

Screening markets for cartel detection - collusive marker in the CFD cartel-audit

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Abstract: Coordination Failure Diagnostics (CFD) is a model that analyses real market processes with the help of time pattern analysis and investigates whether they operate efficiently (See www.wiwi.uni-muenster.de/cfd). The CFD cartel-audit should enable the detection of cartels via characteristic market process patterns. This is based on the assumption that existing cartels cause failures in the observed process patterns. The CFD cartel-audit attempts to draw conclusions from these process patterns in order to find hidden cartels and to engage antitrust agencies into additional more detailed audits.

JEL-classifications: L13, L41, L61, D43

Keywords: cartel, cement, collusive marker, market screening, price fixing

1. Introduction

Most of the detected cartels are found through displeased employees, discriminated customers or a cartel member benefiting from a leniency program. In order to detect cartel structures an instrument is missing that is able to screen markets using economic criteria (Porter, 2004). The CFD cartel-audit is such a tool that should enable the detection of cartels via characteristic market process patterns. This is based on the assumption that existing cartels cause failures in the observed process patterns. The CFD cartel-audit attempts to draw conclusions from these process patterns in order to find hidden cartels and to engage antitrust agencies into additional more detailed audits.

Chapter 2 summarises the fundamentals of the coordination failure diagnostics concept. Chapter 3 figures collusive markers for a market screening and the procedure in the CFD cartel-audit. Chapter 4 applies the method to the German cement cartel and chapter 5 gives concluding remarks.

2. The model: Coordination Failure Diagnostics

Standard economic theory assumes that after exogenous shocks markets move fast and reliable to equilibrium. In contrast the New Austrian School expect markets not necessarily to find a new equilibrium without frictions. Hence, empirical testing is necessary for both hypotheses (Grossekettler, 2001).

In the general equilibrium theory the Walrasian auctioneer matches supply and demand in a market of perfect competition with perfect information and no transaction costs. This process is called tâtonnement related to the finding of the market clearing price (Arrow and Debreu, 1954). But in most markets there is neither an auctioneer nor demand and supply curves are observable. Therefore it is impossible to verify whether prices and quantities represent an equilibrium. The CFD does not try to estimate demand and supply curves, but detects disequilibria on the basis of circumstances that indicate welfare losses. The CFD model uses five market processes as control loop mechanisms in a cybernetic sense, where shocks affect the adjusted variable (e.g. the difference quantity between demand and supply) and the control variable (e.g. the price) regulates the adjusted variable back to equilibrium. The equilibrium of the adjusted variables is zero, because all other values are defects and cause welfare losses. The microeconomic market processes in CFD are the following of which each has a different adjusted variable. The **Market Clearing Process** should provoke a tendency of adjustment between demand and supply to prevent waste of production factors in form of nonsaleable goods or delays of delivery. The adjusted variable is the difference quantity between demand

and supply. The **Rate-of-Return Normalisation Process** aims at the efficient allocation of production factors which are guided towards their best economic use. This is reached by variations in capacities in order to achieve a rate of return equalisation according to the second of Gossen's Law and an efficient primary distribution of income. The adjusted variable is the difference between the market rate of return and the rate of return of a broader industry class. A working **Erosion of Market Power Process** prevents market participants from gaining enduring dominant positions of market power by ensuring that structural variations diminish predominant positions. Concentration indices serve as adjusted variables. The **Product Innovation Process** aims at the interest of consumers by ensuring that domestic producers remain competitive, so that they do not lag behind world-quality leaders in the long-run. The market share of new or quality improved products acts as adjusted variable. The **Technology Innovation Process**' main goal is to ensure that domestic producers in the long-run do not lag behind world-cost leaders. The adjusted variable here is the labor productivity. Empirical analyses show that these five market processes usually do function, because the adjusted variables oscillate around the zero-line (Grossekettler, 1999, 137).

3. Collusive markers and the CFD cartel-audit

Cartels affect the five mentioned market processes in a special manner which can be observed by the CFD cartel auditing method. This chapter shows typical characteristics of collusive behavior which serve as collusive markers in a market screening. If these indicators point at coordination failures in the analysed market this could be an advice for cartel structures.

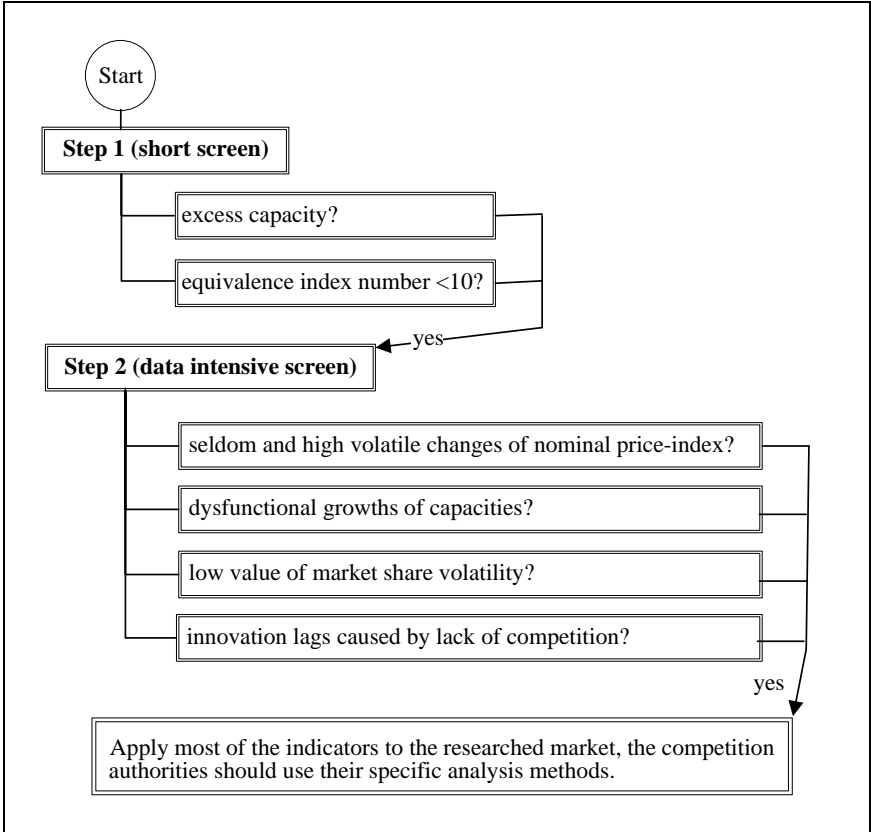
Table 1: Collusive markers in the CFD cartel-audit

Process	Indicator	Characteristics
Market Clearing Process	nominal price	seldom and high volatile changes of price-index fixed prices in cyclical downturns
	capacity utilization	small capacity utilization permanent excess supply
Rate-of-Return Normalisation Process	rate of return	oligopolistic excess rate of return, reduced by excess capacities or by fixed prices in recessions (under fixed costs)
	dysfunctional growths of capacities	excess capacities independent of rate of return reduction of capacities only by acquisition
Erosion of Market Power Process	HHI, equivalence index number	concentration ratios show market power and oligopoly
	volatility of market shares	small volatility of market shares, especially by fixed quotas
Product Innovation Process	market share of new products	obvious innovation lags
Technology Innovation Pr.	labor productivity	innovation success hindered by less effective firms little incentives for productivity gains without competition

Due to different cost structures of cartel members it is difficult for them to agree upon one **price**. The nominal price is usually varied seldom and in high volatility, because cartel members change prices at the same time and at the same ratio so that no one is suspicious to deviation (see Abrantes-Metz et al., 2005). Cartel suppliers act as quantity takers under fixed prices until the cartel assigns capacities by quotas. But the members hold reserve **capacities** to get higher quotas and to be armed for a possible break up of the cartel. This behaviour leads to little capacity utilization and permanent excess capacities. In a successful collusion all members benefit from **excess rate-of-return** through oligopolistic pricing, but this value could be reduced by the costs of the excess capacities or by fixed prices during a fall in demand under constant fixed costs. The **capacities grow** independent from the rate of return and reductions of capacity function only through acquisition or sale from another member. As concentration ratio operates the **Herfindahl-Hirschmann-Index** which involves all firms in the market n with the market share p of each firm to $HHI = \sum_{i=1}^n p_i^2$. The less the number of suppliers in a market, the easier it is to establish collusion (Ivaldi et.al., 2003, 12ff). That is the reason why most cartels are found in oligopolistic markets with less than 10 relevant players (Carlton; Perloff, 1994, 187) and an **equivalence index number** of $n^* \leq 10$. The equivalence index number is the reciprocal of the HHI (corrected with entry barriers and legal cooperating firms) under the assumption that firms have the same size. Market shares of cartel members are fixed so that their volatility is rather small. Market shares are not published in official statistics, but they could be measured with a new indicator – the **market share volatility**. This value measures the annual volatility of market shares of every firm over time and aggregates them to an index number for the whole industry. Thus sensible firm data can be used without revealing details of one firm, which is prohibited by German law authorities. The Technology Innovation Process and especially the Product Innovation Process are characterized by little incentives for productivity gains due to lack of competition. Therefore the **market shares of new products** and usually the **labor productivity** stay low in cartelized markets.

The CFD cartel-audit verifies the collusive markers systematically in two steps. Step 1 checks excess capacities, especially a low capacity utilisation, and the equivalence index number. If step 1 finds an equivalence index number smaller 10 and an existing excess capacity, these indicators suggest the existence of cartel structures. If both indicators are located in the researched market, the procedure continues with (the using more complex data) step 2. Figure 1 shows the procedure of the CFD cartel-audit, where step 1 checks the indicators with little data needs and if necessary step 2 checks the other more data intensive indicators.

Figure 1: Workflow of the CFD cartel-audit



The analysis in step 2 includes the other above mentioned indicators, which can operate as a collusive marker. It is tested whether the nominal prices change seldom and with high volatility. Is the rate of return normal, not because of lower prices, but because of the costs of excess capacities? Another indicator is the small fluctuation of the market share volatility. In the Technology and especially in the Product Innovation Process exist innovation lags as a result of lack of competition. Do most of the indicators apply to the researched market, the competition authorities should be informed and use their specific analysis methods looking for cartelized structures.

4. CFD cartel-audit in the German cement market

The in chapter 3 established indicators will now be applied to the German cement market, where an illegal cartel existed for decades. It should be tested, whether the CFD cartel-audit would have discovered the cartel.

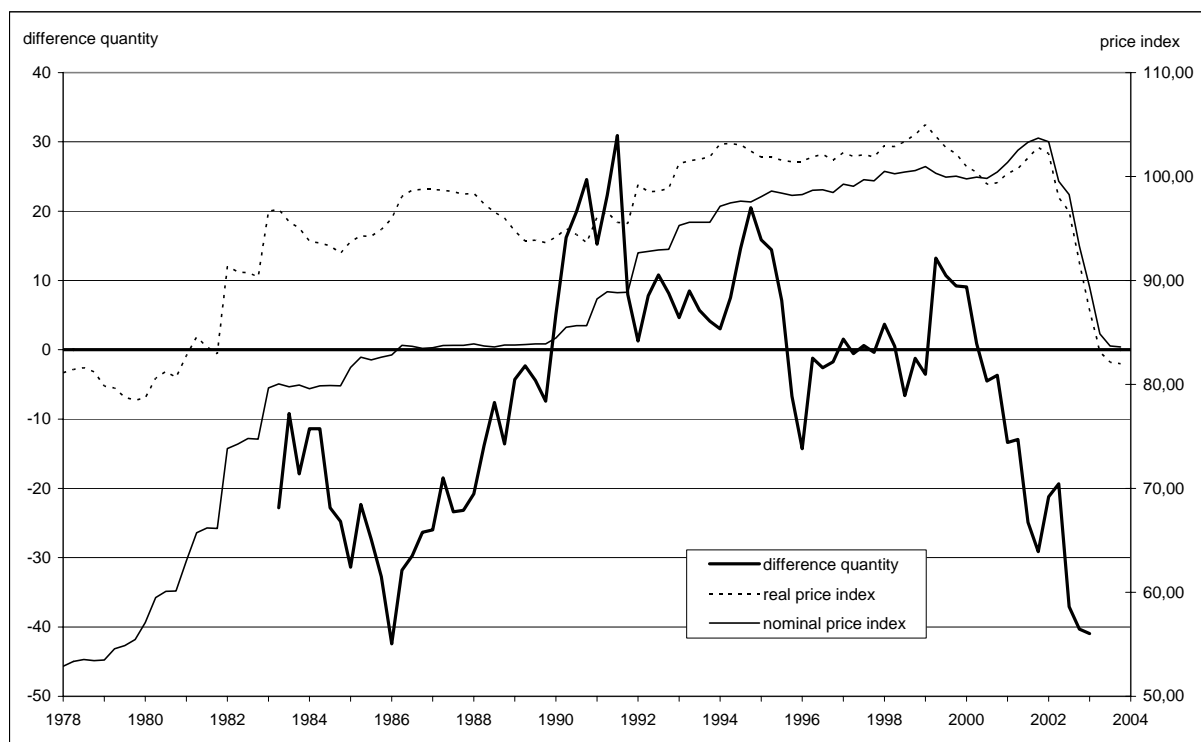
The German cement producers have often been convicted for illegal agreements on prices or quotas in the markets Southern Germany (1988), Europe (1994) and Germany (2002). The cement demanding construction industry complained about the absence of price decreases

despite the well known excess capacities. Cartel members were the biggest German producers like Heidelberg, Schwenk, Dyckerhoff, Lafarge, Alsen (later Holcim), Readymix and 6 small business firms, which were found guilty to pay fines of 661 million euros.

The analysis starts with step 1 of the workflow and tests existing excess capacities in the Market Clearing Process and the equivalence index number in the Erosion of Market Power Process.

The **Market Clearing Process** measures the difference quantity between demand and supply. This adjusted variable can lead to excess demand or excess supply and should be regulated to zero through price changes. Control variable is the real price-index, which is established by deflation with the whole manufacturing industry. Additionally the nominal price-index is given.

Figure 2: Market Clearing Process



Source: Ifo Institute for Economic Research.

The adjusted variable is aggregated by the capacity utilisation, the time for delivery and the stock of inventory, because the difference quantity has to be reflected at least in one of these values. The aggregated difference quantity can be calculated by data of the Ifo Institute for Economic Research with the formula:

$$x_D = \left(\frac{KAD_t}{NKAD} - 1 \right) * 100 + (LUS_t) + \left(\frac{BMD_t}{NBMD} - 1 \right) * 100$$

with

x_D = difference quantity of supply and demand

KAD_t = capacity utilisation in period t

$NKAD$ = normal capacity utilisation in the cement industry

LUS_t = stock of inventory in period t

BMD_t = time for delivery in period t

$NBMD$ = normal time for delivery in this industry.

From the derived arguments for the German cement market results the above process pattern for 1978-2003. The process pattern often shows the tendency for the adjusted variable to move to zero, but there are also permanent phases of excess supply. Additionally a reaction test is conducted, which analyses, whether the adjusted variable and the control variable strongly react to each other to reduce the malfunction. A deviation of the adjusted variable from zero should evoke a reaction of the control variable, which brings the adjusted variable back to the equilibrium. The reaction test shows the coordination failure for the Market Clearing Process, because the variations of the control variable as well as the variations of the adjusted variable show dysfunctional reactions. The number of dysfunctional reactions is very high with 52% and 48% (Lorenz, 2004).

The process pattern shows from the beginning in the second quarter of 1983 a permanent excess supply for seven years. 1990 follows a period of predominant positive excess demand, which however often has a tendency to zero. In the third period from 1996 until 1998 the difference quantity crosses the zero line eight times. From 2000-2003 there is a permanent and increasing excess supply again.

A permanent workability of the process can not be found here most of the time. Workability would be characterized by adjustments of the control variable in the right direction as reactions of the movements of the adjusted variable. Until 1990 with an excess supply the price indices move in a relative constant corridor and do not fall. From 1978-1983 the cement market is characterised by typical movements for cartels; the prices move in stages, but rise at the beginning of the year and stay constant for the rest of the year. In the third period prices remain on a high level, even with a difference quantity around zero. In the last period prices rise for a short time in spite of growing excess supply and the crisis in the building industry, but fall sharply compared to the level of 1990.

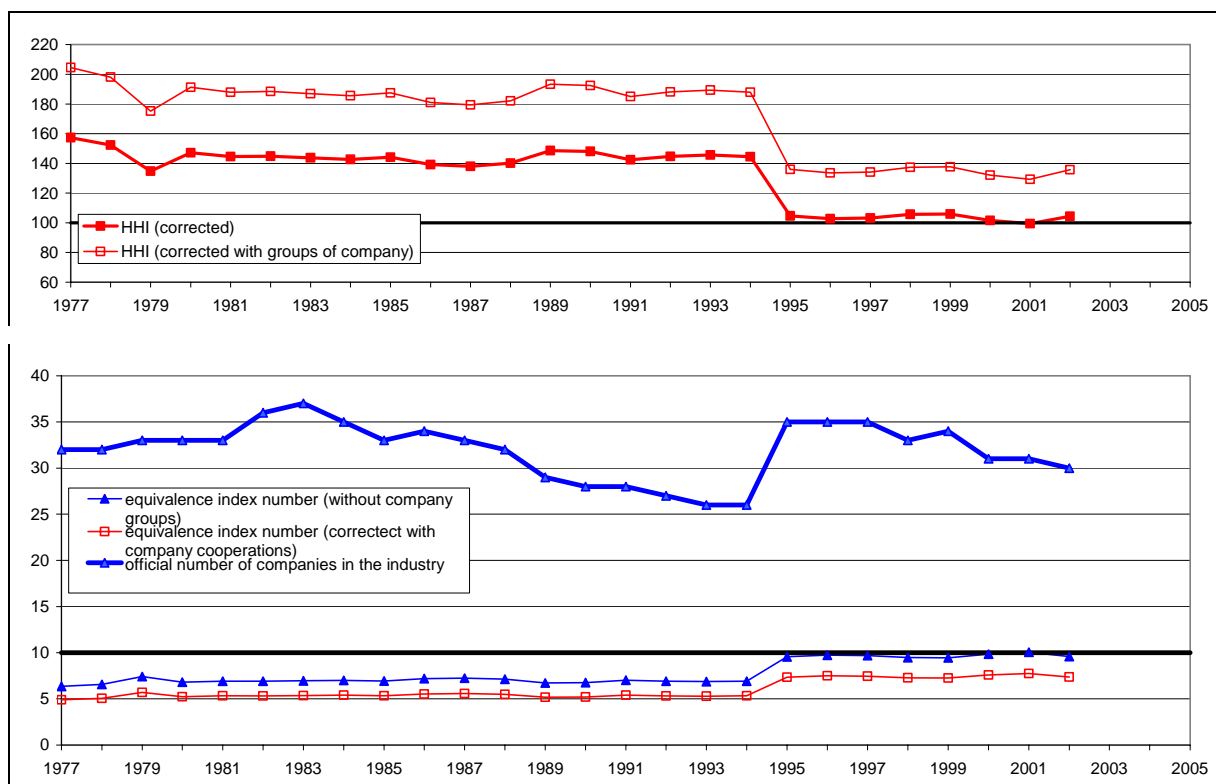
The cement producer determined their prices at a high level and adapted them sporadically. The slump took place after the detection of the cartel in 2002, when cement prices and capac-

ity utilisation dropped dramatically. At the same time Readymix started a price war in all four local markets in Germany (Blum, 2004).

The **Erosion of Market Power Process** analyses the power between supply (cement producers) and demand (building material industry). Workability is given when coordination failures are removed through structural changes like new entry on the stronger side of the market, because the number of possible alternatives on the customers' side rises.

The best indicator to measure market power is the market share volatility, but the data is very difficult to obtain. The Federal Statistical Office published the data only for 2001-2003, which were 2,34%, 5,09% and 8,72% to the previous year. This means that since the cartel detection the volatility of market shares rose as a result of more competition (Lorenz, forthcoming).

Figure 3: Erosion of Market Power Process



Source: Federal Statistical Office.

Because of the problems with the data the Herfindahl-Hirschmann-Index respectively the derived equivalence index number is used and corrected by factors like entry barriers and company cooperation etcetera. Legal cooperation is a very important factor which has to be measured and transformed into a concentration measure, because otherwise the concentration would be underestimated. It is conceived for the whole period by the estimations of the Ger-

man Monopoly Commission, which has measured the HHI for real existing groups of companies for the year 2001.

The upper process pattern shows the high concentration in the market during the whole period, because the measures of the HHI (with and without legal cooperation of the firms) lie above the barriers of an index of 100, which is normally used by the European Commission and the US Department of Justice (Kwoka; White, 2004, 18).

Another concentration measure used here is the equivalence index number, which is generated through the reciprocal of the HHI. Under the assumption of companies with same market shares the equivalence index number shows the number of fictive companies in the market, with the same level of customer choice (i.e. the more suppliers are in the market, the greater is the flexibility to chance the vendor). The more the equivalence index number matches the real number of companies, the more uniformly distributed are the market shares and the less potential has one company to reach a dominant position. In the cement market there exist about 30 companies, but the computed number of fictive companies by the equivalence index number is below ten. This corresponds to the existing six big players in the market Dyckerhoff, Heidelberg, Lafarge, Holcim, Schwenk and Readymix, which dominate the bulk of the market. So the equivalence index number shows a good estimation of the real concentration ratio, which is definitely characterised by high concentration.

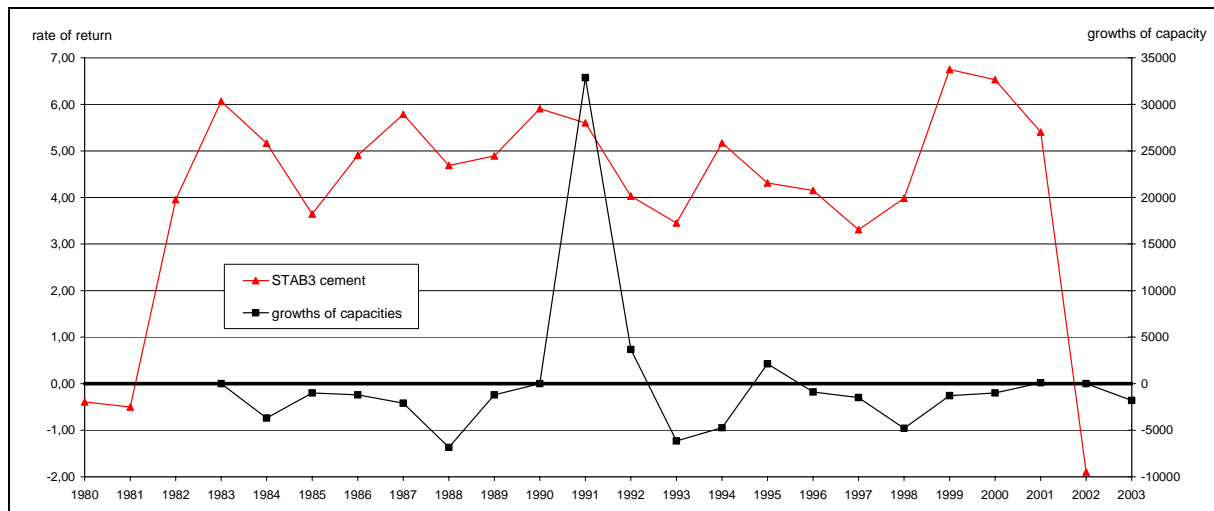
Step 1 shows excess supply and an equivalence index number smaller than ten, so that step 2 of the workflow of the CFD cartel-audit has to be carried out (see Figure 1).

It starts with the **Rate-of-Return Normalisation Process**, which analyses the rate of return in the cement market to the effect whether it follows a functional reaction of the growths of capacities. If there is excess rate of return, it should be adjusted by new entry or upgrades of existing capacities. The rate of return in the cement market and the rate of return of a higher industry class for a comparison are measured by data of the Federal Statistical Office by the following formula for the adjusted variable:

$$STAB3 = \frac{\text{net value added} - \text{gross income of dependent personal services}}{\text{total revenue}} .$$

The perfect indicator for the control variable would be the capacity growth, which is determined only by the actual rate of return or their expected values (Nagel, 1998, 231 and 292ff). This indicator is not available. Hence, the growths of the furnace capacities published by the cement association have to be consulted. The number of furnaces and their specific production capacity is published by the German cement association which represent the following process pattern.

Figure 4: Rate-of-Return Normalisation Process

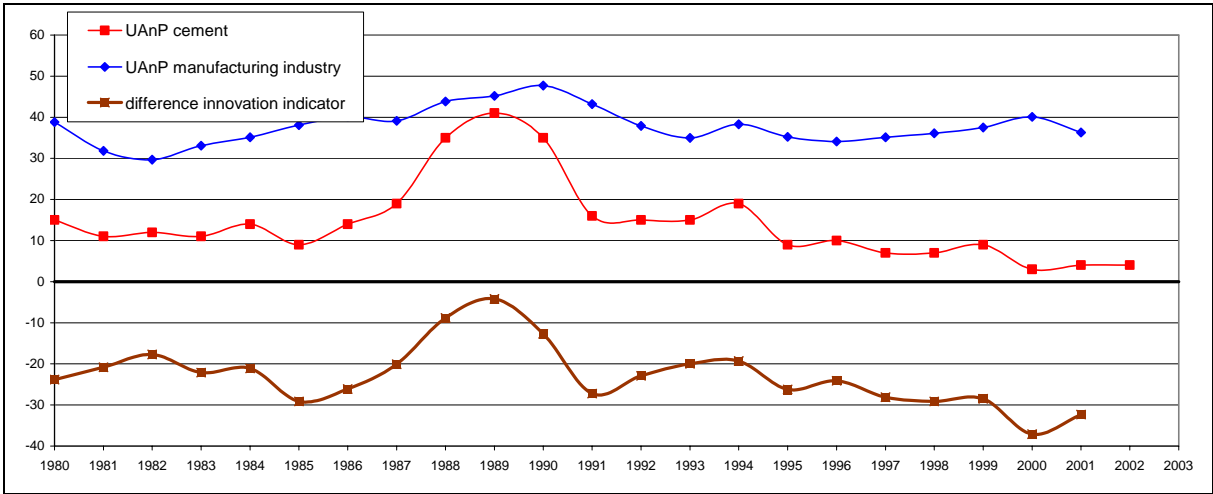


Source: Federal Statistical Office and German Cement Association.

The rate of return of the cement industry starts 1980 and 1981 with negative values, which move fast into a corridor of 3-6% until 2001. After the German Unification 1991 the rate of return fell from 6 to 3 percent as a result of the additional East German capacities. The process pattern shows that the rate of return normalisation process does not function, because the reactions of the control variable (the capacity growths) do not move in the right direction in 68% of all reactions. During the rest of the period the capacities are reduced to a smaller extend, but this could be a sign of excess capacities in the cement industry. The adjusted variable (the difference in rate of return) does not function either, because it reacts in 55% of the process movements dysfunctional. There are light excess rate of returns in the cement industry which are not declining, because of additional capacities or emerging companies. Since the cartel detection in 2002 the rates of return fell dramatically. This means the competition profits are not high enough to keep this level of capacities constant and acquisitions or withdrawals are possible in near future.

The **Product Innovation Process** uses the market share of new or quality improved products as adjusted variable. This indicator functions as a measure for innovation in relation to other cement industries in other countries. The Ifo Institute for Economic Research publishes data of the market shares of goods that are in the launch phase or in the first growths phase. Data of other countries are missing, so that a broader industry class is used for a comparison, the whole manufacturing industry.

Figure 5: Product Innovation Process



Source: Ifo Institute for Economic Research.

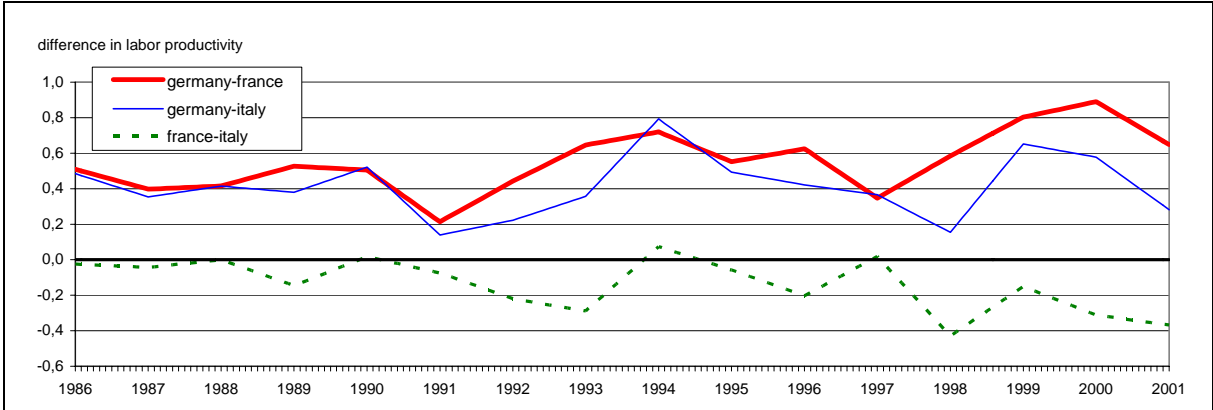
The process pattern shows the market shares of new and quality improved products for the cement market as well as the whole manufacturing industry. Certainly the cement sector is not very dynamic, thus is mainly due to lack of competition, which dampens the incentives to better up one’s position through innovations. In the whole period there is an innovation ratio below average in the cement industry from 5% until nearly 40%. These values show a sustainable function failure in the Product Innovation Process.

Innovations in the **Technology Innovation Process** often occur through increases in productivity, where partial factor productivity is used as indicator (Sebbel-Leschke, 1996, 158f). An increase in capital intensity on the one hand leads to a decrease in capital productivity, but on the other hand to an increase in labor productivity. The labor productivity is defined as the quotient of output and the factor input, but it is important to acknowledge that labor is a very heterogeneous factor. Hours of work is a better indicator than number of employees, because reductions in working time would lead to an underestimation of the productivity, if just the figure is used. For a comparison between two states it is necessary to have the same units of output. The total revenue should not be used, because it does not include vertical integration in comparison to sourced out plant sections (OFT, 2004, 60). Since cement is a homogeneous good with little differences in quality the output can be measured in the quantity of tons, so that there is no need for a conversion into another currency. Indicator is the labor productivity derived by the division of cement in tons per really worked hours.

The German cement market being analyzed should be compared to the worlds market leader in technology innovations, so the differences of the labor productivity of a pair of states is build and displayed in the following process pattern. In the view of industry experts like

business managers or engineers, possible benchmark states in the case of cement technologies are France and Italy.

Figure 6: Technology Innovation Process



Source: Eurostat.

Germany shows a positive difference of labor productivity compared to France and Italy for the whole period. The difference between France and Italy oscillates around zero, but with a small shortfall of France. For France compared to Italy the tendency is right, but not strong enough to reach the zero line. There are overhaul activities in technology innovations, but they are not enough to meet the international level.

The general assumption that incentives for innovations on cartelized markets are smaller than in competitive markets does not hold. But the assumption is approved for product innovations, which are advantageous for the demand while technology improvements are also profitable for the producers. A high frequency in technology innovations on the German market is plausible despite the existence of the cartel, because both the German and the French as well as the Italian cement groups are competitors in the world market. They build up new plants in the whole world with the highest technological levels and try to produce cement with the most efficient technologies.

5. Conclusions

The analysis of the five market processes has indicated typical characteristics, which can be summarized as cartel syndrome and provide evidence for cartel structures. These characteristics are as follows: seldom and high volatile changes of price-index, permanent excess supply, oligopolistic excess rate of return, dysfunctional growths of capacities, the equivalence index number shows an oligopoly and lags in product and technology innovations. Further research

activities will thus concentrate on identifying cartel-characteristic process pattern-syndromes, which can be utilised in form of collusive markers whilst screening for cartels.

The example of the German cement market shows that the CFD cartel-audit is a systematic method to detect cartel activities by economic criteria. It fulfils the three criteria for a general market screening: First, evidence of collusion must be observable by just looking at easily available data. Second, the test to be conducted should be routinizable so that it can be carried out with minimum human input. The third criterion is that the screen should be costly for a cartel to delude by influencing the screening results. The objective is to screen industries as a matter of course, even where is not hint of collusion (Harrington, 2004, 41f). For this reason it can be recommended to the competition authorities to use a screening method like the CFD cartel-audit for the search for suspicious markets.

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