

Online Appendix

[not intended for publication]

This document is Online Appendix (OA) to paper Hyytinen, Steen and Toivanen (An anatomy of cartel contracts, *Economic Journal*). In Online Appendix A, we report examples of the cartels in our data. In Online Appendix B, we present a number of auxiliary analyses and robustness tests.

Online Appendix A Examples of cartels

In this Online Appendix, we illustrate the nature of the manufacturing cartels that we have in our data and provide examples of each cartel type in our typology. Table OA-A1 lists the examples and shows which main clauses they have. We give a short description of each below.

Table OA-A1: Examples of cartel types

Cartel type	Case	Main clauses				
		Pricing	Payment rule	Quota	Area-based	Non-area-based
<i>Pure pricing</i>						
Soft drinks and brewing	#1	1	0	0	0	0
Match producers	#2	1	1	0	0	0
Book publishing and printing	#3	1	1	0	0	0
<i>Pure allocation</i>						
Cement	#4	0	0	0	1	0
Plywood box	#5	0	0	0	0	1
Metal pipes	#6	0	0	0	1	1
<i>Quota</i>						
Wooden houses	#7	0	0	1	0	0
Pulp	#8	1	0	1	0	0
Steel furniture	#9	0	0	1	0	1
<i>Mixed price-allocation</i>						
Cellulose and paper -machines	#10	1	0	0	0	1

NOTES: This table reports the five main clauses for the example cases of manufacturing cartels in our data. All the cartels listed in this table are in manufacturing.

Pure pricing cartels

Case #1: The soft drinks and brewing cartel was founded in 1944 and registered in 1957.

At the time of registration had more than 60 breweries and drink manufacturers as members, located all over Finland (except from Northern Finland). This cartel had a list of recommended prices, which was distributed to members. The list included the sale prices of certain clearly identified soft drinks, sparkling waters, and juices (*Pricing = 1*). Interestingly, some but not all of the members of this cartel were also members of another, related, collusive arrangement, which had fewer members and which coordinated the pricing of brewed drinks and beers. This other arrangement was registered in 1958. The other arrangement included both coordinated price-setting (*Pricing = 1*) and terms of delivery (*Payment rules = 1*). In 1962, the Registry was informed that the price-setting of certain other types of soft drinks and beers was coordinated, too. Apparently, this restriction augmented the earlier two agreements. It moreover seems that in 1978, these separate agreements were in some sense merged, because of the consolidation process in the industry and in the associated industry associations. In 1978, the Registry was informed that the cartel had an oral agreement on practices towards retailers. This arrangement included both prices at the level of cases of bottles and (standardized) bottles (*Pricing = 1*), and rebate tables, terms of delivery and the treatment of transport costs (*Payment rules = 1*).

Case #2: The Finnish match producers' cartel was formed as early as 1927. The cartel was organized around a pricing-committee, which apparently covered almost the entire industry. At the time the cartel was registered in 1961, it had five members. Later also other independent match producers joined it. The cartel agreed on prices, on discounts to both wholesale customers and on cash purchases (*Pricing = 1*). It also agreed on prices of different labels on the boxes and the size of match boxes (*Payment rules = 1*). Thus, even within this relatively homogenous industry, the cartel made an effort to avoid competition in other di-

mensions than price. As a case in point, the match producers' cartel announced some changes to the earlier agreement that had to do with the pricing of different labels. There also was another, related agreement, which provided a framework for collaboration in the industry and which had almost the same members as those who were involved with the pricing committee. The pricing committee was abolished in 1971, and a new kind of collusive arrangement was introduced. This new arrangement was registered in 1973 and it too, focused on coordinating both price-setting and methods of payment and delivery.

Case #3: The book publishing and printing cartel was registered in 1967, had more than 30 publishers as its members, and was located mostly in the large cities in Southern Finland. It coordinated the pricing, sales and distribution of Finnish literature and books. While the arrangement had some elements of spatial allocation of sales areas, it explicitly coordinated price-setting of certain types of books (*Pricing* = 1) and restricted allowed rebates and payment and delivery rules, such as cash-discounts, quantity discounts, rates of interest on late payments, allowed methods of delivery, and return policies (*Payment rules* = 1).

Pure allocation cartels

Case #4: The cement cartel operated in a homogenous goods market, had two members and was registered in 1959. The cartel has the simplest contract observed by us, as the two cement producers only agreed on geography-based market allocation (*Area-based* = 1): The firms announced that they had agreed to divide Finland geographically, with the smaller firm (whose market share was 35%) concentrating on an area that in the South was round the capital Helsinki, and extended to the North. Both to West and East of this area, as well as North of it was the designated area of the larger member. The reason for this split of the market was the location of production facilities, which allowed each of the two firms to serve easily their own dedicated areas (due to the associated opportunities for lake and sea transportation) but not those of its rival. The production facility of the smaller member was, at the time of regis-

tration, located West of Helsinki (in the town of Lohja). 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 at the time 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 member (as the other was not located on the coast).¹ These features of the agreement suggest that in the cement industry, geographic competition is limited. Further correspondence between the Registry and the cartel indicated that the spatially determined market shares remained stable over time. The larger cartel member stated in one of its letters that *'the marketing areas of cement are determined by customer choices, driven largely by transport costs'*. It turns out that in separate contracts, given different identification numbers by the Registry, the two firms agreed, in addition, 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.

Case #5: The plywood box cartel was based on an agreement of two manufacturers whereby one of them ceased the production of plywood boxes altogether (*Non-area based = 1*). It also committed not to re-enter the business for 15 years, and to neither sell nor allow the use of its machinery. Further, it committed to not reveal its production know-how to any domestic competitor. As compensation, the firm continuing production promised to pay a royalty on its plywood box revenues to the firm ceasing production. This arrangement had a flavour of monopoly, as in their correspondence with the Registry, the firms explicitly wanted to state that this agreement did not result in a monopoly in plywood box production.

¹ 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.

Case #6: The metal pipes cartel was bilateral, involving one Finnish and one Swedish producer. The two members agreed that one of the members ceased the production of some very specific welded stainless steel pipe products (*Non-area based* = 1), and the two firms cooperated in the manufacturing of other products via an arrangement that involved some kind of allocation of geographic operating areas (*Area-based* =1). To support the arrangement, the cartel had an external dispute resolution mechanism (private arbitration). The contract also stipulated restrictions on the cartel members regarding the sale of third parties' products.

Quota cartels

Case #7: The wooden houses cartel was founded in 1955 and registered in 1962. It coordinated the manufacturing and sales of houses and other buildings made of wood and closely related materials. It had initially 13 members and each was allocated a quota. The quotas were set separately for exports and the domestic market. The number of members declined for various reasons to 4 by 1971 and then to 3 by 1975, and the quotas were reset accordingly.

Case #8: The pulp cartel coordinated the manufacturing and sales of pulp. At the time of registration in 1964, the cartel was one of the larger quota cartels and had 22 members. Each members was allocated a production quota, according to a verbally described rule (*Quota* = 1). The cartel also utilised a sales organization (association), through which sales and pricing to domestic and export markets was apparently coordinated (*Pricing* = 1).

Case #9: The steel furniture cartel involved two producers that agreed to specialise by product line (*Non-area-based* = 1) and committed to a quota-like scheme (*Quota* = 1). To this end, the firms agreed to organise sales through a joint sales office (owned by one of the firms; the other firm got a seat on the board of the sales office), and the contract involved mentions on how sales will be allocated. The firms also agreed that the joint sales office

would not sell products of third parties. In addition, the firms agreed that they would share blueprints and even patents (the receiving party was not allowed to disseminate the information further).

Mixed price-allocation cartel

Case #10: The cellulose and paper –machines cartel was established by three manufacturers of pulp and paper machines that agreed in 1969 to permanently specialise in manufacturing certain types of paper, paperboard and pulp machines (*Non-area-based* = 1). The members agreed, in addition, that they subcontract from each other as much as possible when one of the members obtains an order, to utilise the collective manufacturing capacity of the members. The prices for these large and expensive machines are a result of long negotiations and complex contracting process. It remains somewhat unclear specifically how and to what extent pricing was coordinated in this agreement, but the contract mentions price setting on several occasions (*Pricing* = 1). The contract also includes mentions about the members sharing their technological information.

Online Appendix B

Auxiliary analyses and robustness tests

In this Online Appendix, we present a number of additional analyses and robustness tests. All the tables to which we refer below can be found from the end of this online appendix.

Joint use of main clauses

Table OA-B1 and OA-B2 take a closer look at the joint use of the five main clauses. The tables show that the (correlation) patterns in joint use are stronger in manufacturing. For example, Table OA-B1 shows that conditional on there being a *Payment Rule* -clause, 80% of the manufacturing cartels have a *Pricing* clause. In line with this, *Pricing* and *Payment Rules* -clauses are positively correlated with each other in manufacturing, with p-value less than 1%. Second, *Area-based* and *Non-area-based* clauses are negatively correlated with the other clauses, especially in manufacturing. As an example, only 2% of the cartels that have an *Area-based* clause have a quota clause. We find much weaker correlations and a couple of very different patterns in non-manufacturing: For instance, *Pricing* and *Payment rules* are negatively correlated with each other in non-manufacturing.

Auxiliary results related to Table 3

Tables OA-B3 and OA-B4 report robustness results for Table 3, whereas Table OA-B5 reports the joint tests mentioned in the main text. For Table OA-B3, we add two law cohort indicators to the models of Table 3. In Table OA-B4, we present results from a multinomial-logit model. Both tables show that the results are similar to what we report in the main text.

Auxiliary results related to Table 5

We report in Table 5 of the main text that *Quota* cartels use more complex contracts. In this section, we show that the result also applies in the larger sample of 898 cartels when an alternative way of measuring complexity is used. To this end, we use auxiliary information from the cartel listing which allows us to calculate how many ‘specific other clauses’ the contract had. Here, the other clauses refer for example to mentions and remarks in the contracts about purchase cooperation in the markets for inputs, production cooperation, commitments to be selective in to whom or which products (brands) are sold, sales and marketing cooperation, and other similar (but not so well-defined) forms of interfirm cooperation.

We calculate the following proxies for the complexity of the contract: *Number of main clauses* (= sum of the main clauses displayed in Table 1 of the main text); *Number of other clauses* (= sum of a set of other specific contract features and clauses which the Finnish CA recorded for the entire population of the registered cartels; these are different from the governance clauses analysed in Section 3), and *Total number of clauses* (= sum of the main and the other clauses). Panel A of Table OA-B6 reports the unconditional descriptive statistics, whereas Panel B of the table reports the regressions in which we control for the structural industry characteristics (i.e., for the same control variables as those used in Table 5). The table shows that both conditionally and unconditionally, *Quota* and *Mixed price-allocation* cartels use more complex contracts than *Pure pricing* (or *Pure allocation*) cartels. The number of main clauses is (almost) by design larger for the *Quota* and *Mixed price-allocation* cartels, but as the table shows, the result is obtained also when the number of other clauses is used as the outcome variable.

Tables to Online Appendix B

Table OA-B1: Joint use of main contract clauses

Panel A: Manufacturing		Pricing	Payment Rules	Quota	Area-based	Non-area - based
	Mean	0.33	0.22	0.16	0.13	0.52
	95%-CI	[0.22 - 0.43]	[0.14 - 0.30]	[0.11 - 0.21]	[0.06 - 0.19]	[0.38 - 0.66]
	N	119	79	58	46	189
	Pricing	-	0.53	0.30	0.04	0.09
H0: Different from the clause mean		-	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i><0.01</i>
	Payment Rules	0.80	-	0.22	0.03	0.14
H0: Different from the clause mean		<i><0.01</i>	-	<i>0.27</i>	<i><0.01</i>	<i><0.01</i>
	Quota	0.62	0.29	-	0.02	0.21
H0: Different from the clause mean		<i><0.01</i>	<i>0.221</i>	-	<i><0.01</i>	<i><0.01</i>
	Area-based	0.11	0.04	0.02	-	0.37
H0: Different from the clause mean		<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	-	<i>0.06</i>
	Non-area-based	0.06	0.06	0.06	0.09	-
H0: Different from the clause mean		<i><0.01</i>	<i><0.01</i>	<i><0.01</i>	<i>0.166</i>	-
Panel B: Non-manufacturing		Pricing	Payment Rules	Quota	Area-based	Non-area - based
	Mean	0.68	0.23	0.03	0.05	0.22
	95%-CI	[0.59 - 0.78]	[0.15 - 0.32]	[0.01 - 0.05]	[0.02 - 0.08]	[0.14 - 0.30]
	N	365	125	15	26	118
	Pricing	-	0.19	0.02	0.05	0.19
H0: Different from the clause mean		-	<i>0.40</i>	<i>0.79</i>	<i>0.97</i>	<i>0.63</i>
	Payment Rules	0.57	-	0.01	0.04	0.03
H0: Different from the clause mean		<i>0.04</i>	-	<i>0.02</i>	<i>0.57</i>	<i><0.01</i>
	Quota	0.60	0.07	-	0.53	0.07
H0: Different from the clause mean		<i>0.65</i>	<i>0.05</i>	-	<i>0.02</i>	<i>0.05</i>
	Area-based	0.69	0.19	0.31	-	0.23
H0: Different from the clause mean		<i>0.93</i>	<i>0.60</i>	<i>0.05</i>	-	<i>0.93</i>
	Non-area-based	0.59	0.03	0.01	0.05	-
H0: Different from the clause mean		<i>0.50</i>	<i><0.01</i>	<i>0.03</i>	<i>0.95</i>	-

Notes : This table provides an analysis of the joint use of main contract clauses by sector. The first line of each panel reports the unconditional mean of the clause mentioned in the column and the second and third rows the associated 95% confidence intervals and the number of cartels having the main clause indicated in the column. The last ten rows of both panels report the conditional means: The reported value is the mean of the column clause, conditional on the row clause being present in the contract. The p-values associated with "H0: Different from the clause mean" are in italics and refer to the tests of the null hypothesis that the reported conditional mean is different from the sample mean of the column clause (reported in the first row of each panel).

Table OA-B2: Pairwise correlations of main contract clauses

Panel A: Manufacturing (N = 364)						
Clause	Count	Pricing	Payment Rules	Quota	Area-based	Non-area-based
Pricing	119	1	-	-	-	-
Payment Rules	79	0.53***	1	-	-	-
Quota	58	0.27***	0.08	1	-	-
Area-based	46	-0.18***	-0.16***	-0.14***	1	-
Non-area-based	189	-0.59***	-0.40***	-0.27***	-0.11**	1

Panel B: Non-manufacturing (N = 534)						
Clause	Count	Pricing	Payment Rules	Quota	Area-based	Non-area-based
Pricing	365	1	-	-	-	-
Payment Rules	125	-0.14***	1	-	-	-
Quota	15	-0.03	-0.06	1	-	-
Area-based	26	0.00	-0.02	0.38***	1	-
Non-area-based	118	-0.10**	-0.25***	-0.06	0.01	1

Notes : Panel A refers to manufacturing cartels and Panel B to non-manufacturing cartels. The main clauses are not mutually exclusive, as a cartel may use many of them simultaneously. The first column in both panels reports the number of cartels using the main clause mentioned on the row. The matrices present pairwise correlation coefficients for the contract clauses. *** = significant at 1% level; ** = significant at 5% , * = significant at 10% level.

Table OA-B3: LPM-regressions of the determinants of cartel types

Explanatory variable	Cartel types			
	Pure price	Pure allocation	Quota	Mixed price-allocation
Manufacturing	-0.236*** (0.070)	0.115* (0.058)	0.184*** (0.049)	-0.010 (0.037)
B2C	0.156*** (0.032)	0.001 (0.024)	-0.089*** (0.021)	-0.068*** (0.024)
Capital intensity high	-0.021 (0.039)	-0.062** (0.029)	-0.014 (0.036)	0.154*** (0.042)
Capacity utilisation low	-0.002 (0.035)	-0.071** (0.034)	0.053 (0.040)	-0.050* (0.029)
Industry-growth slow	-0.103** (0.049)	0.032 (0.039)	-0.009 (0.025)	0.073** (0.032)
Industry-growth fast	-0.043 (0.042)	0.030 (0.032)	0.013 (0.027)	0.037 (0.031)
GDP-b-fast	-0.042 (0.044)	0.044 (0.037)	-0.051** (0.021)	0.075** (0.028)
GDP-f-slow	-0.056 (0.046)	0.068 (0.060)	-0.028 (0.031)	0.004 (0.032)
Year of registration (YoR)	0.001 (0.005)	-0.011* (0.006)	0.004 (0.004)	0.008** (0.004)
YoR*Manufacturing	-0.008* (0.004)	0.021*** (0.004)	-0.006* (0.003)	-0.004 (0.002)
Law_regime_64_72	-0.211*** (0.057)	0.084 (0.056)	0.013 (0.031)	-0.019 (0.039)
Law_regime_73_90	-0.352*** (0.101)	0.327** (0.126)	-0.050 (0.067)	-0.095 (0.063)
Constant	0.837*** (0.082)	0.048 (0.040)	0.053 (0.042)	0.018 (0.041)
R2	0.302	0.391	0.101	0.173
Number of observations	898	898	898	898
Joint Chi2-test (within equation, p-values)				
#1 H0: All industry characteristics = 0	<0.01	0.155	<0.01	0.023
#2 H0: All included explanatory variables = 0	0.862	0.030	0.396	<0.01

Notes : The method of estimation is OLS. The standard errors allow for clustering by the year of Registry entry ("year of birth"). Statistical significance: *** p < 0.01, ** p < 0.05, * p < 0.10.

Table OA-B4: Multinomial-logit estimations

	Marginal effect	Std. Err.	z-statistic	p-value
Manufacturing				
Pure pricing	-0.11	0.07	-1.51	0.13
Pure allocation	0.12	0.07	1.67	0.10
Quota	0.13	0.06	2.15	0.03
Mixed price-allocation	-0.06	0.05	-1.11	0.27
B2C				
Pure pricing	0.17	0.03	5.61	0.00
Pure allocation	0.01	0.02	0.58	0.56
Quota	-0.11	0.02	-4.83	0.00
Mixed price-allocation	-0.08	0.03	-2.61	0.01
Capital intensity high				
Pure pricing	0.03	0.04	0.84	0.40
Pure allocation	-0.08	0.04	-2.23	0.03
Quota	0.00	0.02	-0.11	0.91
Mixed price-allocation	0.10	0.02	4.68	0.00
Capacity utilization low				
Pure pricing	0.04	0.04	1.10	0.27
Pure allocation	-0.06	0.03	-1.80	0.07
Quota	0.03	0.02	1.35	0.18
Mixed price-allocation	-0.06	0.03	-2.17	0.03
Industry-slow				
Pure pricing	-0.11	0.05	-2.31	0.02
Pure allocation	0.02	0.04	0.63	0.53
Quota	0.02	0.03	0.87	0.39
Mixed price-allocation	0.05	0.03	1.60	0.11
Industry-fast				
Pure pricing	-0.06	0.04	-1.48	0.14
Pure allocation	0.03	0.03	1.07	0.29
Quota	0.04	0.03	1.62	0.11
Mixed price-allocation	0.02	0.03	0.61	0.54
GPD-b-fast				
Pure pricing	0.01	0.03	0.45	0.66
Pure allocation	0.00	0.03	0.04	0.97
Quota	-0.04	0.02	-1.90	0.06
Mixed price-allocation	0.06	0.02	2.51	0.01
GPD-f-slow				
Pure pricing	-0.09	0.05	-1.94	0.05
Pure allocation	0.11	0.04	2.78	0.01
Quota	-0.04	0.02	-1.88	0.06
Mixed price-allocation	0.02	0.03	0.65	0.51

Notes: This table reports results from a multinomial logit estimation, estimated by the method of maximum likelihood. The standard errors are clustered by the year of Registry entry. Log pseudolikelihood = -881.06, and Pseudo R2 = 0.28.

Table OA-B5: Joint tests for Table 3

	Pure price	Pure allocation	Quota	Mixed price-allocation
Joint Chi2-test (within equation, p-values)				
#1 H0: All industry characteristics = 0	<0.01	<0.01	<0.01	<0.01
#2 H0: All included explanatory variables = 0	<0.01	<0.01	<0.01	<0.01
Joint Chi2-test (cross-equation, p-values)				
#1 H0: Manufacturing = 0		<0.01		
#2 H0: B2C = 0		<0.01		
#3 H0: Capital intensity high = 0		<0.01		
#4 H0: Capacity utilization low = 0		0.022		
#5 H0: Industry-growth slow = 0		0.064		
#6 H0: Industry-growth fast = 0		<0.01		
#7 H0: GDP-b-fast = 0		<0.01		
#8 H0: GDP-f-slow = 0		0.107		

Notes : This table reports joint tests for Table 3, estimated by GMM.

Table OA-B6: Characteristics of cartels by cartel types

Panel A. Descriptive statistics			
	# of main clauses	# of other clauses	Total # of clauses
Manufacturing cartels			
	Mean	Mean	Mean
Pure pricing	1.46	0.34	1.80
Pure allocation	1.07	0.36	1.44
Quota	2.14	0.84	2.98
Mixed price-allocation	2.64	0.71	3.36
H0: "Cartel types do not differ" (p-value)	<0.01	<0.01	<0.01
Sample means: All manufacturing	1.35	0.49	1.84
Observations (N)	364	364	364
Non-manufacturing cartels			
	Mean	Mean	Mean
Pure pricing	1.20	0.30	1.50
Pure allocation	1.04	0.56	1.60
Quota	2.27	0.87	3.13
Mixed price-allocation	2.09	0.91	3.00
H0: "Cartel types do not differ" (p-value)	<0.01	<0.01	<0.01
Sample means: All non-manufacturing	1.22	0.55	1.77
Observations (N)	534	534	534

Notes : We implement the joint test using LPM-models (OLS, standard errors clustered at register year). In all models, a dummy for the cartels not having any of the five main clauses is included. The joint tests are F-tests and the reported numbers are p-values.

Table OA-B6: (continued)**Panel B: Regression results**

	# of main clauses	# of other clauses	Total # of clauses
	LPM	LPM	LPM
Cartel type:			
Pure allocation	-0.22*** (0.04)	0.13 (0.10)	-0.09 (0.11)
Quota	0.86*** (0.14)	0.51*** (0.12)	1.37*** (0.16)
Mixed price-allocation	1.02*** (0.05)	0.47*** (0.12)	1.48*** (0.15)
Control variables	YES	YES	YES
Observations (N)	898	898	898
R2	0.64	0.23	0.38
H0: "Pure pricing vs. other cartel types"	<0.01	<0.01	<0.01
H0: "Structural industry factors"	0.01	0.44	0.39
Unconditional median / mean of dep. var. for Pure-pricing	1.25	0.31	1.56

Notes : LPM-models are estimated by OLS, with the standard errors clustered by Registry year. Control variables are indicators from Manufacturing, B2C, Capital intensity high, Capacity utilisation low, Industry-growth slow, Industry-growth fast, GDP-b-fast, GDP-f-slow and Year of registration (YoR). In all models, a dummy for the cartels not having any of the five main clauses is included. Statistical significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. The joint tests are F-tests and the reported numbers are p-values.