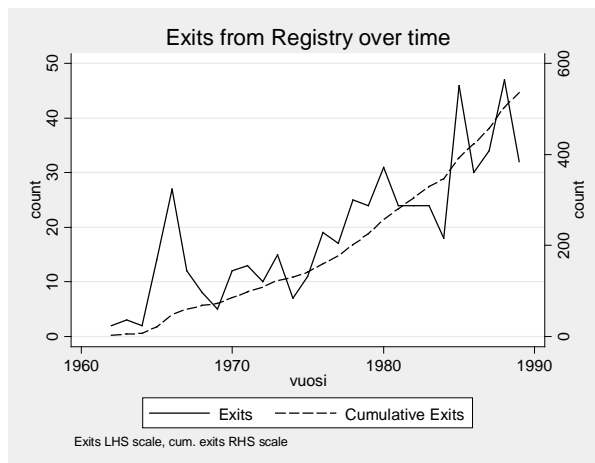Figure A1. Entry and cumulative entry into the Registry



Figure A2. Exit and cumulative exit from the Registry

Figure A3. Map of market allocation and location of plants of the cement cartel in 1959.

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**26/11** **Øivind Anti Nilsen** and **Katrine Holm Reiso**, "Scarring effects of unemployment".

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**01/12** February, **Ola Honningdal Grytten**, "The Protestant Ethic and the Spirit of Capitalism the Haugian Way".

**02/12** February**, Alexander W. Cappelen**, Rune Jansen Hagen, **Erik Ø. Sørensen**, and **Bertil Tungodden**, «Do non-enforceable contracts matter? Evidence from an international lab experiment".

**03/12** February, **Alexander W. Cappelen** and **Bertil Tungodden**, "Tax policy and fair inequality".

**04/12** March, Mette Ejrnæs and **Astrid Kunze**, «Work and Wage Dynamics around Childbirth".

**05/12** March, **Lars Mathiesen**, "Price patterns resulting from different producer behavior in spatial equilibrium".

**06/12** March, **Kurt R. Brekke**, Luigi Siciliani, and Odd Rune Straume, "Hospital competition with soft budgets".

**07/12** March, **Alexander W. Cappelen** and **Bertil Tungodden**, "Heterogeneity in fairness views - a challenge to the mutualistic approach?"

**08/12** March, Tore Ellingsen and **Eirik Gaard Kristiansen**, "Paying for Staying: Managerial Contracts and the Retention Motive".

**09/12** March, **Kurt R. Brekke**, Luigi Siciliani, and Odd Rune Straume, "Can competition reduce quality?"

**10/12** April, Espen Bratberg, **Øivind Anti Nilsen**, and Kjell Vaage, "Is Recipiency of Disability Pension Hereditary?"

**11/12** May, **Lars Mathiesen**, **Øivind Anti Nilsen**, and **Lars Sørgard**, "A Note on Upward Pricing Pressure: The possibility of false positives".

**12/12** May, **Bjørn L. Basberg**, "Amateur or professional? A new look at 19th century patentees in Norway".

**13/12** May, Sandra E. Black, Paul J. Devereux, Katrine V. Løken, and **Kjell G. Salvanes**, "Care or Cash? The Effect of Child Care Subsidies on Student Performance".

**14/12** July, **Alexander W. Cappelen**, Ulrik H. Nielsen, **Erik Ø. Sørensen**, **Bertil Tungodden**, and Jean-Robert Tyran, " Give and Take in Dictator Games".

**15/12** August, **Kai Liu**, "Explaining the Gender Wage Gap: Estimates from a Dynamic Model of Job Changes and Hours Changes".

**16/12** August, **Kai Liu**, **Kjell G. Salvanes**, and **Erik Ø. Sørensen**, «Good Skills in Bad Times: Cyclical Skill Mismatch and the Long-term Effects of Graduating in a Recession".

**17/12** August, **Alexander W. Cappelen**, **Erik Ø. Sørensen**, and **Bertil Tungodden**, «When do we lie?».

**18/12** September, **Kjetil Bjorvatn** and Tina Søreide, «Corruption and competition for resources".

**19/12** September, **Alexander W. Cappelen** and Runa Urheim, "Pension Funds, Sovereign-wealth Funds and Intergenerational Justice"

**20/12** October, **Ingvild Almås** and **Erik Ø. Sørensen**, "Global Income Inequality and Cost-of-Living Adjustment: The Geary–Allen World Accounts".

**21/12** November, **Ingvild Almås** and Åshild Auglænd Johnsen, "The cost of living in China: Implications for inequality and poverty".

**22/12** December, **Alexander W. Cappelen, Tom Eichele, Kenneth Hugdahl, Karsten Specht, Erik Ø. Sørensen**, and **Bertil Tungodden**, "Fair inequality: a neureconomic study".

**23/12** December, **Ingvild Almås, Alexander W. Cappelen, Kjell G. Salvanes, Erik Ø. Sørensen,** and **Bertil Tungodden**, «Willingness to compete: family matters».

**24/12** December, **Ingvild Almås, Alexander W. Cappelen, Kjell G. Salvanes, Erik Ø. Sørensen**, and **Bertil Tungodden**, «Willingness to compete in a gender equal society».

**25/12** December, Ari Hyytinen, **Frode Steen**, and Otto Toivanen, "Anatomy of Cartel Contracts".