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I. Containerboard Industry/Product Definition

Paperboard includes various heavyweight grades of paper used for manufacturing shipping containers, boxes, and cartons for packaging of various durable and non-durable consumer products. Within the paperboard segment there are three main product groups: containerboard, boxboard, and industrial converted products. The largest single category among the three paperboard products is containerboard, which is made with the inner and outer facing of linerboard and inner layer or layers of corrugating medium. In its turn, the unbleached kraft linerboard, or the inner and outer facing of containerboard, comprises about 46 percent of the total 2000 US containerboard production, measuring up to 33.4 million tons. Due to its dominant position in the US paperboard production, we focus in this review on the US linerboard industry.

II. Paperboard/Linerboard Market Structure

As early as in the 1980’s the US pulp and paper industry has seen an increased pace of corporate consolidation. Yet, in the early 1990’s there has been an unprecedented rise in the number of mergers among paperboard producers, and it is expected to reappear in the early 2000’s. Experts suggest that intense consolidation is the response to less than impressive market performance caused by chronic excess supply.

Due to the massive merger activity over the last two decades, the structure of the US linerboard industry has become more concentrated. In 2001, the top five linerboard producers—Smurfit Stone Company (SSCC), International Paper (IP), Georgia-Pacific Corp. (GP), Weyerhaeuser (Weyco), and Inland Paperboard and Packaging Co.—managed over 60 percent of the total U.S. linerboard capacity.¹

A. Concentration Ratios

1. Pulp and Paper North-American Factbook, 1999-2000, Miller Freeman Inc., San Francisco, CA. These numbers should be considered with care. Although the numbers do not include Canadian capacity (as in Pulp and Paper and NAFB top capacity reports), they combine the following linerboard grades: unbleached kraft linerboard, bleached linerboard, as well as recycled linerboard. The typical Standard Industry Classification (SIC) system treats the three linerboard grades separately by giving them the following SIC numbers: 26311 for unbleached kraft linerboard, 26312 for bleached linerboard, and 26314 for recycled paperboard. For comparison in the Census of Manufacturers the concentration ratio of top four producers (CR4) for paperboard, that combines all linerboard grades as well as corrugated medium, was 28 percent in 1982 and 33.6 percent in 1997.
1) Data Used for Concentration Ratios

There are three sources of capacity concentration information that is used in this study. The first one is the most commonly used Census of Manufacturers, which publishes the CR4s at five-year intervals. For the purposes for this analysis, the five-year data points have been linearly interpolated to the annual series. The Census of Manufacturers publishes the CR4s at the 4-digit level of Standard Industrial Classification (SIC) code. In our paper we look at the three SIC industries: pulp with SIC 2611, paper with SIC 2621, and paperboard with SIC 2631, with an in-depth examination of the latter.

The second source is Pulp and Paper trade journal and its annual almanac North-American Factbook. Pulp and Paper publishes total annual capacity, CR5, and CR10 for individual paper and paperboard grades. The concentration ratios are based on the total North-American capacity including Canadian plants. Paper and paperboard grades represent a more detailed view than the 4-digit SIC industry grouping (comparable to Census 4-SIC-digit level information is not available in Pulp and Paper). Paperboard grades of interest are: linerboard, corrugating medium, bleached board (SBS), and recycled board.\(^2\) In SIC terms, these are 5-SIC-digit level industry groupings and have the following SIC numbers: unbleached kraft linerboard 26311, bleached packaging medium 26312, corrugating (semichemical\(^3\)) medium 26313, and recycled board 26314.

Finally, the third source of data, the Forest Product Laboratory (FPL) data set, offers both 4- and 5-SIC-digit information, or respectively the aggregate paperboard and individual board grades. The FPL data is the annual panel data of more than 30,000 annual mill counts (for 500 mills for 30 years), collected by the Forest Products Laboratory of the US Department of Agriculture, Madison Wisconsin. Capacity estimates by mill and process type have been collected from industry directories, corporate reports, trade journal

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\(^2\) Linerboard includes the grade of unbleached (and bleached) kraft and represents outer walls of containerboard used mainly for shipping containers. Corrugating medium is an inside fluted layer of containerboard. Together linerboard and corrugating medium constitute containerboard. Finally, solid bleached board is used for boxboard, milk carton, and food service products such as paper cups, plates, etc. Recycled paperboard is merely the paperboard that is made solely from recycled materials.

\(^3\)
articles, and other sources. The data contains capacity information for eight paper categories: newsprint, four writing and printing paper categories, tissue and sanitary paper products, kraft packaging; four paperboard grades: linerboard, corrugating medium, solid bleached board, other recycled paperboard; and market pulp that is used for papermaking.

![Figure I. Census Pulp, Paper, and Paperboard CR4s.](image)

2) Concentration Ratios of Top Four and Five Producers (CR4s, CR5s)

According to the Census of Manufacturers, the pulp industry has the highest concentration of the top four pulp producers jumping up to almost 60 percent in 1972, climbing down to mid 40’s percent and then coming back up to 60 percent by 1997 (Figure I). In contrast, paper and paperboard producers have rather low concentration ratios barely crossing over the threshold of 30 percent once in mid 1980’s and second

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3 Corrugated medium comes in two types: semi-chemical and recycled. AFPA defines semi-chemical medium as containing no more than 25 percent of recycled fiber, whereas recycled medium is made entirely from recycled pulp. In the US the average recycled content in semi-chemical is 42 percent.


5 The four major writing and printing paper categories are: coated and uncoated free sheet, and coated and uncoated groundwood. “Groundwood” is an outdated term that refers to the compositional context of a paper grade. Free sheet and groundwood have less than 10 and more than 10 percent of mechanical pulp fiber respectively.

6 Kraft packaging includes only unbleached kraft and constitutes for the most part grocery bag and sack paper, shipping sack paper, and a relatively small proportion of unbleached kraft wrapping paper.
time in mid 1990’s (Figure I). The CR4s for paperboard, calculated from the FPL data, also lie low, in the range of mid 20 to mid 30 percent (Figure II).  

Figures III and IV present a more detailed look at the market structure of paperboard. Both figures feature CR5s for four paperboard grades: linerboard, corrugated medium, bleached and recycled board. Figure III displays CR5s calculated using the FPL data, whereas Figure IV uses CR5s published in Pulp and Paper (P&P). As mentioned earlier, Pulp and Paper uses the overall North-American capacity that includes Canadian mills. Therefore, P&P CR5s are noticeably higher than the FPL estimates, which are based solely on the US capacity. The two graphs are drastically different.

According to Pulp and Paper, the bleached paperboard (Solid Bleached Sulfate, SBS) capacity is the most concentrated in North America, lying within the range of 60 to 80 percent. Capacity for the remaining three paperboard grades—linerboard, semi-chemical (another name for corrugating medium) and recycled board—lie within the lower half of

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7 This information will be used in further analysis of price cost margins and market concentration. There have been recognized a number of problems in ownership coding of the FPL data. As mentioned earlier, the data is at the mill level, carrying a unique mill identification code. Company ownership is recognized in the Company Name field. Besides such minor problems as misspellings, there are a number of mis-identified companies. The typical misidentification rose from the actual ownership change that was not properly reflected in the data. For example, the FPL lists Stone Container as an individually standing entity for the years 1999 and 2000, where in fact, it has been merged with Jefferson Smurfit in 1998 carrying the resultant company name of Smurfit-Stone. Both entries (Stone Container and Smurfit-Stone) appear among the top 10 capacities for both 1999 and 2000.

8 Missing issues for 1982 and 1983.
the percentage range closing up on 50 percent at the beginning of the 1990’s, with only linerboard crossing over the threshold of 60 percent in 2001.

Yet, according to the FPL, the highest concentration is in corrugating medium—its CR5 jumps up to 80 percent in 1991, down to 70 percent in 1997, and to 80 percent again in 2000. US SBS CR5, in fact, climbs from the low 50’s percent in the 1970’s to the mark of 80 percent in 2000, thus following the pattern of the total North-American capacity published in Pulp and Paper. Another marked difference is in linerboard CR5: while based on North-American capacity, linerboard CR5 crawls over the 60 percent mark towards 2000, the US linerboard CR5 never crosses over the 50 percent threshold. Such distinctions are important to keep in mind when conducting comparative analysis based on data covering different markets. It is also important to remember that despite large capacity shares of the five leading linerboard companies, 45 percent of new capacity is
coming from producers whose capacity ranking is below 15 (there are 50 linerboard producers in the USA in total).¹⁹

3) HHIs
A more academic measure of industry concentration is the Herfindahl-Hirschman Index (HHI). According to the Antitrust Division of Department of Justice, the spectrum of market concentration as measured by the HHI is divided into three regions that can be broadly characterized as ‘unconcentrated’ (HHI below 1,000), ‘moderately concentrated’ (HHI between 1,000 and 1,800), and ‘highly concentrated’ (HHI above 1,800).¹⁰

The HHI adds up the square of the market share for each producer in a grade and makes the cross-industries comparison (between different paper grades) easier. In this regard, many prefer HHI to other concentration ratios because HHI incorporates information on all players in the market. Therefore, the FPL HHI becomes a powerful measurement as the FPL is the most accurate as well as detailed (disaggregated into eight paper and four board grades) capacity database on pulp, paperboard, and paperboard mill capacities.

According to the FPL HHIs, only pulp exhibits relatively high industry concentration throughout the three decades, whereas paper and paperboard stand under the low 500’s of the HHI scale. In Figure V paperboard industry is presented as one of the most fragmented paper industries. Among the paperboard grades, only bleached board, or SBS, reaches out to the high 1,800-HHI points towards the end of the 1990’s. Yet, within the overall paperboard capacity, SBS historically held an average only 13 percent of total paperboard capacity (with the high of 15 percent in 1970 and low 12 percent in 1990).

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B. Mergers

1) New Strategies: Downtime and Mergers
At the onset of the 1980’s and 1990’s paper companies have accumulated hefty capacity in the anticipation of booming exports to Asia. When, towards the end of the 1990’s, these expectations have not materialized, prices plunged down forcing managers to eliminate extra capacity. In order to sustain prices, industry has moved from inventory streamlining and aggressive sales promotions towards downtime management. Taking downtime and shutting mills has become the main tool to maintain the level of production what would, in turn, keep inventories liquid.

In addition, companies have changed their ways of increasing and, when necessary, upgrading their capacity stocks. Industry managers believe that merging is the key solution to both tasks. Buying new capacity is perceived to be cheaper than building new capacity. Moreover, once two companies merge they have greater leverage to shut down older and less profitable mills while maintaining or even increasing their productive capacity overall. Finally, merging firms can enjoy increased financial flexibility and additional efficiencies can be gained by sharing overhead costs such as R&D and administrative expenses.

The “disappointment” with Asian exports in the 1990’s was characteristic to all of the US manufacturing, and the merger wave hurried throughout the whole economy. Yet, containerboard industry is seen as the champion in mastering the corporate merging strategy in fending off over-capacity. In 1998, right after the 1997 Asian downfall,
Jefferson Smurfit acquired Stone Container, the biggest linerboard producer, and then St. Laurent Paperboard. In 1999, Weyerhaeuser acquired McMillan-Blodel, and International Paper bought Union Camp. The three mega-companies—Smurfit-Stone, Weyerhaeuser and International Paper—now account for more than 35 percent of linerboard and corrugated box production, and all three have shut down their older mills.

The question whether mergers are an effective tool of stabilizing prices remains controversial. On one hand, in the article dated by November 2000, financial analysts have expressed that mergers in containerboard industry helped maintain prices at stable and rather low levels. On the other hand, two years later, paper industry analysts are citing that mergers and shutdowns in 1998 were conducive to the price hike in 1999-2000 to $400’s per ton from $300’s in 1998.

2) Number of Mergers in Pulp and Paper

Figure VI presents number of mergers counted using the North-American Factbook’s (NAFB) list of mergers and acquisitions in paper and allied products industry. The NAFB publishes a varying list of mergers from year to year, therefore, two counts are included: the most recent and frequent counts for any specific year. The data is available from 1976 on. The results show that the process of mergers and acquisitions mounted in 1983-1986 with 16 consolidations in 1986, and then peaked up to 34 mergers in 1991. Additionally, the latest counts indicate 1995 as the year of heightened consolidation.

11 As the result of these mergers, Smurfit-Stone became one of the top paperboard producers.


activity. It is important to note here that 1995 is also a year of sharp price spikes that have thundered through all of the paper industry.

Figure VI.

3) **Entries and Exits in Paperboard**

Structural industry activity for paperboard is measured by counting the number of entering and exiting firms into the paperboard sector. This has been done using the annual Standards and Poor (S&P) Register of Corporations, which lists the companies registered in the US under SIC 2631, Paperboard Mills, and indicates the location of their incorporation. The number of companies are counted year after year and noted as existing, entering, or foreign companies along with the location of their incorporation. The results demonstrate that the greatest number of entries and exits were in 1972-1974, 1981, 1984, 1988-1989, and 1998-2000 (Figure VII). The years of high entry/exit activity generally correspond to the years of economic recessions. Alternatively, the early 1970’s, as the first years of environmental regulations that had direct impact on the paperboard industry, noted higher levels of entries and exits in the industry.
A serious outlier in the number of entering companies is the year of 1999. The number of registering companies rose to 58 in comparison to 22, or the second highest number of entrants since 197. The reason for such a jump is the drastic increase in the number of foreign companies entering the US market. Throughout the early 1970’s, with the overwhelming majority of Canadian companies, the total number of foreign companies classified as paperboard mills amounted to the maximum of 24. In 2000, such number became 86 in comparison to 94 US companies, with the difference of only 8. Many attribute such changes to the economic recessions in Europe and Asia at the time as well as the soaring stock market in the US. Interesting to note that the total number of companies registered under the paperboard classification has risen in 1997-2000 almost as sharply as real linerboard prices.

**4) Vertical Integration with Pulp Mills**

Historically, paperboard companies have experienced two periods of increased growth in the number of integrated companies. According to the Annual Survey of Manufacturers, the number of companies with paperboard mills integrated with the pulp mills rose during mid 1970’s and 1990’s. The peak number of integrated companies was in 1977, growing from 63 in 1963 to 82 in 1977, yet by 1992 it dropped back to 60. The growth trend among integrated operations picked up by 1997. Conversely, the number of companies that chose to keep their operations as non-integrated kept going down from 208 in 1963
to 137 in 1987. Yet, starting with the late 1980’s the number of nonintegrated companies started to grow back. In 1997, there were 150 nonintegrated companies. Despite this trend, the proportions between the two types of companies have remained stable over the 20 years—integrated companies ranged from around 20 percent to 30 percent to the total number of companies (Figure VIII).

Figure VIII

5) Vertical Integration with Corrugated Plants
According to the NAFB, only 25 to 30 percent of the US containerboard production are available to the open market, or independent boxing converters and non-US customers. The rest 70 to 75 percent of the primary market goes directly to the integrated box plants, that is from the company’s paperboard mill to its own boxing plant, or traded among other integrated converters. About 65-70 percent of the open market share goes to the estimated 800 US independent corrugated converters and sheet plants. The rest is exported offshore. In this light, containerboard market is highly integrated not only at the lower end of producing its own pulp, but also at the end of manufacturing boxing/packaging products. Among the top ten containerboard producers, Weyco and Willamette are the two most integrated companies with 107 and 102 percent of integration respectively. Over 100 percent integration in this case means that the two companies are net buyers of containerboard as they produce less containerboard than they
consume.\textsuperscript{15} Yet, unlike with the classification of pulp mills’ production, containerboard is not differentiated as ‘market’ vs. ‘non-market’ capacity.\textsuperscript{16}

6) The Top Five

According to Pulp and Paper, the top five \textbf{paper} companies in the US are Smurfit-Stone Container Corporation (SSCC), International Paper (IP), Weyerhaeuser, Georgia-Pacific (GP), and Inland Paperboard. Within this group, SSCC is the largest US \textbf{linerboard} producer with the capacity of 4.97 million tons per year, followed by IP with 4.09 million tons per year, Weyerhaeuser with 3.01 million tons per year, and GP with 2.75 million tons per year. In 2000, SSCC’s total pulp and paper capacity was 7.24 million tons per year or 8 percent of world capacity and 20 percent of North-American capacity.

III. Government Regulation

A. Environmental Regulations

The first environmental acts have been introduced during the late 1960’s—early 1970’s. The main laws affecting the paper and pulp industry are regulations concerning air and water pollution, and the disposal of solid wastes. The Clean Air Act (Air Quality Act of 1967) requires paper and pulp companies to install the best available technology possible in the attempt to preserve and not to harm the quality of air resources. Such technology is referred to as the maximum achievable control technology (MACT). The following mills are subject to the Air regulations: dissolving kraft, bleached papergrade kraft/soda, unbleached kraft, dissolving sulfite, paper-grade sulfite, and semichemical mills.

In addition to this list, the following processes are subject to the regulation under the Clean Water Act (Federal Water Pollution Control Act Amendments of 1972): mechanical pulp, nonwood chemical, secondary fiber deink, secondary fiber nondeink,

\begin{itemize}
  \item Data is of 1999 from the NAFB.
  \item In most industry sources, only market pulp capacity is reported. ‘Market pulp’ is the pulp that is available for purchase in the market; the rest is consumed by companies’ own integrated paper or paperboard plants. According to the FPL Report, only 15 percent of total US pulp production is considered ‘market’ pulp.
\end{itemize}
fine and lightweight papers from purchased pulp, and the categories of tissue, filter, nonwoven, and paperboard from purchased pulp. Mills are required to control and limit the amounts of pollutants discharged in waters. The controls should be technology-based and employ the best available technology (BAT).

The third main component of the environmental regulations affecting the industry is the Solid Waste Disposal Act of 1980 (Resource Conservation and Recovery Act) has the most effect on day-to-day operations of paper and pulp mills (the original Solid Waste Disposal Act was enacted in 1965). Dioxin, chlorine and chlorine derivatives are considered hazardous waste substances and have to be disposed according to the federal requirements.

Additionally, starting with 1995, pulp and paper companies located in the eight states bordering the shores of the Great Lakes are asked to control the release of bioaccumulative industrial chemicals, pesticides, and metals that are believed to produce a broad range of health risks for humans and wildlife. There are about 40 pulp and paper mills affected by this initiative representing such companies as Georgia-Pacific, Smurfit-Stone, Potlatch, Mead, and Fort James. The AFPA anticipates that compliance with the Great Lakes Initiative (GLI) will cost $1.25 billion in new capital expenditures, and $43 million in recurring annual costs.

Finally, the Cluster Rule, started off in 1993, is designed to put together Water and Air regulations and provide for a consistent, non-exclusionary body of rules. The regulations are staged in three phases with different deadlines. Mills are expected to install the maximum achievable control technology (MACT), that would cost the industry about $1.8 billion, according to the Environmental Protection Agency. In contrast, the American Forest and Paper Association (AFPA) estimates that the costs will be up to $2.6 billion plus the operating costs of $273 million.

Historically, the environmental legislature has had a profound effect on the paper and pulp companies (P&P). The total paper and pulp industry capital expenditures for
environmental purposes have been highly unstable with steep increases in the years of active legislature as well as a few years after the legislative changes. The most palpable periods of environmental compliance in P&P industry are: 1970-1975, 1986-1990, and in 1995 there is a reversal towards further capital increases. From 1993 to 1997 the Environmental Protection Agency has worked to enact the new Cluster Rule that is considered to have the most serious impact on the pulp and paper industry in general.

B. Shipping Regulations
In 1991, the National Railroad Freight Committee and the National Classification Committee of the Motor Carrier industry have adopted proposals to Rule 41 and Item 222, respectively, to allow box makers an option to use either minimum bursting strength specifications or minimum edge crush specifications. These changes have allowed the weight of boxes and the containerboard be reduced by 10-15 percent. Lower weight requirements, decrease from 42lb to 37lb, and enable manufacturers produce more paperboard (in terms of square feet) with the same capacity level. Therefore, both capacity and productivity of paper machines are increased by 10-15 percent.

C. Economic Litigation
In the 1980’s and 1990’s there have been three main litigation processes against linerboard producers involved: Champion International Corp., Georgia-Pacific Corporation, and Stone Container Corporation. In 2000 two separate cases involving Stone Container were combined into one class-action suit against seven (out of nine) largest containerboard producers in North America.

In 1984-1986, Champion faced charges by the Federal Trade Commission (FTC) as the result of its August 1984 acquisition of the stock of St. Regis Corporation for approximately $1.2 billion. The FTC claimed that the acquisition of St. Regis would reduce competition in the West Coast linerboard market. As of March 1986, Champion entered into the consent agreement with the commission not to acquire for 10 years any interest in any company involved in manufacturing linerboard in the West Coast market without prior FTC approval.
In March of 1996, the US Department of Justice (DOJ) waged civil action against Georgia-Pacific Corporation (GP). The DOJ alleged that the proposed acquisition of Domtar Inc. by GP threatened to raise prices and harm consumers of gypsum board in the Northeast regions in violation of Section 7 of the Clayton Act. As the result of the acquisition, the new entity would have 90 percent of gypsum board capacity in the Northeast. In the outcome, Georgia-Pacific entered into a consent decree with the DOJ requiring it to divest two of its wallboard plants in the Northeast.

The third case of litigation started off as a complaint filed by the FTC in 1998. The FTC alleged that the Stone Container Corporation involved in the price-fixing behavior in 1993. According to the FTC, in January 1993 Stone announced a $30.00 price increase for linerboard. In March 1993, the company was forced to withdraw the price increase as other companies did not follow suit.

Shortly after this, seven lawsuits were filed against Stone Container: three by purchasers of corrugated sheets in the Northern District of Illinois and four by purchasers of corrugated boxes in the Eastern District of Pennsylvania. Plaintiffs alleged that Stone developed a plan (by conducting a telephone survey of major US linerboard producers asking competitors how much linerboard was available at what price) and decided to take downtime at its plants, to reduce its production by approximately 187,000 tons and to purchase 100,000 tons of linerboard inventory from competitors. The reduction in output was the largest voluntary reduction in the history of the US linerboard production. According to the allegations, such actions on the part of Stone constituted an invitation to its competitors to join in a coordinated price increase.

In May 1999 two class actions have been filed in the Eastern District of Pennsylvania against multiple parties. Both complaints allege that other producers of corrugating sheets were ‘invited’ by Stone and accepted its ‘invitation’ to restrict the production of linerboard and artificially raise prices, resulting in an antitrust conspiracy in violation of the Sherman Act. In 2000 the two complaints were combined into one class-action suit.
that now involves seven (out of nine) largest containerboard producers in North America. The companies are: Gaylord Container, Georgia-Pacific, Inland Paperboard and Packaging, International Paper and former Union Camp (now part of the IP), former Stone Container and Smurfit Jefferson (now Smurfit-Stone), formerly Tenneco Packaging (now Packaging Corporation of America), and Weyerhaeuser. The plaintiffs, independent box companies, seek repayment of the money they paid for linerboard and boxes from the beginning of October 1993 through the end of November 1995. They believe that linerboard producers have increased prices for linerboard, therefore pushing up the prices for boxes. In 2002, a US appellate court in Pennsylvania has held that in the proceedings the companies are combined and are subject to the same outcome. Currently, the ruling is pending.\footnote{Order and Memorandum of the United States District Court for the Eastern District of Pennsylvania, available at: \url{http://www.paed.uscourts.gov/documents/opinions/00D0769P.HTM}.}

**IV. Containerboard Market**

**A. Overview**

Production and distribution of both durable and non-durable goods is made possible by timely availability of packaging. Shipping of packaging materials over long distances is not efficient, and therefore, box plants, which convert containerboard into boxes, are usually located around manufacturing sites. Similarly, paperboard mills are located close to box plants.

**B. Demand**

Containerboard production feeds into box-making industry, and as such it has similar demand conditions. Therefore, the main factors that affect containerboard demand are domestic economy, global dynamics, and competition in the form of imports and product substitutes.

1) **Domestic Economic Trends: GDP, Unemployment Rate**

The US domestic production kept growing continuously throughout the 1980’s and 1990’s. The rates of growth were slightly lower in the years of recessions: 1980-1981,
1990-1991, and 2000-2002. Stable economic growth usually can have a time trend effect on real prices. Yet, in the case of unbleached kraft linerboard prices (with the most widely produced 42lb basis weight), there is no clear evidence of trend component in the data (Figure IX).

Figure IX

2) **Linerboard Demand and Inventory**

Historically, linerboard producers have been concerned with excessive inventory build-ups. Inventory buildups follow the pattern of general economic recessions when demand for linerboard is weak. The downturn in the world linerboard demand has been attributed to Europe’s slowdown and Asian crisis. Starting with 2000, rehabilitating world demand has helped decrease inventory build-up. Additionally, producers are settling down on the notion that inventories can be managed by the way of taking massive downtimes. In 2001, linerboard producers have used up only 86 percent of their capacity,\(^\text{18}\) leading up to 4.5 million tons of downtime. The producers believe that this is the key for fending off weak demand and maintaining stable inventory levels.

Additionally, the litigation of Stone suggests that the antitrust authorities have found a robust relationship between linerboard prices and levels of inventory in the period of 1993-1998. The 42lb unbleached kraft linerboard prices and inventory levels at paperboard mills seem to be in reverse relationship (Figure XI).

3) Containerboard Capacity

- US and World Containerboard Capacity
The beginning of 2000 has seen an increase in the world containerboard production by three percent. The largest countries producing containerboard are: the US (17.7 million metric tons (mt)), Japan (4.7 million mt), China (4.18 million mt), Germany (1.9 million mt), and France (1.69 million mt). The US share of world linerboard capacity was estimated 42 percent in 1998, but was expected to drop to 41.5 percent in 1999 and 2000, due to new capacity in Asia and Europe, and the permanent shutdown in the US for four linerboard mills (three by SSCC and one by IP). Most of the new linerboard capacity was based on recycling and was going to China and Asia.\(^{19}\)

- Increases in Paperboard Production Capacity
Total US paperboard production in 2000 has gone up to 51 million tons with the total value of shipments of $19.8 billion. The general growth pattern of the paperboard production over the 30 years is a step-by-step increase from the 1970’s to 1980’s by 5 million tons, and 10 million tons from the 1980 to 1990 and from 1990 to 2000. Experts attribute the paperboard production capacity increase over the last 30 years to two main factors: improvements in papermaking technology and changes in freight regulations.

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The improved watering and pressing equipment has allowed paper machines to increase their productivity by 10-20 percent. Such operating efficiency improvements are not seen throughout all paperboard mills as US tax policies do not provide necessary incentives to keep adding on new technology investments. The second factor is the change in freight regulations (mentioned earlier) which let same number of boxes be made with 10-15 percent less of fiber.

- **Unbleached Kraft Linerboard Capacity**

  Narrowing down to the unbleached kraft linerboard, in 2000 the world unbleached kraft linerboard capacity was 25,305 thousand metric tons with the US capacity of 19,044 thousand mt, Indonesia—2,459 thousand mt, Brazil—1,420 thousand mt, Sweden—897 thousand mt, and Austria—340 thousand mt. In 1999, experts projected an increase in the US unbleached linerboard capacity from 22,515 to 22,606 thousand mt. In reality, the number grew to 25,305 thousand mt. Over the period of 1970 to 2000, the US capacity to produce paperboard has been steadily increasing with just slightly higher rates of growth between 1993 and 1997. During those years 14 new containerboard machines have been installed amounting to 3 additional million tons/year of capacity.

- **Paperboard New Capital Expenditures**

  The periods of high capacity growth follow the years of the largest new capital expenditures within the paperboard industry. Here one could argue that dramatic increases in new capital expenditures have been caused by exceptionally active environmental legislature. The periods of increases in capital expenditures in paperboard and environmental expenditures for all of pulp and paper coincide. For paperboard the years of mounting increases are 1973-1976 and 1987-1990; for pulp and paper environmental expenditures these years are 1974-1980 and 1988-1991 (Figures XII and XIII).
4) Global Dynamics

- Exports
With many manufacturing plants and converting box plants moving to developing countries, containerboard market has become much more global. Box converters located offshore enjoy the ability to order containerboard from any mill in the world. Therefore, containerboard producers face increasing pressures from foreign competition in export markets.

The US is the largest exporter of kraft linerboard with about 10 percent of annual linerboard production sent abroad. According to the industry experts, although exports represent only a small fraction of total containerboard production, around 5 to 15 percent, they dictate the magnitude of profit margins the industry can enjoy. The 10 percent of total linerboard production sent to exports represent 95 percent of total paperboard shipments for export. 1997 has seen an unprecedented surge in the US linerboard exports oversees (Figure XIV). Consequently, the exports have declined from 3.2 million tons in 1999 to 2.78 million tons in 2000; this is a relatively short time span for a 0.5 million tons decline. Prices for linerboard exports have slumped under the pressure of fluctuating exchange rates and domestic price decreases. Visually, the domestic linerboard prices and exports could be seen as in reverse relationship (Figure XIV).

Figure XIV

Exchange rates fluctuations can determine the volatility of margins: at times of an overvalued US dollar, linerboard prices can not be maintained at competitive levels.
Thereby, weak exports also can be explained by comparatively lower offshore prices for linerboard. For example, in November of 2001, the difference between 42lb kraft linerboard in the US and Ecuador was $120/ton, with Ecuador being the fourth largest export market for kraft linerboard.

- **Imports**

There is an increasing pressure from foreign competition. Figure XV shows a dramatic increase in the volume of paperboard imports from 36 thousand tons in 1970 to approximately 1,700 thousand tons in 1998. Additionally, experts believe that one should also count the inflows of prepackaged goods from Asia, which previously have been packaged primarily in the US (such as toys and sporting goods). Omitting these numbers causes the discrepancy that comes between accounting for stand-alone paperboard imports and paperboard in the boxed form with a product inside. National Paperbox Association (NPA) cites that in 2002 about $15 million of US rigid box production has been lost to the Asian imports, yet this number accounts for only stand-alone box imports. The total rigid box inflows, including prepackaged goods, could be as high as $50 million. According to International Trade Commission, imports in corrugated containers have increased from $8.2 million in 1996 to $24.1 million in 2002.²⁰

Figure XV

![Figure XV. Paperboard Imports.](http://www.packaging-online.com)

²⁰ Jackie Schultz, (2003), “Comrades or Competitors?” Packaging on Line, April 1, Available at: http://www.packaging-online.com
• **Substitutes**

There are three product groups that are deemed as substitutes to unbleached kraft liner: domestic and international competition from returnable plastic containers (RPCs), foreign-made test liners competing with the US linerboard in export markets, and substitution by a lower quality test liner, that’s produced from less than 80 percent of virgin kraft pulp (usually with around 60 percent).

• **Returnable Plastic Containers**

In recent years, the paper industry as a whole has experienced the onslaught of a wide range of plastic products, starting with plastic grocery bags to milk containers. Substitution is especially strong in packaging areas. According to industry specialists, RPCs present a serious threat to corrugated boxes and paperboard containers. RPCs are foldable, stackable, interlocking, reusable, standard-sized, and finally, display-ready boxes that are especially popular in Europe and considered to be most useful for produce suppliers.

RPCs represent a new concept of supply chain management. Plastic containers are passed from user to user with the provider collecting them at the end delivery point for inspection, cleaning, repairing and recycling, or re-using. The process involves high-tech, often internet-based logistical coordination. RPCs are effective in Europe due to the governmental regulations requiring retailers to cut their solid wastes to landfills by 50 percent. This is believed to be as the most compelling factor for slow adaptation of RPCs to the US market. Another reason for RPCs slow penetration into the US is the resistance on the part of suppliers to technological improvements in logistics.

Despite these barriers, some major US companies already ship bulk of their products in RPCs. For example, Wal-Mart ships about 70 percent of its produce to retailers in RPCs. According to Wal-Mart managers, the paperboard industry is inconsiderate of the bigger view the supply chain system, which prevents them coming up with products that would adequately compete with RPCs. Additionally, it is remarked that there is a possibility
that the two products (corrugated containers and RPCs) are complementary: “…RPCs are good for grapes and corrugated are good for lettuce.”

There are no easy proxies that can be used instead of the RPCs’ prices. The PPIs for plastic packaging including and excluding film exhibit no clear pattern of interrelationship between plastic packaging and paperboard PPIs.

- **Recycled Paperboard**

It is possible that substitution of unbleached kraft linerboard occurs with comparable yet relatively cheaper board products. Unbleached kraft linerboard is made with no less than 80 percent of virgin pulp. In contrast, recycled paperboard uses less than 80, usually 60, percent of virgin pulp. Historically recycled liner has been viewed as an inferior product to kraft liner. However, new technology allows for 100 percent recycled linerboard that is comparable with kraft linerboard in most performance characteristics.

The pattern of kraft and recycled liner prices shows that recycled paperboard prices have been consistently lower than linerboard prices up to 1995, the peak year for both products, and stating with 1996 recycled board has been indexed higher than linerboard. The price drop from 1995 to 1996 has constituted the negative 13.7 percent while an increase in recycled board capacity has measured up to the same positive 13.7 percent change, with total production up to 14.6 percent increase from the level of 1995. Experts acknowledge that recycled linerboard mills have a manufacturing cost advantage at times when the price for their raw material, old corrugated containers (OCC), drops. Historically the price for OCC has been low, which allows recycled board producers give significant discounts to their customers and increase competitive pressures on kraft linerboard.

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22 Schedule B, Vol.1 of the US Department of Commerce defines “virgin pulp” as “fibers obtained by the chemical sulfate or soda processes.”

C. Linerboard Prices

1) Historical Pattern

The development of the 42lb unbleached kraft linerboard prices from 1970 to 2000 is noted with the five general declines. The price drops happened during the years of 1981-1982, 1984-1985, 1989-1991 and 1992-1993, 1995-1997, and 2000-2002, or the periods of the general economic recessions. Additionally, environmental regulations appear to influence prices as well. The three major real price increases overlap with the active legislature (Figure XVI).

Figure XVI

The record high real price is registered in June 1995 as 487.58/ton. Prices have risen from the beginning of 1999 up to the end of 2000 getting to the second historical high of $475.00/ton. In February and March of 2000, linerboard producers implemented a price increase of $50.00/ton for kraft linerboard. Starting with January of 2001, prices have been sliding downward.

According to the NAFB, prices of linerboard are almost always affected by prices of corrugating medium. Experts note that medium price changes are always followed by changes in linerboard prices. Although, graphically such pattern can not be easily discerned, there are a number of instances when corrugating price changes precede the changes in linerboard prices (Figure XVII). US corrugating market is deemed to be more
regionalized and competitive than the linerboard market. According to the above-mentioned FPL CR5s, the US corrugating medium market is a lot more concentrated than linerboard: for 2000, the CR5 for corrugating medium is 45 percent and 77 percent for linerboard. Additionally, it is more volatile due to much lower amounts of required inventory at box plants and greater reliance of box-makers on just-in-time inventory.

Figure XVII

![Figure XVII. Current Prices for Linerboard and Corrugating Medium.](image)

2) Margins and Costs
Paperboard producers, on average, recognize a 15 percent margin of a selling price as the minimum level. Yet, there are big differences in the factors determining price margins—productivity, financial leverage, and operating costs—from company to company. More efficient firms are able to exercise higher margin levels. Traditionally, companies attempt to manipulate operating costs. Fixed costs are usually 30-40 percent of total production costs and are insensitive to production/operating rates. These costs include different capital and administrative expenses such as depreciation, interest, insurance, administrative expenses, and R&D. The majority of variable costs cover firms’ expenditures on raw materials, labor, and energy. The highest cost is for fiber or pulp, with the second largest as labor and the third place is divided between energy and delivery costs. For containerboard, prices are also determined largely by boxing plants, which have to be able to pass on price increases to their customers.

3) Pricing Strategies
The pricing of both external and internal (if a company is integrated owning boxing plants) transactions is based on published prices in company newsletters, trade journals, and industry consulting groups. Generally, small degree of discounting is not viewed as the cause of price falls; it is not widely spread and is used only by small producers that can not afford taking market-related downtime. In contrast, during economic slowdown and demand decrease, producers can involve in incremental pricing or accepting spot orders at significantly lower prices, recognizing only variable costs, with the sole purpose of keeping mills operating. Naturally, there is a strong incentive for others to follow suit. Hence, incremental pricing is viewed as a dangerous practice as it can speedily depress prices in the overall markets.24

**Data Sources:**

- Annual Census of Manufacturers.
- Department of Justice.
- Federal Trade Commission.
- Paperloop.com.
- Pulp and Paper Week.
- Standard & Poor Register of Corporations.

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24 From interviews with the industry expert panel.