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Capacity Constraints and Irreversible Investments: Defending Against Collective Dominance in *UPM Kymmene/Norske Skog/Haindl*

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Abstract
Scrutiny of potential mergers by the European Commission often focuses on unilateral effects or single firm dominance. But some cases have involved concerns over coordinated effects: the concern that the merger could increase the likelihood of consumer harm through tacit collusion by the reduced number of firms in the industry (this is known as collective dominance). The economic and legal issues are far less certain in these cases and a particular challenge is how to bring empirical evidence to bear on the decision. In this chapter we examine a case in newsprint and magazine paper - UPM Kymmene/Norske Skog/Haindl . Here, coordinated effects were at the centre of the Commission's concerns. We discuss how collusion theory and evidence were used to help clear the merger without remedies in the final Decision.

Keywords: coordinated effects, joint dominance, irreversible investment, capacity constraints
JEL Classifications: L1, L4, L73

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1. Introduction

Scrutiny of potential mergers by the European Commission typically focuses on unilateral effects or single firm dominance. But in a series of important cases starting with *Kali and Salz , Nestlé-Perrier*, and most importantly *Airtours*, the Commission has showed itself concerned over the issue of "joint dominance". However, until the judgment on *Airtours* there had been controversial debate whether "joint dominance" was equivalent to the idea of coordinated effects as used in the US: the concern that the merger could increase the likelihood of consumer harm by making tacit collusion easier. But although the Court effectively established that a joint dominance finding required a "coordinated effects" analysis, the practical implementation of such an approach has remained difficult. A particular challenge is how to bring empirical evidence to bear on finding or rejecting the existence of coordinated effects of a merger.

In this chapter we examine a case in newsprint and magazine paper - UPM Kymmene/Norske Skog/Haindl. The case involves to separate transactions in which Haindl sold all of its business to UPM Kymmene and the latter sold some of Haindl's major assets on to Norske Skog. The case arose because the Haindl family, which had run the business, wanted to withdraw from management activities. Haindl was an attractive target for UPM Kymmene because of its modern plant and low production costs. However, an outright takeover was likely to cause serious competition concerns, especially in magazine paper. The purchase was therefore combined with a deal to sell significant Haindl capacity, primarily in magazine paper, on to Norske Skog. The latter had at the time become a major player in newsprint. This deal allowed Norske Skog also to become a significant player in magazine paper. Effectively splitting Haindl assets between UPM Kymmene and Norske Skog thus addressed some competition concerns and allowed Norske Skog to achieve a strategic goal in its expanison plans.

The case is of particular interest because coordinated effects were the primary focus of the Commission's analysis. Indeed, the Commission very quickly developed serious concerns in Phase 1 of the proceedings about the scope for tacit collusion in the industry, which were expressed in a statement of objections in phase 2. We discuss how collusion theory combined with empirical evidence were used to convince the Commission that the merger was unlikely to

have coordinated effects and clear the merger without remedies despite their strong initial objections .

The Commission's worries were easily understandable given the industry context at that time. In 2001 the Commission was faced with the third major merger proposal in the European publication paper industry since 1995. In addition, the industry had come under close scrutiny because of a Commission investigation of alleged collusive behavior in the newsprint market that had run for several years. Furthermore, the company that was about to be purchased, Haindl, was considered at the time a pioneer in the investment into new equipment and the use of recycled paper as an input for paper production. The Commission clearly felt that a particularly disruptive "maverick" competitor would be taken from the market.

Despite the previous consolidation, concentration in the industry was not high enough for a credible unilateral effects case to be made. But the history of the industry had all the ingredients to raise potential concerns about coordinated effects (i.e. tacit collusion). However, such a case was not straightforward. Individual contracting combined with capacity constraints made it highly unlikely that coordination in prices was easy to achieve. The Commission therefore went for an alternative route, claiming that firms were able to jointly limit capacity expansion in order to keep prices high.

We describe the arguments and counter-arguments over the Commission's claim of coordinated effects. In particular, we show how a defense was built by carefully constructing theoretical arguments on the basis of specific industry characteristics. A variety of evidence was used to support an alternative competitive story of industry behavior over time. We then show that irreversible investments makes coordination highly unlikely and demonstrate how evidence for irreversibility and the implied pre-emption effects can be used to support the claims of the theory. Our discussion also sheds some light on the use of evidence from market announcements and information sharing institutions in the context of a coordinated effects cases. We regard this paper as a case study of how, through a careful presentation of alternative theories and their empirical implications, a coordinated effects analysis can be focused on empirical evidence that

can resolve the case in favor of the firm.[1] The Commission conceded in its decision that the irreversibility argument and the supporting evidence undermined any coordinated effects claim.

In section 2 we give a brief introduction to the markets for newsprint and magazine paper. Section 3 illustrates the evolution of the industry in the 1990s and explains why the Commission had concerns about the price patterns observed. In section 4 we then describe the case made by the Commission. We continue in section 5 with a discussion of the theoretical arguments that coordinated conduct in markets with irreversibility is highly unlikely and present the type of evidence that would support a conclusion that the market satisfies the conditions under which one should find a low likelihood of collusion. Finally, we take up the issue of short run coordination on "downtime" after negative demand shocks in section 6 and discuss the use of market transparency arguments in the case in section 7

2. The Markets for Newsprint and Magazine Paper

Paper production covers a fairly large range of products, which all have in common that some kind of wood pulp is converted to paper. Some companies active in paper production like UPM Kymmene are broad conglomerate firms active in most of these production areas. Other companies like Haindl and Norske Skog specialize in the production of "publication paper", which this merger is concerned with. Publication paper includes the broad categories of "newsprint" and "magazine paper".

Newsprint is primarily used for the publication of newspapers. The manufacturing of newsprint requires either mechanical pulp (derived from wood) or recycled pulp (derived from recycled paper). Besides labor, energy is a very important input for newsprint production. Newsprint comes in a variety of grades depending on weight, type of finishing, and brightness. Despite such gradations the Commission and the parties agreed to treat all of these varieties as a single market.

[1] We are less confident that it is possible generally to build a satisfactory case that a merger should be blocked on the basis of coordinated effects. This means competition authorities will generally be in a relatively weak position in such cases. This paper attempts to show that a fairly rigorous and convincing defense can be built by relying on a combination of theoretical arguments and simple empirical evidence.

Magazine paper is primarily used for consumer magazines, catalogues, and advertising materials. The quality requirements for these three areas of usage can be quite different. The basic ingredient for magazine paper is again pulp. In addition to mechanical and recycled pulp, chemical pulp is also used. In contrast to newsprint there is typically heavy use of coating chemicals and chemical fillers. The Commission decided for the purposes of the investigation to define two different markets for magazine paper. Based on a price correlation analysis, the highest quality paper (wood free coated reels), which is heavier and brighter than other types of magazine paper, was found to be in a separate market. This market definition issue was unimportant for the actual case.

In the geographical dimension, UPM Kymmene suggested that the market should be treated as worldwide. However, in newsprint the three largest North American producers were participating in the European market only with very small amounts. In magazine paper this participation was even lower. For this reason the Commission concluded that the geographic market was only European-wide.

The proposed merger occurred at the end of an important consolidation wave in the publishing paper industry in the 1990s. In 1995 UPM and Kymmene merged to become the largest firm in terms of capacity in magazine paper. In 1998 a merger between Stora and Enso created the largest newsprint producer in terms of capacity share. The top five firms in the newsprint market (Stora Enso, UPM-Kymmene, Norske Skog, Holmen, and Haindl) at the time of the merger had between 70% and 80% capacity share and between 60% and 70% share in sales.[2] Given that Haindl held 10% to 15% capacity share and 5% to 10 % share in sales the merger brought about a significant increase in concentration. It was not obvious to what extent asymmetries would be significantly affected by the merger. The leading firm in the market, Stora Enso, held about 20% to 25% market share in sales and capacities. The transaction moved UPM Kymmene from a group of three firms (including Haindl) with 10% to 15% market share in capacities into the number two position in the same range and just behind Stora Enso, but ahead of Norske Skog at 15% to 20%.

[2] Market share figures are taken from the non-confidential version of the Commission's decision. All numbers reported here come from publicly accessible data, i.e. the Commission's decision or data from the industry association CEPIPRINT.

In the magazine market the three leading firms were UPM Kymmene (25%-30% capacity), Stora Enso (20%-25% capacity), M-Real/Myllykoski (10%-15% capacity), followed by a group of firms in the 5% to 10% range: Haindl, Norske Skog, Burgo, and SCA. The total capacity and sales shares of the three largest firms together with Norske Skog and Haindl were between 75% and 85%, so that the magazine market was somewhat more concentrated than the newsprint market. Without the sale of magazine paper assets to Norske Skog, UPM Kymmene would have achieved close to 40% capacity share (and close to 35% share in sales). The deal with Norske Skog brought the capacity share in the range of 30% - 35% and moved Norske Skog into a more significant market position with 10% - 15% capacity share. Note that strong asymmetries in capacity holdings remained in this market after the transactions despite the fairly concentrated overall structure of the market.

A number of important structural features characterize both markets. First, there are ***substantial scale economies*** for given production capacity. Plant costs have a fixed cost element of the order of 45 percent for a machine operating at full capacity. The average cost of production steeply decreases with volumes for any given plant.

The second fact of great importance for the operation of the industry is that ***capacity decisions are lumpy and irreversible***. Newsprint and magazine paper are produced on large paper machines. At the time of the merger a new efficient newsprint machine had a capacity of up to 400,000 tonnes a year. Such a machine would have covered about 3-4 percent of total EEA consumption of newsprint at that time. The cost for such a modern machine was in the order of 500 million Euros. New machines take about two years to build and are highly durable. Most importantly, capacity decisions are *difficult to reverse* because much of the investment is sunk. It has to be mentioned that there are alternative ways to expand capacity, for example, through the rebuild or upgrade of an existing machine. However, these opportunities are limited because of technical considerations. Even rebuilds are lumpy and costly and generate the additional cost of a machine not being available over the time of the rebuild. Rebuilds and upgrades therefore do not make it possible to smoothly adjust capacity to short run fluctuations in demand.

Thirdly, ***demand is highly volatile and very inelastic.*** The demand for newsprint and magazine paper is a derived demand. It inherits its volatility from the volatility of demand by advertisers for space in newspapers and magazines. Industry demand is therefore extremely vulnerable to aggregate shocks in economic activity, which is the variable driving advertising demand. According to all the evidence the demand for newsprint and magazine paper is also fairly price inelastic. Estimates used by the Commission range between –0.15 and -0.3 for newsprint and between -0.3 and - 0.6 for magazine paper. In the short run demand is even less elastic since production quantities of downstream users of paper tend to be committed for some period of time. There is only limited scope for 'production smoothing' through the building and depletion of stocks, because newsprint is perishable. Storage beyond three months is usually not possible. A second factor that limits production smoothing is technological. In general it is extremely inefficient to use machines at anything else but optimal capacity utilization. In times of low demand it is therefore best to adjust by switching off whole machines.

Finally, the contracting practices of the industry are central for understanding market behaviour. Contracting is on an individual basis with each buyer for periods of, typically, one year.[3] These contracts in principle commit both sides to a given price for a given expected quantity. In practice, there is, however, an important asymmetry. Paper producers are generally committed to the price of the contract even when a high demand realization occurs and producers hit capacity constraints. However, when demand is low customers will often seek to renegotiate the price downwards. In fact, some of the larger buyers will even specify such asymmetric commitments in the purchase contract. The partial downward flexibility of prices arises in all likelihood because the actual quantity delivered cannot be fully controlled through the contract. Buyers do not take one delivery for the year but call up deliveries on the contract in irregular intervals and at varying quantities throughout the year. This means they do not have to take delivery if their need of paper turns out to be low. It is harder to explain why prices do not adjust upwards when

[3] Contracting can be longer in newsprint or shorter in magazine paper, but yearly contracting is the typical form contracts take.

demand is unexpectedly high. It appears that the parties believe that delivery can be enforced as long as the paper company is not fully capacity constrained.

3. The Evolution of the Industry in the 1990s

As a background for the case we begin by illustrating the behavior of the industry during the 1990s. First, we describe the price movements that created the initial impression on the side of the European Commission that coordinated conduct might already be a problem pre-merger. We then show that the price dynamics observed in the 1990s are consistent with a non-collusive explanation based on the major characteristics of the industry that we highlighted in the previous section. To simplify the exposition we analyze only the price and capacity dynamics in the newsprint market. A similar analysis can be conducted for different categories of magazine paper as well.

In Figure 1 below we plot the quarterly average real prices per tonne of newsprint in 1990 DEM (Deutsche Mark). The graph illustrates the trend towards sharply lower prices in the publication paper industry during the 1990s. Fourth quarter prices for newsprint in 2000 are about 30 percent lower in real terms than in the first quarter of 1990. This trend reflects the efforts in the industry to reduce costs. Gaining cost advantage is a major competitive factor in the industry and the graph shows how this is translated into falling prices over time.

[Insert Figure 1]

The Commission's concerns about coordinated effects of mergers were raised by the behavior of prices in the period between the beginning of 1997 and the end of 2000. In this period prices seem remarkably stable over time. In addition, there is a sharp upward spike in prices at the beginning of 2001. Given the contrast with the much more volatile prices before this period, the Commission conjectured that firms might be artificially stabilizing prices by coordinating policies on capacity expansion.

The merger occurred on the background of a European cartel investigation into the newsprint market. This investigation covered the period 1989 through 1995. The case was closed only in September 2002, after the Haindl transaction had been approved by the Commission. It should be noted that the steeply declining prices in the period up to 1995 do not contradict a charge of collusion. Possibly the prices could have fallen much faster. However, the concerns about coordinated conduct in the merger case clearly did not arise from the price pattern in the period of the alleged cartel but from the price stability at the end of the 1990s.

We now show that the steeply declining pricing pattern between 1991 and 1995 as well as the stable pricing pattern between 1997 and 2000 can be explained as the result of an un-coordinated (competitive) outcome generated by the specific demand, capacity, and contracting conditions in the industry. Suppose that there is no collusion in a market. Then prices in a world with capacity constraints are determined by the current realization of demand relative to existing capacity. However, in markets with long term contracts prices typically are set for a whole year and will be determined by *expected demand* and not realized demand. If firms suffer an unexpected negative demand shock during the contracting period, capacity utilization will be low and prices will adjust downward only with a lag. We can verify whether the data is consistent with these market characteristics being the main drivers of prices by using data on demand forecasts and capacities in addition to the price data presented in Figure 1.

Figure 1 suggests that the history of price changes in this industry over the last 10 years can be divided into four periods. In the early 1990s (period 1) prices for newsprint and magazine paper fell very sharply and then increased rapidly in 1995 (period 2). Prices then, again, fell sharply in 1996 and early 1997 (period 3). After late 1997 (period 4), prices were fairly stable until the increase in the first quarter of 2001, which is the part of the price path that raised the Commission's suspicions.

In interpreting this price history, The capacity utilization figures reported in Table 2 below are particularly helpful.

[Insert Figure 2]

The early 1990s were characterised by a global recession. As can be seen from Figure 2, capacity utilisation dropped well below 95% and prices fell sharply by 30 percent.[6] Low prices and low capacity utilization in this period are consistent with a reduction in demand due to the recession combined with a considerable expansion in capacity that firms had committed to before the downturn. Reflecting low demand and capacity utilization in 1993 and industry expectations of continued low demand would remain[7], contract prices were still low in 1994. Given such low prices, capacity utilisation in newsprint jumped to over 96 percent in 1994. There was no sharp price increase in the course of 1994 because of the rigidities imposed by the annual contracts. However, prices increased sharply at the end-of year negotiations for 1995, from DEM 825 to DEM 964 per tonne.[8]

Possibly cautioned by the surprise of 1994, paper firms signed an unusually large number of six-month contracts (instead of the standard yearly ones), that would allow faster adjustment to rising demand. This change in contract length combined with higher than predicted demand growth in 1995 (see footnote 7) explains the large price jump between the second and third quarters of 1995. The demand situation fed through fully to the market at the end of that year

[6] We understand that given accounting conventions used by CEPIPRINT at the time a 95% capacity utilization figure would correspond – at least approximately - to full capacity utilization in an economic sense.

[7] The sharp rebound of demand in this year surprised the industry: CEPIPRINT's Demand-Supply report of February 1995 records that the size of the rebound took the industry by surprise: "Recent changes in direction of the world economic pendulum has witnessed the paper markets of Europe rebounding from recession with astounding strength." The CEPIPRINT forecast made at the start of 1993 under-predicted 1994 Western European newsprint demand by 8.7 percent and the 1994 forecast under-predicted 1995 demand by 5.7 percent.

[8] The prices quoted in the text are nominal DEM, prices displayed in Figure 1 are real, 1990 DEM.

[11] Note that the response to increased uncertainty makes sense given the pattern of downward price flexibility and upward price rigidity in the contracts. If uncertainty increases it becomes more likely that prices cannot rise as a response to unexpectedly high demand. This means that the paper company would ask for higher prices to cover this risk. When full adjustment to the demand shock increases efficiency both buyer and seller can increase joint benefits by agreeing to have the price adjust more frequently. The buyer realizes part of the gains through lower initial prices.

when the contract price for yearly contracts was adjusted and the newsprint price rose to DEM 1,236.[11]

The year 1996 (period 3) illustrates the opposite phenomenon: a large unanticipated negative demand shock hits the industry. Given the high prices that had been negotiated at the end of 1995 an unexpected decline in demand drove capacity utilisation down to 90 percent. CEPIPRINT's Demand-Supply Report of February 1996 had forecast newsprint deliveries of 9,300 for 1996, but their report of June 1997 records a realization of only 8,715 - 7 percent below forecast. As we have discussed, there is more of a possibility of renegotiating contractual prices downward after a negative demand shock. This led to a gradual decline of the price from DEM 1,236 in the first quarter to DEM 1,176 in the fourth quarter. When all long term contracts adjusted at the beginning of 1997, the price fell back further to DEM 1034.

From 1997 to the second quarter of 2000 (period 4), demand recovered and remained strong. However, considerable new capacity was introduced in Europe so that the effects of any growth in demand were offset by large capacity increases. There was also a slump in overseas demand from Asia. These factors had a moderating effect on price increases, and concerns about the longer run (e.g. the impact of electronic media) contributed to a climate of greater uncertainty. In these circumstances we see paper producers conclude a greater number of longer-term contracts exceeding the standard one year term. As a result prices looked very stable over the period. Only at the 2000 end-of-year negotiations do we finally see sharp price increases getting through.

We can therefore explain the price dynamics in the market by competitive forces taking into account capacity constraints, demand volatility, and the desire of market participants to hedge increased demand risk through longer term contracts. We see that demand is very volatile and prices reflect demand forecasts and to a much smaller extent realized demand due to contracting induced lags in price adjustments. Both the steep price declines at the beginning of the period

and the smoother prices at the end of the period can all be explained by the same underlying set of market forces.

4. The Commission's Coordinated Effects Case

The Commission never considered a theory of unilateral effects in this case but always focused exclusively on the possibility of coordinated effects. It seemed to acknowledge that based on the price movements and capacity utilization figures observed there appeared to be little evidence for any price coordination. In addition, and consistent with the strong emphasis on issues of transparency in the decision, the Commission heavily leaned on the argument that transactions prices were not observable in order to dismiss the possibility of coordination in long-run contract prices.

Instead the Commission focussed on two issues. First, they were concerned that newsprint producers could coordinate investment decisions, reducing the rate of capacity expansion in order to increase transaction prices. Second, they claimed that firms could coordinate on the use of downtime in order to support short run prices when short-run demand reductions occurred.

In the remaining sections of this paper we systematically analyze these possibilities in the light of economic theory and the available empirical data. In particular, we emphasize what kind of data was of importance to support the theories that were used in the defence against coordinated effects.

Here we first sketch the Commission's approach. At a first glance the approach closely resembles a traditional checklist approach. The Commission lists a number of criteria that are commonly considered to favor coordinated conduct. If they are present this weighs in negatively for the merger, if they are not this weighs in positively for the merger. The Commission claimed that the product is homogeneous, that demand is very inelastic, and mentions the existence of multi-market contact, limited buyer market power, and high entry barriers as criteria that pointed towards a danger of coordinated effects. The Commission also claimed that the removal of a player would make the market more transparent and less uncertain, which would facilitate

coordination.[13] On the other hand the Commission lists the limited stability of market shares, lack of transparency on capacity expansion projects and prices, as well as the lack of symmetry in cost structures as elements not conducive to collusion. According to the Commission simply weighing these observations would be a sufficient basis for a decision. The Decision discusses the possible coordination mechanism only "for the sake of completeness" (para 126 of the decision).

But, at a closer look, the Commission's analysis is more sophisticated than traditional checklist approaches. Their greater emphasis on issues of asymmetry between competitors and the role of market transparency is closer to modern economic theory and empirics (see Dick 2002 and Kühn 2006). The Commission has also closely stuck to the common wisdom that the disappearance of a competitor will facilitate collusion directly. The conceptual approach to coordinated effects analysis in Dick (2002) is along these lines. He describes an asymmetry increasing merger as leading to a tradeoff between a firm disappearing making collusion easier and the asymmetry making collusion harder. However, the theoretical analysis of such models by Compte, Jenny, and Rey (2002) and Kühn (2004) shows that selling assets to other firms in the market is not the same as exiting the market with the assets.[14] What matters in these models is the asymmetry between the largest and smallest firms in the industry, not the reduction of the number of firms in the market. This suggests that arguments based on the "elimination of a competitor" may be very misleading in an analysis of coordinated effects. The discussion in the Commission decision also appears to appeal to a variant of the disappearing firm argument: the elimination of a "maverick". Haindl was a very innovative firm. It was the first to heavily invest in production facilities that could use recycled pulp. This process significantly reduces marginal cost. It was therefore considered a pioneer in investment, innovation and cost reduction. The Commission was concerned about such a dynamic firm disappearing from the market.[15] The problem of the Commission's approach in general is that there is currently no satisfactory method to weigh the different criteria against each other.

[13] See Kühn (2006) for a discussion why such traditional criteria are not meaningful indicators of the danger of collusion.

[14] Essentially, the incentives for deviating from a given collusive agreement do not change for non-merging firms, while it they do change when the assets of an exiting firm are removed from the market. See Kühn (2006), page for a careful explanation of this effect.

[15] In retrospect the whole industry has invested in this technology and it is unclear whether and it may be that part of the impression created was a result of the lumpiness in investment.

We suggest an approach to the problem that focuses the analysis much more on the theoretical implications of the specific characteristics of the industry and a systematic use of industry evidence. For that purpose we can first do a backward looking empirical analysis to see whether earlier mergers in the industry show any sign of the presence of significant coordinated effects. If previous mergers had a significant impact on prices and capacity expansion there would be *prima facie* evidence for significant merger effects. Second, to do a prospective analysis one will want to focus the analysis directly on the incentives to collude under the particular circumstances of the industry. For example, we can ask: How difficult is it to collude in capacity if investments are irreversible? If the answer is "very difficult" other aspects of the market do not even need analysis. If collusion is difficult even when markets are completely transparent and symmetric, the criteria of transparency and symmetry do not matter anymore because coordinated effects are already unlikely in the worst case scenario. A negative test for coordinated effects can therefore focus on the elements of the market that are most important for undermining collusion incentives. This illustrates how a simple weighting of a list of criteria for the ease of collusion will not necessarily lead to an appropriate analysis.

5. Is there Evidence for Significant Effects from Previous Mergers?

The first approach to assessing the likelihood of coordinated effects is to see whether previous large mergers have had any discernable effect on behavior in the market. This is, of course, difficult to gauge. To generate a rough picture we can look for a structural break in the behavior before and after a previous large merger event.

An example is the Enso/Stora merger in 1998. The Commission initially believed that it, provided evidence for significant merger effects. As evidence for this view the Commission points out that capacity utilisation in the newsprint market had remained high after this merger (close to 96 percent for the leading five suppliers) and prices had been "extremely stable". The Commission claims that this points to a structural break since it contrasts dramatically with the pattern observed in the first half of the 1990s, when there were periods of excess capacity and declining prices. The Commission suggests that the post-1998 stability "could be seen as an indication that capacity is being adjusted to keep prices stable."

We have already explained that the pattern of prices and capacity utilization can be rationalized without any appeal to coordinated behaviour. However, there is still the possibility that investment behaviour changed after the EnsoStora merger.

In order for a claim of anticompetitive merger effects to be supported by evidence we would want to see a structural break in which the investment rate in the industry was significantly reduced or significantly fell behind the rate of growth in expected demand. Such a conclusion is not consistent with the facts as shown in Table 1. Over the period 1998 through 2000, newsprint capacity grew at an average annual rate of 2.1 per cent compared to only 1.6 percent between 1990 and 1997. Hence investment in newsprint has been *higher* since the Enso/Stora merger, not lower.[16]

Can the recent increase in the rate of capacity expansion be explained by an increase in the rate of the expected growth of demand? Table 1 compares the growth of capacity to the growth of demand over the same period using two-year ahead forecasts from CEPIPRINT. This is the appropriate variable if there is approximately a two-year lag[17] between the decision to build and when the capacity comes on-stream. Here the picture is even starker. There is a much larger acceleration in investment relative to expected demand post-merger than pre-merger.

Table 1: Comparing Capacities and *Forecast* Deliveries Before and After the Enso/Stora Merger

Average Percentage Growth Rates Per Annum in Newsprint, 1994-2000

1. Growth in capacity 1994-97	2. Growth in capacity 1998-2000	3. Two-year ahead forecast growth in deliveries 1994-1997	4. Two-year ahead forecast growth in deliveries 1998-2000
1.29	2.06	4.69	-0.28

Source: CEPIPRINT Demand-Supply Report, Newsprint and Magazine Paper Grades (various years). The "two year ahead forecast" is based on (for example) the forecast growth of deliveries for the February 1999 - January 2000 period made in February 1998. These forecasts were only available since 1992 which is why the first available observation is for 1994

On the basis of this first cut analysis, the facts do not support the view that there has been a restriction of capacity expansion in the period since Stora and Enso merged.

However, the data analysis above might not reflect the real change in incentives because the period between 1998 and 2000 was relatively short and the merger effect could have occurred after the year 2000. To assess the plausibility of such an argument we can also look at planned capacity extensions as documented in the CEPIPRINT Demand and Supply reports. The CEPIPRINT-Demand Supply Report for March 2001 forecasts an increase in Western European deliveries (i.e. from Western European suppliers to Western European consumers) of 571,000 tonnes over the three-year period 2001-2003 (an average annual growth rate of 2.0 percent using 2000 as the base year). But the report also forecasts that *exports* of newsprint from Western European suppliers will fall by 413,000 tonnes. This is mainly because of increasing capacity in local production in Far Eastern markets. As a result, total demand from Western European producers is expected to grow over the three years by only 158,000 tonnes (an annual rate of 0.5 percent). At the same time, the report also forecasts that capacity will increase over the three years by 206,000 tonnes (or an annual rate of 0.7 percent). So there is a surplus of forecasted capacity increases over forecasted demand increases of 48,000 tonnes.

It is also worth noting that even if we had seen some kind of capacity slowdown, this could have been for many other reasons completely unrelated to the Enso/Stora merger. With greater uncertainty (e.g. the increasing uncertainty over the importance of alternative non-paper advertising such as internet-based advertising) "real options" effects should be expected to cause a delay in investment (see Bond, Bloom and Van Reenen, 2007, for econometric evidence of the importance of real options for investment). Indeed there has been widespread speculation about the impact of electronic media on paper producers.[19]

[19] A report produced in September 1999 by the BCG group suggested that newspapers and in particular classified advertising could be threatened by the online formats (Boston Consulting Group: Paper and the Electronic Media: Creating Value from Uncertainty. September 1999).

6. Can There be Coordinated Effects in Capacity Expansion Decisions?

a. The Conventional Wisdom

Coordination on capacities is generally believed to be one of the most difficult problems for firms to resolve. In homogeneous goods industries with large capacity investments, like the paper and pulp industry, there are recurring episodes of persistent overcapacities that firms find very difficult to eliminate for both strategic and competitive reasons. This is particularly apparent in the history of legalised, explicit cartels. Examples include the Norwegian cement industry from 1927 to 1968[20] and the German cartel in the coal and steel industries in the 1920s and 1930s[21]. Even in these cases of sanctioned cartels firms were still unable to coordinate capacity choices.

These apparent difficulties of coordinating capacity decisions are reflected in the economic literature, which often directly assumes that firms can collude in prices but not in capacities. In the literature this assumption is justified either with an appeal to the stylized facts we cite above or with an intuitive argument about the role of irreversible, long term decisions like capacity investments. For example,[22]:

"… in the absence of perfect enforcement, agreement on a capacity-reduction may be much less likely than agreement on a price-hike: if a firm cheats on the former, its opponent is in a weak position, while any change in price is easily reversible."[23]

b. The Theory

The central problem for collusion on capacities identified by the conventional wisdom is the irreversibility of capacity expansions.[26] Once new capacity has been brought on-stream, its

[20] See Steen and Sorgard (1999).

[21] See Bloch (1932).

[22] See also Davidson and Deneckere (1990), page 523; and Fershtman and Muller (1986), page 214.

[23] Osborne and Pitchik (1987) at 414-15.

[26] Under the term irreversibility we include cases in which the option value of waiting to withdraw a unit from the market is very high.

effects are persistent. However, at the time of the case, the precise effects of irreversible capacity investments on collusion had not been modelled formally in the theoretical literature. The problem with irreversible capacity is that the game is no longer a repeated game for which we know how to fully characterize the set of equilbiria.[27] Investments in capacity have persistent effects for the rest of the game. In this case standard ways of characterizing optimal punishment equilbiria cannot be applied. Both the price setting incentives and the incentives for further investments will depend on the capacity installed and its distribution across firms. However, the most basic feature of all collusive models will be preserved. The scope for collusion will depend on the short run gains from deviation and the potential long run losses from switching to a low profit equilibrium. Existing theory can then give some guidance as to the effects of irreversibility on firms' incentives to collude.

Irreversibility changes the structure of incentives because any capacity expansion is a commitment device for the future. This means that any deviation from restricted capacity levels also commits a deviating firm to higher capacity in the future. The effect is well known from the pre-emption literature[28]. Essentially, a deviator can put a lot of capacity on the market. This *commits* him to be a large producer in all future periods. The competing firms now have a choice. They can either greatly expand their capacity as a punishment response – and destroy the profitability of the industry for the deviator and themselves alike – or they can accommodate in their capacity investments and lose market share, but remain profitable. Clearly they will decide to remain profitable. But this means that the incentives of a deviator are very considerably increased relative to the standard repeated game model. In the standard model the deviator gets a benefit only for one period of deviation, but afterwards an unfavourable equilibrium will be played. With irreversibility, the deviation does *not* lead to only one period of benefits: rather it also changes the playing field for the whole future, shifting benefits from other firms to the deviator *over the whole time horizon of the industry.*

To get a clearer intuition about the effect consider a simple Cournot model with irreversible output expansions. Irreversibility then means that output can only be increased from the previous

[27] See Abreu, Pearce and Stacchetti (1990)
[28] This has recently been fully worked out for capacity investment models with subsequent price competition by Allen, Deneckere, Faith, and Kovenock (2000).

period but not decreased. Suppose that the punishment equilibrium involves a return to the worst Markov perfect equilibrium for the deviator starting from the output distribution generated from the deviation. A deviator then accomplishes two things at the same time. He moves market share to himself in the first period, as in any other collusion model. But then he also acts as a first mover (Stackelberg leader) in quantity setting for future periods. When a Markov Perfect continuation equilibrium is played, the deviator can never do worse than a Stackelberg leader. But this guarantees the deviator vastly higher profits than a return to a one shot Nash equilibrium in a traditional super-game model. Hence, the deviator benefits from the ability to pre-empt its rivals in all future periods in precisely the same fashion as in the entry deterrence literature[29]. Kühn (2001b) formalized this intuition in the Cournot model with linear demand and showed that *collusion cannot be sustained at any discount factor*.[30]

The combination of the basic economic arguments of collusion theory combined with the insights of the theory of pre-emption in capital investments will necessarily lead to the conclusion that the incentives for collusion in capacity will be vastly reduced under irreversibility. The result may not be quite as extreme as the impossibility result of Kühn (2001b) when demand grows over time or when there is depreciation.[32] However, the basic argument shows that irreversibility undermines collusion in a *qualitatively* much more dramatic way than other market features that limit collusion. Hence, there is a tight economic argument linked to irreversibility and pre-emption incentives that suggests that coordinated effects are highly unlikely when irreversible capacity decisions are involved.

[29] See Dixit (1980) or Allen et al. (2000).

[30] There is some relatively simple intuition for this surprising result: With irreversibility and quantity setting it is always possible for the deviator to expand output so much that in any continuation equilibrium the rivals will not increase their output at all after a deviation. In Kühn's (2001b) particular specification with linear demands the deviator can obtain exactly the same profits from such a strategy as he can obtain by sticking to the collusive output. However, by only slightly reducing his output below this critical output he can strictly increase his profits in the deviation period and only induce a second order effect on future profits, which are discounted, slightly. Since this argument holds for any discount factor, we have shown that collusive output reductions can never be sustained.

[32] In a model in which firms set irreversible capacities first and then set prices similar effects are at work since (from the results of Allen et. al.) a sufficient capacity expansion does lead to a best response of limiting capacity by competitors.

c. Empirical Evidence on the Assumptions of the Theory

To support the applicability of this theory to the specific case empirically, three pieces of evidence can help. First, we want convincing evidence that investments are irreversible. Second, there should be some evidence that pre-emption is a concern for the investment decisions of the firms. And thridly, investments should be credibly communicated to the market as soon as they become irreversible.

One feature that causes considerable irreversibility is the combination of large sunk costs with a high degree of uncertainty about market demand. Most of the costs of having a plant available in the paper industry are the initial costs of building the plant. Since such plants are highly industry-specific, these costs cannot be recovered by simply selling the plant onto the second-hand market. This means that disinvestments can only occur by scrapping a plant. But scrapping a plant also involves some cost, and there is no recovery of benefits, so that decommissioning is very unattractive. In addition, the industry is subject to substantial demand and cost shocks. In the presence of strong sunk cost effects, disinvestments get delayed because firms want to avoid the investment costs they may have to incur when times get better. Even relatively small sunk costs can generate large irreversibility effects[33], because of this option value of maintaining capital investments. This is often called a 'real option' effect. In industries such as the paper and pulp industry in which investments are lumpy and involve massive sunk costs, this effect would make us expect that investments are (to a first approximation) irreversible.

The irreversibility assumption seems to agree well with the basic feature of the industry that paper machines tend to be in operation for time periods of 50 years and longer. However, we can generate a more convincing test for irreversibility from a very simple observation. If investments are not irreversible then variations in demand in an overall growing market should lead to countercyclical disinvestment decisions (i.e. substantially more old plant should be crapped during a slump than during a boom). But if irreversibility is very important, a machine should get scrapped only when it is completely depreciated – at least to a first approximation.

[33] Analytical approximations indicate that the effects of irreversibility are substantial. Suppose that the sunk entry cost is 10 percent of the variable cost of production and there are no exit costs. Assume also that the annual standard deviation of project returns is 20 percent and the risk-free interest rate is 5 percent. In Dixit (1991), the critical revenue level that triggers entry is approximately 33 percent higher than the critical revenue level at which exit occurs. The Marshallian approach, which ignores irreversibility, would give a corresponding figure of 0.5 percent.

The market evidence appears to confirm this feature. Figure 3 below shows the total quarterly amounts of disinvestments, over the 10 year horizon considered in the case, as reported in the Paperinfo dataset. The dataset gives details of the projects undertaken in the pulp and paper industry in the EEA between 1990 and 2000. Three facts stand out. First, there is no evidence of large-scale capital scrapping in the early 1990s. Second, there are several quarters where disinvestment is literally zero. This is consistent with the notion that there are large sunk costs associated with investment, so it may often be worth "doing nothing". Similar "zones of inaction" are observed amongst industries where there are irreversibilities associated with large sunk investment costs[35].

[Insert Figure 3]

Third, if capacity was reversible then we should expect to see a counter-cyclical pattern in the data: more scrapping during bad times (1991-93 and 1996) than in good times. In fact there is no cyclical pattern in the data. In contrast, capacity expansion appears to be pro-cyclical, increasing at times when demand is expected to increase. Figure 4 shows that *positive* capacity expansions are correlated with a CEPIPRINT demand indicators (newsprint delivery growth) in the newsprint industry[36].

[Insert Figure 4]

The natural conclusion is that irreversibilities are large and that disinvestment is very difficult in the industry.

[35] For example Caballero, Engle and Haltiwanger (1995). Another point is that if there was collusion one would expect to see co-ordinated scrapping – this has not occurred

[36] The aggregate CEPIPRINT net capacity data and the aggregated Paperfinfo investment and disinvestment data match up well when adjusted for timing (see Annex A). The magazine paper aggregates do not match up well, suggesting an under-recording problem. The near random pattern of disinvestments is also present in magazine paper.

d. Capacity Forecasts and Announcements as Coordination Devices

In order to make a pre-emption story credible it must become known to the market when irreversible investments have been committed to. This feature is also present in the industry. Major investment decisions become known through public announcement that are partly made credible by obligations of the firm vis-à-vis the financial markets. It seems clear that if a firm has made an irreversible commitment to an investment that this will be known by the competitors. Furthermore, at least one of the parties in the proceedings documented that pre-emption concerns played a role in the timing of investments, so that the theoretical story appeared to be confirmed by what became known to the Commission about actual investment processes. The theoretical framework therefore seemed to closely match the central features of the market in question.

Despite this evidence that pre-emption opportunities in the industry undermine incentives to comply with collusive agreements, the Commission nevertheless focused its analysis in the decision on the existence of potential coordination mechanisms. From a theoretical perspective this may appear strange because any form of communication can only have an effect if substantial collusion is in principle possible. But the Commission had clear doubts whether it should interpret the announcements in the market as evidence for a commitment mechanism for pre-emptive irreversible investments or in a more traditional way as instruments for the coordination of investments.

The Commission's investigation especially focused on whether announcements of investment plans were reversible or not. The idea was that an announcement of capacity expansion by a firm that was not reversible allowed others to react and retaliate before a commitment to an irreversible investment occurred and hence make the theoretical mechanism described inoperable. This argument overlooked the fact that a firm would have an incentive to keep its investment plans secret until commitment was achieved and only announce its plans then.

Although the argument of the Commission was essentially beside the point, evidence about investment announcements is not irrelevant for the credibility of the theoretical argument proposed in this section. If the theory is true we should find evidence that firms are very secretive about investment plans and that announcements almost always occur when there is

effective commitment to the investment (i.e. construction contracts etc. have been written). A fairly complete source of such initial announcements can be found on the PPI web site (www.paperloop.com). We examined 51 recent announcements under "Week in Review", "Printing News"/"Expansions and Modernisations" and "Converting News"/"News and Information"/"Expansions and Modernisation" classifying them into (i) announcements of plans (ii) committed announcement (iii) realisation. We found 29 announcements of completions or realisations, 24 of commitments and only 3 announcements of plans (some releases contained more than one type of announcement). Hence the evidence from the PPI site suggests that the announcement of plans is not common lending further support to the theory of the case proposed in this section.

7. Coordinated Effects on Short Run Prices or "Downtime"

Although most contracting takes place in yearly contracts, there is also some short run contracting during the year, even in the newsprint market. The Commission initially raised concerns that firms could coordinate conduct to raise prices in the short run. There seems to have been agreement in the case that coordination on prices would have been difficult since prices and discounts are individually negotiated and can hardly be considered observable.

However, the Commission argued that for a given level of capacity firms could raise prices in the short run by coordinating on taking downtime for the machines. This issue can be addressed in two ways. First, we can consider whether the characteristics of the market make such coordination credible. Secondly, we can investigate whether the observed periods of downtime can be well explained in a competitive context.

We first investigate whether collusion on downtime can ever be credible. In this discussion we abstract from possible issues of market transparency that are discussed in the next section. One way of interpreting downtime is to consider the possibility of firms coordinating the use of downtime to raise (unobserved) prices. Note that in industries with capacity constraints this type of collusive agreement is difficult to sustain. First, when the industry operates at the capacity constraint there is no issue of collusion. Collusive periods can therefore only occur in periods of

excess capacity. However, in the presence of capacity constraints the ability to punish deviations in the future will typically be constrained. Sustaining collusion requires the punishment of deviations in the long run. Given capacity constraints, harsh punishments can typically not be given in a single period, but have to be spread over time. However, if the industry quickly returns to full capacity utilisation, severe punishments are impossible. These conditions seem to be the ones prevailing in the paper industry. Although there are periods of excess capacities there is expected long run growth in demand during this period that was expected to push sales towards full capacity utilisation even after a negative shock. This would have been different in a declining industry. In such an industry there is a trend to greater and greater excess capacities so that firms become less and less capacity constrained over time. This means that the future ability to punish is greater. The specific circumstances of the industry considered are therefore very important when assessing the ability to collude.[37].

Given the significant asymmetries between firms in costs and capacities and serious doubts about the transparency of downtime decisions, there is little evidence that this collusive mechanism could work in practice.

To further support the notion that downtime is not used for collusive purposes it helps to analyze why downtime may be taken in a competitive environment. If we can show that there are strong unilateral incentives for taking downtime, a collusive explanation is even less plausible. For such an analysis the characteristics of the industry are again crucial. First, competition in this industry is to a large extent in long-term contracts, most of which are concluded at the beginning of the year. Under these contracts buyers in practice remain free to purchase less at given contractual prices than initially contracted for. Sellers then face a shortage of sales relative to their capacities. They can then decide whether to sell additional paper by lowering prices or saving on the costs of keeping a machine running.

[37] A second way the Commission suggested that downtime could have collusive effect was through a commitment to reduce the incentives to compete in prices in the short run. However, we understand that the start up and shut down costs for machines are not particularly high and that downtime periods are fairly short. Given these facts it appears highly implausible that capacity downtime could be used as a credible commitment device to raise prices in short run negotiations. Indeed, no evidence was presented in the case that would suggest otherwise

Frequently, it may be much more efficient to shut down machines temporarily because the additional sales will not justify the costs of keeping machines running. The reason for this is directly related to the low elasticity of demand. Significant additional sales can only be achieved through very large price cuts because paper demand by newspapers is extremely inelastic in the short run. Such large price cuts would not be profitable for a producer relative to the costs saved from shutting down a machine. An innocent explanation for market related downtime will therefore be more plausible if the market related downtime is short relative to the planning horizon of paper users. This appears to be the case in the data since downtime is taken for short periods up to two weeks. The observation that there is more downtime in periods of low demand realizations is therefore clearly not evidence of collusion over downtime.

8. Assessing Market Transparency

While the Commission appears to have accepted the characterization of the incentive structure arising from irreversible investments it still focused its discussions in the decision on the question of market transparency and the observability of decisions. We discuss this issue in this section because it illustrates an overemphasis on the market transparency question.

Market transparency matters for the issue of coordinated effects only in so far as it facilitates the monitoring of rivals' decisions in an uncertain environment and reveals to competitors when deviations occur.[38] When theoretical considerations suggest that coordinated effects are highly unlikely even in the presence of perfect market transparency, there is no reason even to consider this issue. However, for completeness, we use this section to discuss some of the ways market transparency has been analyzed in this case.

Theoretically, firms could try to use announcements to co-ordinate on a collusive equilibrium. We know that cheap talk can achieve coordination in games with multiple equilibria. For

[38] The issue of market transparency has been carefully discussed in a report to the European Commission by Kühn and Vives (1995), and in Kühn (2001a).

example in *U.S. vs. Airline Tariff Publishing* there were a huge number of announcements, counter announcements and withdrawals which arguably could have been used to establish a collusive agreement.

The Commission suggested during the proceedings that capacity forecasts distributed by the industry association CEPIPRINT could be used to coordinate investment decisions. The Commission suggested that a pattern existed in which capacity forecasts were monotonically adjusted downward over time. This view was apparently influenced by empirical results of Christensen and Caves (1997) about the US pulp and paper industry. They found that in smaller markets subsequent project announcements of rivals would trigger the abandonment of projects previously announced.

We have already seen that announcements seem to lead to pre-commitments in the European context. This contradicts a view in which announcements are used as cheap talk for coordination purposes. This result is further strengthened by an analysis of the three-year, two-year, and one-year ahead forecasts as well as realized outcome for the five years 1996-2000. *Monotonically declining forecasts never occur for newsprint*.[39]

For the period 1996-2000, we have calculated the differences between two adjacent forecasts. For each grade of paper, there are three differences: three-year ahead minus two-year ahead, two-year ahead minus one-year year ahead and one-year ahead minus actual. For each grade-difference there are five observations. The difference between two adjacent forecasts can be regarded as a forecast error. The usual hypothesis is that the expected forecast error is zero. The Statement of Objections claimed that the expected forecast errors are positive. Table 2 gives summary statistics by grade and difference. Three of the mean differences are negative. The sample standard deviations are so high compared to the means that none of the estimated means are significantly different from zero.

[39] They occur once over the 10 year time horizon for each magazine paper category considered in the case. Overall, the pattern occurs twice out of fifteen occurrences. The Commission had initially cited the example from one magazine paper category as evidence for their view

Table 2: Summary Statistics for Differenced Forecasts

Grade	Variable	Mean	Sample standard deviation	Standard deviation of estimate of mean	T-statistic
News	F3 – F2	6.8	256.2	114.6	0.1
News	F2 – F1	144.8	295.2	132.0	1.1
News	F1 – Actual	-99.6	133.4	59.7	-1.7

Source: CEPIPRINT's *Demand-Supply Report*, Newsprint and Magazine Grades, (Various Years). Note: F3 is the three-year ahead, F2 the two-year ahead and F1 the one-year ahead forecast.

The data in the analysis is consistent with the hypothesis that the expected forecast errors are zero.

Even if the pattern described by the Commission would have been found in the data it is not clear whether such evidence would have constituted good evidence for coordination. Christensen and Caves (1997) and Doyle and Snyder (1999) (for the car industry) interpret such patterns as evidence for efficient information sharing about demand conditions.

Information sharing should not be seen as inevitably a bad thing. Evidence for communication channels on aggregate forecasts of demand and public statements like investment announcements have many plausible efficiency enhancing explanations. They can arise from efficient information sharing or the desire to properly inform financial markets. Such information can also help the customer side in planning their decisions. For these reasons Kühn and Vives (1995) have argued that information exchanges that are on aggregate data or that are announcements to the public should not subject to antitrust scrutiny. Unfortunately, it is apparently seen as legitimate to consider them as negative factors in assessing coordinated effects in mergers.

9. Conclusion

In this paper we have reviewed the analysis of the merger involving the split of Haindl and its sale to the competitors Norske Skog and UPM Kymmene. We have shown how coordinated effects analysis has to be adapted to the specific market features. Concentrating on features that make collusion very difficult one can find strong arguments against the existence of coordinated effects. We have shown how the basic theoretical insights can be supported by the qualitative features of empirical data - even where a rigorous test would not be possible.

The merger was cleared without remedies in Phase 2 of the merger proceedings. Although the Commission stuck to its emphasis on market transparency issues and arguments about the commitment effects of announcements, it in the end agreed with the argument that with irreversible investments collusion is extremely hard.

Shortly afterwards, the pending collusion case was closed in the fall of 2002. However, this was not the end of suspicions about conduct in the markets for publishing paper. After UPM Kymmene was involved in a US collusion case in an unrelated market, new management conducted a wide internal review to detect any potential anticompetitive activities. In an attempt to obtain a general clean slate for the company, they reported to the US Department of Justice suspicious activities in several markets in the paper industry. We are unaware of the exact claims the new management of UPM Kymmene made. But it is important to note that under the US system anything that could serve as evidence for collusion in some market that is withheld by the firm could jeopardize any antitrust immunity achieved in markets where it matters. UPM Kymmene therefore had strong incentives to disclose even fairly ambiguous evidence on collusion. The allegations of UPM Kymmene led to the European Commission opening another investigation into the newsprint and magazine paper markets in 2004. The Commission raided the company headquarters of the major European players in the publishing paper business. However, it appears that little evidence for collusion was found, so that the Commission closed the case in November 2006.

Whether or not one believes that there were attempts to collude in this industry after the year 2001, market performance appears to support the economic analysis of a limited scope for

collusion in this industry: Since 2001 price cost margins in the industry have been at a record low and competitive pressure has led to major reorganization efforts by some of the firms. It appears almost impossible to predict in merger proceedings whether firms might attempt to collude at some point in the future. However, our analysis shows that a careful analysis of the structural features of the industry, as distinct from a simple checklist approach, can help in making reasonable predictions for the likely success of any hypothetical coordination attempts.

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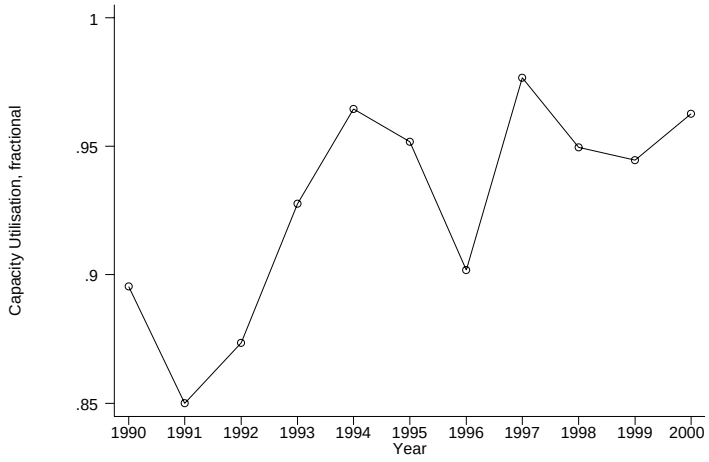
Figure 1: Real Newsprint Price, 1990 DEM per tonne

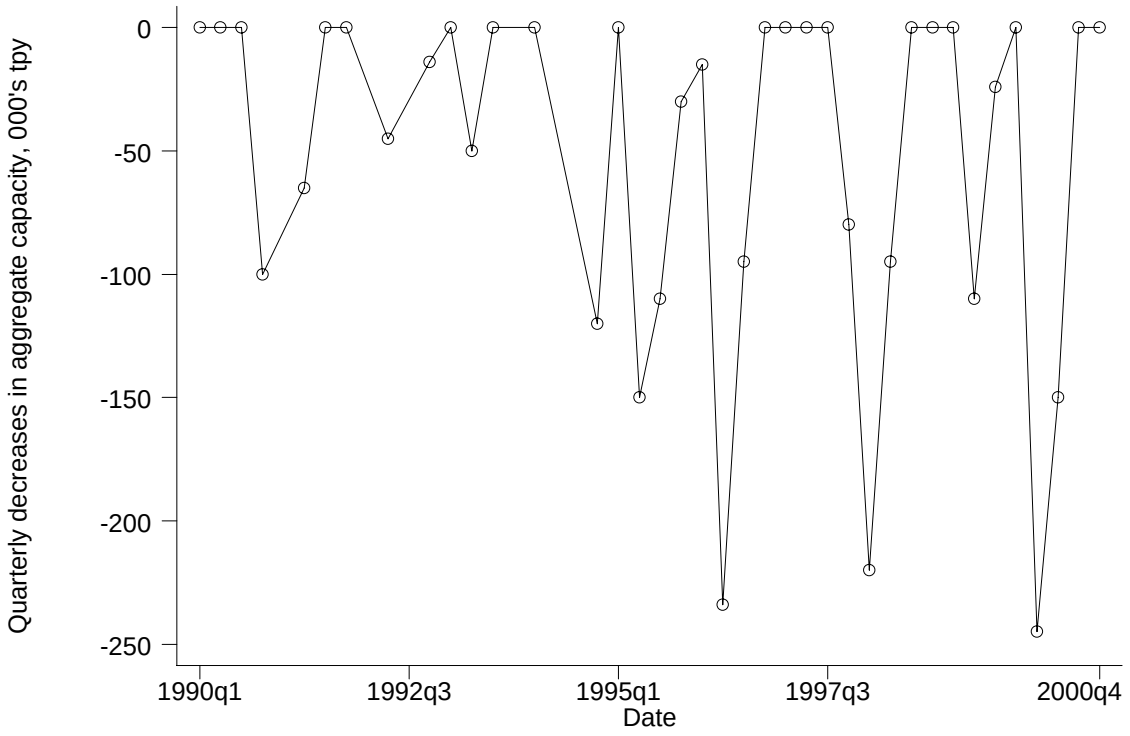
Source: Pulp & Paper International (PPI) (www.paperloop.com)

Figure 2: Capacity Utilisation, Newsprint



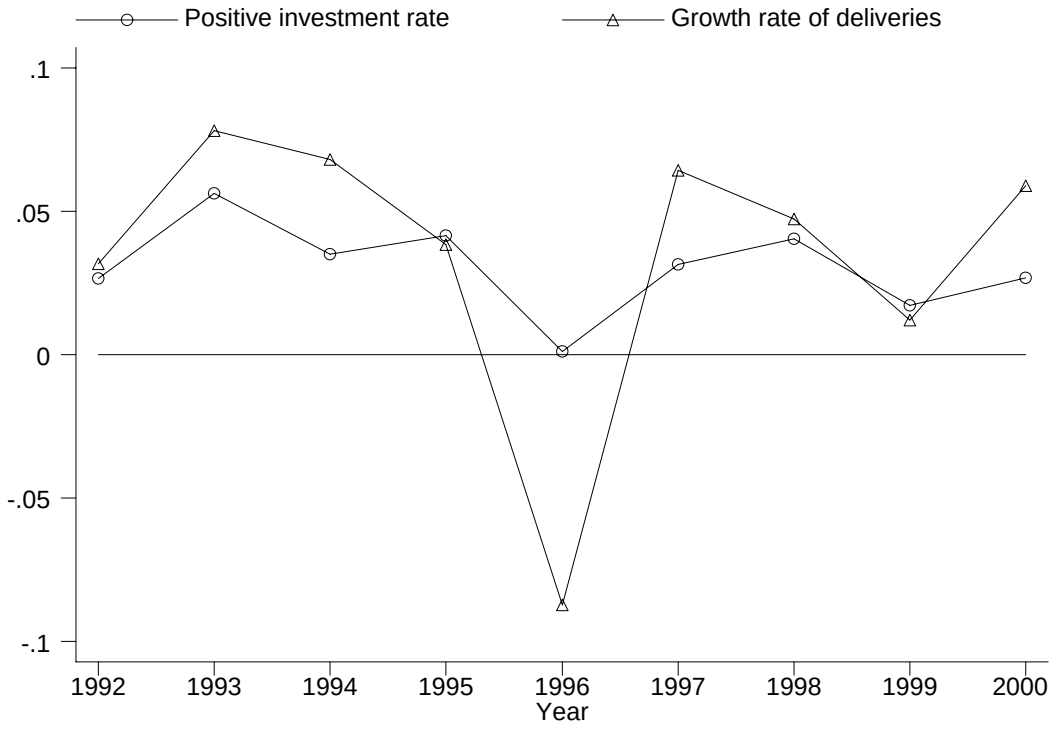
Source: Calculated from delivery and capacity data reported in CEPIPRINT Demand and Supply Report: Newsprint and Magazine Paper Grades (various years)

Figure 3: Disinvestments in Pulp and Paper



Source: Paperinfo Global Capacity Projects Database (papaerinfo.fi). Includes all disinvestment projects undertaken by Western European paper suppliers between 1990 and 2000.

Figure 4: Annual Positive Newsprint Investment and Growth Rate of Demand



Source: Calculated from CEPIPRINT Demand and Supply Report: Newsprint and Magazine Paper Grades (various years) and Paperinfo Global Capacity Projects Database (papaerinfo.fi). (Various years).

Notes: The annual positive investment rate is defined as the ratio of positive annual investment in newsprint capacity from the Paperinfo dataset to lagged total CEPIPRINT newsprint capacity. The purpose of dividing investment by lagged capacity is to normalize the data. The growth rate of demand is defined as the first difference in the natural logarithm of newsprint deliveries.