Cartels Uncovered & Anatomy of Cartel Contracts

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March 6, 2018

Motivation

Little evidence on

- the prevalence of cartels,

- the duration of cartels taking the nature of data into account,

- what cartels look like and

- what affects what a cartel looks like.

Our lense

- Data on Finnish 898 legal cartels 1959 - 1993.

- Cartels legal in many countries post WWII.

- Legal cartels face incentive compatibility issues.

- An analysis of their prevalence and duration provides a counterfactual to assess need for competition policy.

- Their contracts reveal what cartels would like to contract on, given the chance.

Objectives for "Cartels Uncovered"

Key problem with cartel data re prevalence and duration: most of the time we don't know if there is a cartel in a given market at a particular point in time.

- Our solution: Hidden Markov model (HMM).

We estimate

- the probabilities of forming and continuing a cartel; and
- the degree of cartelization.

Objectives for "Anatomy of Cartel Contracts"

Key problem with the existing literature on cartel types: data small and/or not easily comparable, statistics not linked to theory and no econometric analysis provided.

We

- propose and make use of a typology of mutually exclusive cartel formats that links to theory;
- characterize how prevalent different types of cartels are, conditional on observables;
- what they look like in other dimensions; and
- study how different types of cartels try to ensure compliance.

Outline for the rest of the talk

1. Institutional environment.
2. HMM for cartel formation and continuation.
3. Cartel dynamics.
4. Typology of cartels.
5. Most popular contract types.
6. Predicting cartel type with structural industry characteristics.
7. Projecting cartel features on cartel types.
8. Compliance solutions by cartel type.

1. Institutional environment

- Cartels legal in Finland until March 1993.

- Starting 1959, a competition law & registry, with changes.

- Cartels had implicit and explicit reasons to register.

- Register not complete.

- Legal status unclear, probably not dissimilar to the Sugar Institute (Genesove and Mullin 2001).

2. HMM for cartels

One may summarize much of the large theoretical literature on collusion and cartels in

1. a probability of cartel formation, conditional on no cartel in the previous period ($H1$), and

2. a probability of a cartel continuing, conditional on a cartel in the previous period ($H2$).

2. Modeling Cartel Data
The Transition Matrix of the Hidden Process

Table 1: transition matrix

$t-1 \,/\, t$	n	c
n	$(1 - H1_{it})$	$H1_{it}$
c	$(1 - H2_{it})$	$H2_{it}$

2. Modeling Cartel Data

A HMM consists of two key processes:

1. An underlying hidden (latent) process - in our case, the actual cartel state of an industry (c, n).

2. An observation process - in our case, what is known about the state of the industry (c, n, u).

2. Modeling Cartel Data
Observation Process

We make the following assumptions:

1. If the industry is not in a cartel, the true status is observed with probability β_{it}^n.

2. If the industry is in a cartel, the true status is observed with probability β_{it}^c.
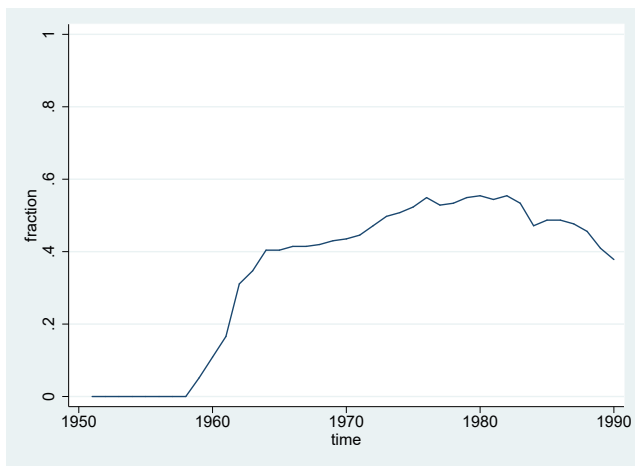
3. No mistakes in labeling.

2. Modeling Cartel Data
Transition Matrix of the Observation Process

Table 2: Partial transition matrix
of the observation process

$t-1 \ / \ t$	n	c	u
n	$\beta_{it}^n(1 - H1_{it})$	$\beta_{it}^c H1_{it}$	$1 - \beta_{it}^n(1 - H1_{it}) - \beta_{it}^c H1_{it}$
c	$\beta_{it}^n(1 - H2_{it})$	$\beta_{it}^c H2_{it}$	$1 - \beta_{it}^n(1 - H2_{it}) - \beta_{it}^c H2_{it}$

3. Cartel Dynamics

The raw data

- 193 manufacturing industries, 134 (69%) with a cartel at some point in time.

3. Cartel Dynamics

Estimated cartelization (mixture model)
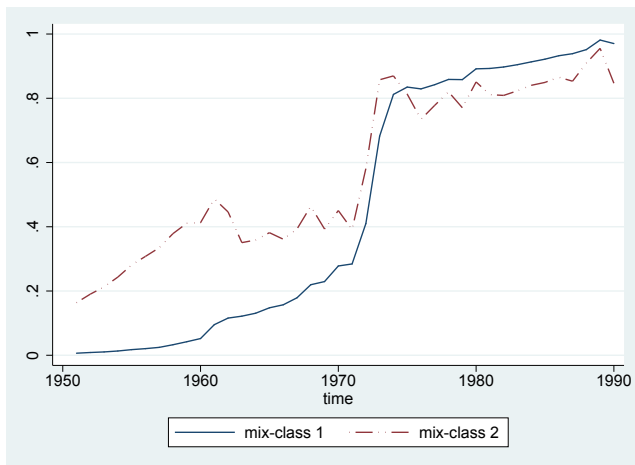
- 60% in class 1.

3. Cartel Dynamics

Estimated $H1$ and $H2$ (mixture model)
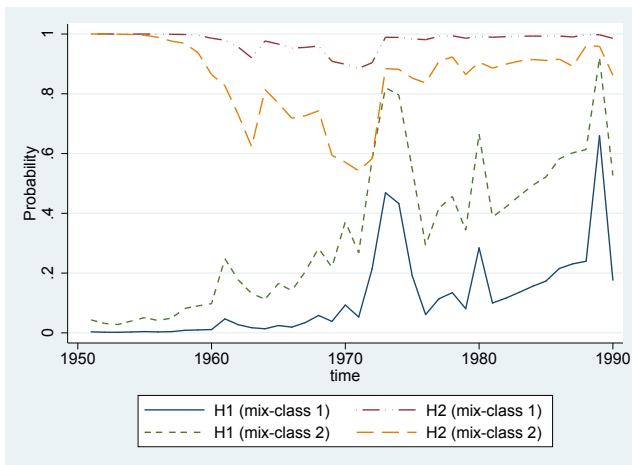
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3. Cartel Dynamics

- Probability of cartel formation $0.2 - 0.3$.

- Probability of cartel continuation $0.8 - 0.9$.

- Steady state degree of cartelization $0.8 - 0.9$, duration 8.5 years.

- In the absence of competition policy, much of manufacturing would be cartelized.

4. Typology of cartel types

- 4 main forms of cartels identifiable in the theoretical literature:

1. pricing cartels (Canadian retail gasoline),

2. market allocation cartels,

3. quota cartels (e.g. JEC), and

4. mixed cartels (Lycine).

5. (none of the above) (Sugar Institute).

- We use data on the 898 (108) cartels in the Registry.

4. Typology of cartel types

- We consider the following structural industry characteristics:

1. observability of choice variables (Stigler 1964, Harrington and Skrzypacz 2011);

2. fixed costs and entry conditions (Friedmand and Thisse 1994, Bos and Harrington 2010); and

3. capacity and demand fluctuations (van den Berg and Bos 2017, Green and Porter 1984).

5. Most popular cartel types

Table 1: Combinations of main contract clauses and their mapping to cartel types

Panel A: Manufacturing Combination of cartel clauses	Count (N = 364)	Share	Cumulative share	Typology of cartel types
Non-area-based	152	0.42	0.42	A
Pricing + Payment rules	39	0.11	0.52	P
Pricing	33	0.09	0.62	P
Area-based	26	0.07	0.69	A
Pricing + Quota	18	0.05	0.74	Q
Panel B: Non-manufacturing Combination of cartel clauses	Count (N = 534)	Share	Cumulative share	Typology of cartel types
Pricing	214	0.40	0.40	P
Pricing + Payment rules	66	0.12	0.52	P
Pricing + Non-area-based	65	0.12	0.65	PA
Payment rules	50	0.09	0.74	P
Non-area-based	43	0.08	0.82	A
Quota	6	0.01	0.83	Q

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Table 2: Cartel types by industry

	Count	Share	Pure pricing	Pure allocation	Quota	Mixed	Diff.
Manuf.	364	**0.41**	0.23	0.53	0.16	0.04	<0.01
Non-manuf.	534	**0.59**	0.62	0.09	0.03	0.15	<0.01
Total:	898	1.00	0.46	0.27	0.08	0.10	

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6. Predicting cartel type

Table 3: LPM-regressions of the determinants of cartel types

	Cartel types			
Explanatory variable	Pure price	Pure allocation	Quota	Mixed
Manufacturing	-0.253***	0.120**	0.186***	-0.012
	(0.068)	(0.058)	(0.047)	(0.037)
B2C	0.162***	0.006	-0.093***	-0.070***
	(0.032)	(0.025)	(0.021)	(0.024)
Capital intensity high	-0.011	-0.080***	-0.009	0.159***
	(0.037)	(0.031)	(0.034)	(0.042)

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7. Projecting cartel features on type

Table 4: Characteristics of cartel types

	# mem.	Nation wide	Vert.	Sales coop.
	Quant.	LPM	LPM	LPM
Pure all.	**-5.55***	0.01	0.12***	-0.10**
	(1.84)	(0.05)	(0.04)	(0.05)
Quota	**-5.00***	-0.00	-0.00	0.22**
	(1.98)	(0.07)	(0.03)	(0.08)
Mix price-all.	-1.00	-0.22***	0.11**	0.31***
	(8.88)	(0.07)	(0.05)	(0.06)
Med. / mean Pure-price	16.5	0.63	0.05	0.16

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8. Compliance solutions by cartel type

Table 5: Use of additional governance contract clauses

Cartel type	Internal stability				External threats			∑clauses
	Monit.	Enfor.	Expel	Fine	New mem.	NC supply	Entry	
Pure all.	0.09	-0.00	-0.27	-0.03	-0.43***	0.45**	0.24**	-0.26*
	(0.13)	(0.07)	(0.22)	(0.09)	(0.13)	(0.17)	(0.11)	(0.15)
Quota	**0.46***	**0.54***	**-0.27**	**0.42***	-0.17	**0.33***	-0.06	**0.43***
	(0.13)	(0.11)	(0.10)	(0.12)	(0.13)	(0.10)	(0.04)	(0.09)
Mixed	-0.07	-0.04	-0.56***	-0.07	-0.48**	0.19	-0.07	-0.66**
	(0.10)	(0.07)	(0.14)	(0.11)	(0.18)	(0.28)	(0.07)	(0.33)
Mean	0.2	0.02	0.49	0.09	0.6	0.09	0.02	4.02
Pure-price								

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Conclusions

- Antitrust needed as otherwise cartels would be prevalent (in manufacturing).

- Prevalence driven by high continuation probability.

- Cartel types differ systematically by structural industry characteristics.

- Paying attention to such differences potentially helpful in detecting cartels.