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Influence of Firm Structure on Profitability in the U.S. Pulp and Paper Industry (1960-1998)

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INFLUENCE OF FIRM STRUCTURE ON PROFITABILITY IN THE U.S. PULP AND PAPER INDUSTRY (1960-1998)

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Thesis Advisor: Dr. David B. Field

An Abstract of the Thesis Presented
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This study indicates that firm size, market share and equity/sales ratio are the principal factors contributing to the profitability (net income) of pulp and paper firms in the United States. Timberland ownership, exports, K-Factor (a measure of relative firm capacity), growth, new supply/real gross domestic product (RGDP) ratio and price index also influence the profitability of pulp and paper manufacturing firms.

Market share, an index of the structure of the pulp and paper industry, is determined by a firm's size (assets) and net income. In addition, the number of a firm's production units, K-factor, whether the firm exports, previous concentration in this market sector, number of firms, sales growth, timberland ownership, new supply/ RGDP ratio, and product mix may also influence a firm's market share, but not consistently.

The present study also describes factors that help a pulp and paper manufacturing firm in decision-making about the ownership and management of timberlands. According to the research findings, net income, equity/sales ratio, mergers, firm size, and K-Factor

are the most significant factors related to timberland ownership and management. The current study also confirms the findings of a number of researchers that no significant changes in the timberland ownership of firms in the pulp and paper industry have occurred during the last forty years, in spite of a decline in the area of commercial timberlands. Firms that own or manage timberlands have a significant advantage in terms of net income over those that do not.

DEDICATION

To my parents

My Mother and My Father

Hakeem Rao Muhammad Luqman (L)

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CHAPTER 1

INTRODUCTION

The importance of the U.S. paper industry to the national economy and the severity of recent challenges to the profitability of the industry indicate a strong need for understanding and addressing these challenges and issues. The purpose of this study was to collect and analyze information about the structure and performance of pulp and paper manufacturing firms during the last 39 years, to infer their response to the increasing levels of technical, economical, financial and global constraints and to explore appropriate strategies to meet current and future pulp and paper industry challenges. The main objectives and related hypotheses of the study were as follows:

--------Identification of different factors related to the firms, industry, and economy, responsible for the historical structural changes and resultant financial performance of the pulp-and paper-manufacturing firms during 1960-1998.

Hypothesis: Factors related to the firms, industry, economy, and globalization influenced the profitability, market share, and timberland management and ownership decisions of the U.S. pulp-and paper-manufacturing firms during 1960-98.

-------To analyze the influence of a firm's market share on profitability in the U.S. pulp and paper industry during the study period.

Hypothesis: Profitability of pulp and paper manufacturing firms was significantly associated with market share of the firms during the study period.

------To examine the importance of timberland ownership to pulp and paper firms in building their competitive advantage in the U.S. pulp and paper industry.

Hypothesis: Timberland ownership by pulp-and paper- manufacturing firms was associated with firm, industry, and economy-related factors that ultimately improve the profitability and help in building a firm's competitive advantage in the pulp and paper business. Furthermore, there was no decline in the attractiveness of the timberlands among the pulp-and paper-manufacturing firms during the study period.

-------Identification and testing of structural changes in the profitability and market share of the U.S. pulp and paper firms during the study period.

Hypothesis: Significant structural changes occurred in the profitability and market share of the pulp and paper firms during the study period because of factors related to the individual firm, the industry, the economy, and globalization.

Hypothesis: Factors related to the firms, industry, and economy that directly or indirectly influenced the profitability, market share, and timberland ownership decisions of the pulp-and paper-manufacturing firms in the US did not remain stable during the study period.

------To develop strategies for the improved profitability of the U.S. pulp and paper industry in the light of past structural changes.

The U.S. pulp and paper industry is a major branch of U.S. manufacturing that plays a critical role in the local economies of virtually all regions of the U. S. (CPBIS, 2002a). It accounts for just fewer than $100 billion in the value of shipments of finished products, and it constitutes 30 percent of the global market for paper and related products. It also provides jobs to more than 175 thousand people and accounts for five percent of the U.S. manufacturing sector's contribution to gross domestic product (GDP) (PPNAFB, 1999). The ninth largest manufacturing sector in the United States, the Forest Products Industry, of which the paper industry is a major part, plays a vital role in most regions of the US, where it ranks among the top 10 employers in 43 of 50 states (McGraw-Hill, 1999). The pulp and paper business is among the top five sectors in sales of non-durable goods.

The U. S. pulp and paper industry is among the most modern in the world (USEPA, 2000). It has a highly skilled labor force and is characterized by large capital expenditures aimed largely at production improvements. Clearly, the paper industry, both in the US and globally, is an integral part of today's social and economic fabric. Growth in the paper industry is closely tied to overall growth because nearly all of the industry's end-uses are consumer oriented. Over the past decades, however, exports have taken on an increasingly important role, and growth in a number of key foreign paper and paperboard markets is expected to play an important role in the health of the U.S. paper and allied products industries in the future (McGraw-Hill, 1999).

Paper and allied product companies range in size from giant corporations having billions of dollars sales, to small producers with revenue bases a fraction of the size. Because market size is quite large, there are numerous buyers and sellers, the four-firm concentration ratio is very low, no producer has controlling market power, most of the paper products are commodities, and prices are established by the intersection of supply and demand in the market, then pulp and paper markets may be regarded as fairly competitive. Price levels in the U.S. paper industry are therefore closely tied to domestic and foreign demand as well as industry capacity and operating rates, which determine supply (Standard & Poor's, 1999).

The paper industry suffered from low prices on various occasions throughout the study period (1960-98). During the last decade and a half, the industry has been burdened with economic, financial and organizational dislocations that firms found difficult to address. Among these have been chronic problems of overcapacity, weak prices, poor profit outlooks and deteriorating (Fig1.1) shareholder value (CPBIS, 2002b).

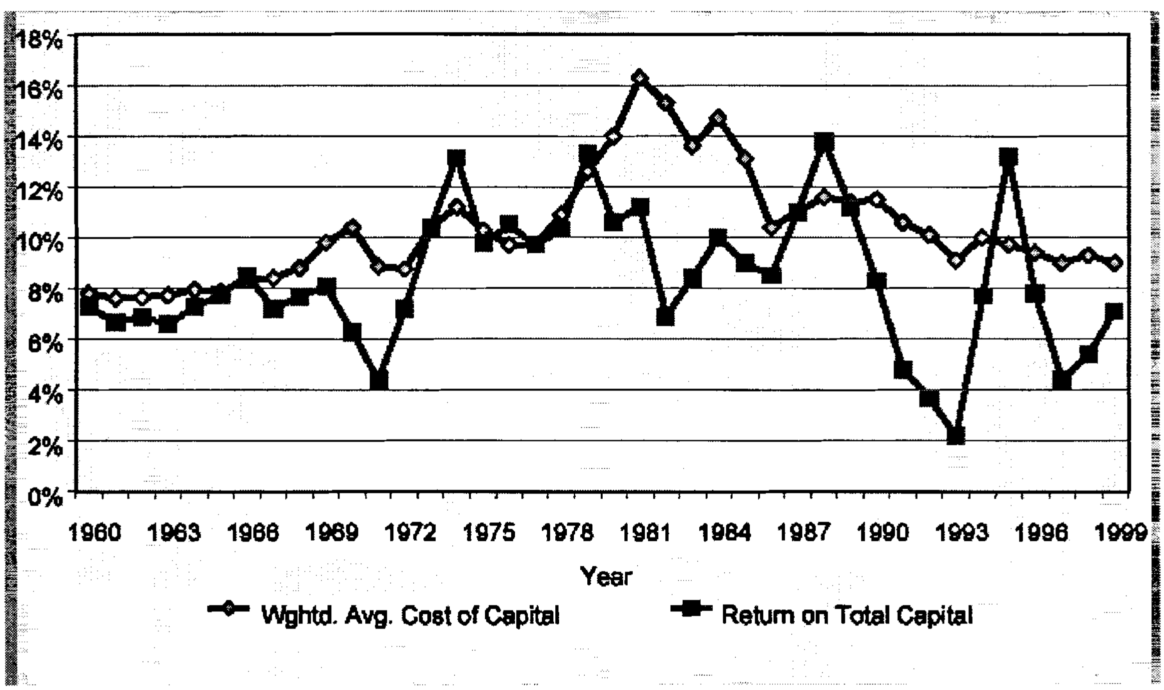

Fig.1.1 Historical pulp and paper industry return on capital (1960-99).

Source: Perkowski (2001).

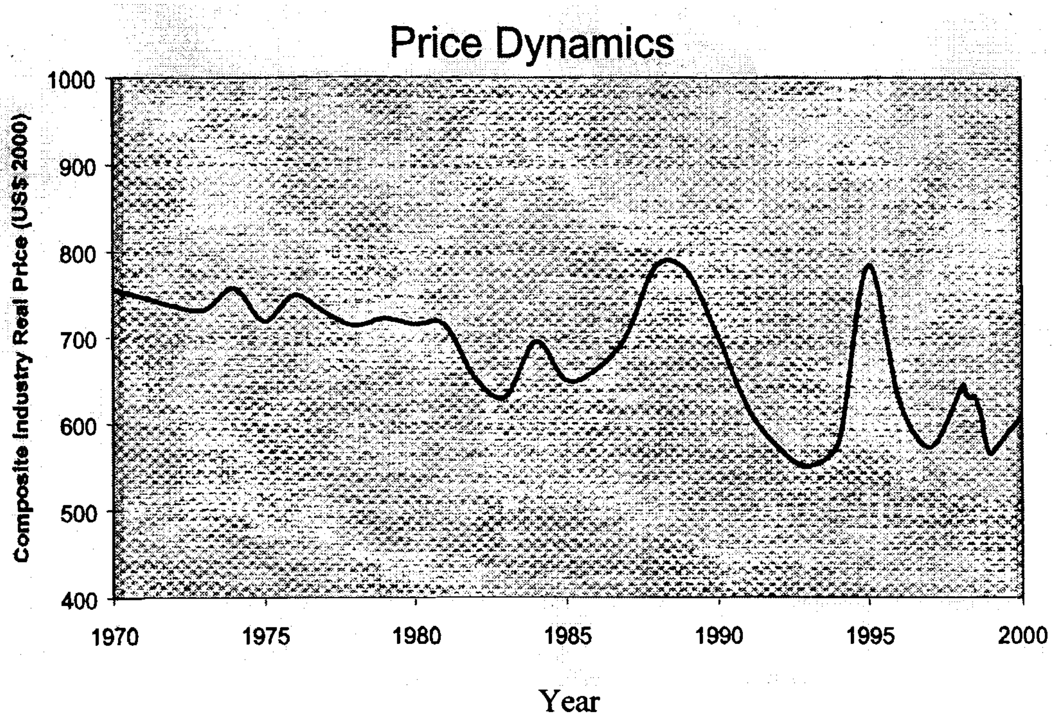

Fig.1.2 General trend of pulp and paper prices in the U.S. markets.

Source: Perkowski (2001).

Many experts believe that the volatility of pulp and paper prices (Fig 1.2) is the result of boom and bust cycles of the domestic as well as world economy. In a boom, new capacity is added. When the new capacity appears in the market, economic cycles change and leave investors and the industry in a difficult position. Indirectly, we may say that there is a lag between demand and the availability of new capacity. Lagged capacity additions may increase the excess supply and may exert negative prices in the market. This happened in the 1980s and 1990s. The capacity expansion in the 1980s and weakening demand in the early 1990s resulted in overcapacity and a period of supply/demand imbalance, which led to low prices and weak operating conditions in the industry (Standard & Poor's, 1999).

The paper industry manufactures a variety of paper grades such as printing and writing papers, sanitary tissue, industrial-type papers, containerboard, and boxboard. The U.S. pulp and paper industry uses a variety of pulping processes, but the Kraft chemical process is used for the vast majority of the pulp tonnage produced in the U.S. Generally speaking, the pulp and paper industry divides itself along pulping lines: chemical pulping (e.g. Kraft pulping), mechanical pulping, and semi-chemical pulping. On a tonnage basis, chemical-pulping methods produce approximately 85 percent of the pulp manufactured within the country, mechanical 10 percent, and semi-chemical five percent (EPA, 2002).

Stier (1985) described the technological changes in the U.S. pulp and paper industry during the 1960s and 1970s. According to him, mills that utilized the older groundwood, sulfite, and soda processes were steadily phased out of production and new capacity expansion, most of which occurred in the South and West, was based primarily on the sulfate and semi-chemical processes. These changes enabled greater use of hardwood species, which are generally more abundant and less costly, and which provide a higher yield of fiber per cord of pulpwood than do softwoods. In addition, the sulfate process exhibits declining unit costs of production as mill capacity increases (Gregory, 1972). In past changes in production technology, the pulp and paper industry has shown a consistent record of cost-saving technological improvements at all levels of processing. Stier concluded that the pulp and paper industry has been using labor-saving technologies, and a trend towards a wood-using bias can easily be observed, which suggests an increase in the wood pulp volume/pulpwood volume ratio with the passage of time. Production technology has led to a relatively concentrated industry, characterized by very large plants in absolute size. Technological progress in the U.S. pulp and paper industry has tended to conserve labor relative to capital and wood.

The U.S paper industry has undergone significant structural and financial changes over the last forty years. These changes are demonstrated by its position in the market place, the nature of capital expenditures, and the adoption of new technology. These changes appear to be the result of economic, technical, environmental, and global factors, which either separately or jointly impact the structure and performance of the pulp and paper industry. The U.S. pulp and paper manufacturing firms are preparing themselves to face the new challenges through mergers and acquisitions, building bigger and bigger plants to achieve economies of scale, implementing cost reduction strategies through increased recycling of wastepaper, vertical and horizontal integration, developing higher yielding pulping processes and increasing inorganic contents of final paper products. All these measures are being taken to increase the competitiveness of the U.S. pulp and paper industry in the world market.

Many financial and industry experts believe that the problems of the U.S. pulp and paper industry are not so simple and cannot be explained merely by over-expansion and the resultant supply and demand situation. There are many issues related to firms, the industry, and domestic or world economies that directly or indirectly impact the performance of the U.S. pulp and paper industry. Historically, problems have included over-capitalization, low barriers to entry but meaningful barriers to exit, a fragmented industry, non-differentiated products, flat cost curves, poor management, and incentives not aligned with shareholders. As a result, the industry only makes a decent profit for a fraction of the cycle and loses a lot at the bottom (Roberts et al. 2000).

In the past, the U.S. pulp and paper industry has relied heavily on capital solutions for improving manufacturing operations and has not emphasized enough the benefits of operating excellence or low/no capital projects (Phillips, 1997). Given the relative lack of risk inherent in capital investments that reduce costs, particularly when compared with high risk on both the investment side and product price uncertainties, it is remarkable that the industry continues to fund risky expansions while foregoing more certain cost reduction opportunities. Phillip suggested that paper companies must take better command of their investments, all the way from the R&D stage to the project concept.

Ince (1999) argued that the global cycle is changing the rules for the U.S. pulp and paper industry. Like other industries, the fortunes of the U.S. pulp and paper industry are now closely tied to the global cycles of supply and demand. One effect of this exposure in recent years is increased market volatility associated with trade-related adjustments in export demands and capacity utilization. Price volatility and sensitivity of profits to the global cycles are related to capital intensity and competitiveness in the pulp and paper sector. The recent economic downturn (Asian Decline) caused a number of significant "ripple effects" throughout the pulp and paper sector that are linked to the global cycle of supply and demand. Ince (1999) further added that the behavior of product prices and industry profits is tied to capacity utilization levels and shifts in exports, determined in large part by the global cycle of supply and demand.

The poor profitability of the U.S. pulp and paper industry is caused by global and domestic overcapacity and new low-cost global production facilities. These, in turn, have generated downward pressure on both prices and costs and led to deterioration of shareholder values, share prices and in general financial insolvency (McNutt, 2002).

Furthermore, foreign competitors in pulp and paper have modern and new machines compared to U.S. paper-manufacturing firms, which are still using old machines and technology. Worldwide surplus capacity is another reason for the poor profitability. It is estimated that capacity is more than 15-20 percent over sustainable demand. In addition, with operating rates needing to be at or above the low 90 percent range to generate effective prices and returns, the impact of this domestic and global overcapacity on deteriorating industry returns becomes obvious. Ince (1999) concluded that capacity utilization has fluctuated in recent years by 12 to 13 percent in a range that is roughly between 85 to 100 percent. Prices generally peak about four to five months after peak capacity utilization. Small changes in demand can cause significant changes in product prices and profitability. It is believed that competitive price volatility has a three- to four-fold amplification relative to the level of capacity utilization. Ince (1999) further concluded that U.S paper and paperboard capacity utilization tends to follow trends in exports. This indicates the importance of export markets for U.S pulp and paper producers. Although the U.S pulp and paper exports are not large in the world market, these exports may turn the profitability balance in the favor of U.S producers. Similarly, small imports may cause disturbance in U.S paper prices.

Haizheng, Banerjee, and McCarthy (2001) estimated that significant and unpredictable paper and pulp price movements have had a number of serious consequences for the pulp and paper industry, including excess capacity, unintended inventories build-up, and financial losses. In the long term, unanticipated price behavior will threaten the economic viability of the industry. They emphasized that understanding pricing behavior is the most important issue for the pulp and paper industry. Information on prices is essential for budgeting, project financial assessment, contract negotiations, and capacity planning. However, explaining price movements poses a formidable challenge. Fundamentally, market prices are determined in a system of equations that include demand and supply side variables interacting within a specific market structure. Because many variables in this system are endogenous, it is by no means an easy task to accurately model price movements and, therefore, to evaluate where prices may be headed.

Haizheng, Banerjee, and McCarthy (2001) concluded that present price models for the pulp and paper industry neither focus on causative factors nor provide information on price sensitivities due to change in the causative factors. In addition, econometric techniques and methodologies have significantly advanced in recent years, yet many of the existing models of price behavior fail to reflect these advances.

Increased use of recycled paper in different pulp furnishes to manufacture nearly all grades of paper has raised questions about the value of timberland management and ownership by the forest products companies. One school of forest economics believes that pulp and paper firms may remain competitive without timberland holdings (Binkley, Raper, and Washburn,1996; Zinkhan, 1988; Rinehart, 1985). Others believe that timberland ownership is necessary to remain competitive in national as well as global markets (Clephane, 1978; PPNAFB, 1999). No doubt the environmental movement has pressed the pulp and paper firms to increase their use of wastepaper in their pulp furnishes. However, technology development has played a significant role in the increased use of wastepaper. Use of recycled paper in papermaking has changed timberland ownership preferences. Recycled wastepaper use has not only influenced the structure of the pulp and paper industry but it has also reduced the firm's dependency on timberlands to some extent. Just what is the potential relationship between a firm's competitiveness and the timberland ownership and management option? Can pulp and paper manufacturing firms remain profitable in the domestic as well as global markets by leaving the wood supply control in other hands despite the fact that wood is one of the major costs in paper manufacturing?

From a review of the history and characterization of the U.S. pulp and paper industry, still it is not clear which factors related to the firm, industry, economy or globalization jointly or individually are responsible for the historical performance of pulp and paper manufacturing firms and structural changes in the industry. Even if these factors impact the performance of the U.S. pulp and paper industry, still we do not have enough information about the factors' interaction path in shaping the performance and structure of the industry. Understanding the mechanism of their interaction may help the U.S. paper industry to develop appropriate strategies for boom and bust cycles and maintain shareholder value for future growth.

CHAPTER 2

REVIEW OF LITERATURE

This chapter synthesizes findings from previous studies of pulp and paper firm profitability, relations with market share, and the importance of timberlands. Information about the structure of firms and the industry focuses on market share, concentration ratios, and structural changes in the pulp and paper industry during the last forty years. Past studies focus mainly on U.S. firms and the role of market share on profitability. Additional information included here, although not specifically about the pulp and paper industry, provides good reference for discussion of the subject. The last section of this chapter provides information about the timber resources of U.S. pulp and paper firms, the importance of timberland ownership and management to the firms, and the possible role of timberlands in building a firm's competitive advantage in the pulp and paper business.

2.1 Structure of Industry

Shughart (1990) defined market structure as the number and size distribution of firms that populate an industry. In his opinion, the performance of an industry can be deduced directly from industry structure. However, the structure of the market may be quite different from the structure of the industry. He concluded that there was no change in the four-and eight-firm concentration ratio of pulp mills from 1967 to 1982. The Herfindahl-Hirschman Index (HHI) was about 760, which indicated significant fragmentation among the pulp-manufacturing firms in the U.S.

Broemeling and Hiroki (1987) defined structural change in regression analysis terms as a switch in a regression equation; that is, one or more regression coefficients change. Hansen (2001) defined structural change as a statement about parameters, which only has meaning in the context of a model. Domingo and Giorgio (2000) explained the difference between structural changes and variation. They argued that structural changes appear when some part or properties are lost or added to the object, some relations may appear, disappear or change their form. In other words, structural changes imply changes in object identity. Of course, it may happen in such a small degree that the change is not noticeable, or in such a degree that the system becomes a new one. Variations, on the contrary, appear when the values of one or more properties change, but the object maintains its identity. In other words, the parts, their properties, and their relations remain the same. Structural change is the addition and elimination of parts and subsystems, disintegration, collapse, and changes in the main behavior.

Davis and Vebrugge (1978) stated that, as the concentration of resources in a given market increases, the likelihood of aggressive competition in the market decreases. Similarly, the more equal are the market shares and the larger the number of firms, the greater is the probability of intense competition. They further concluded that the results of competition were reflected in both price and non-price performance. According to them, to assess the effects of market structure on performance, several aspects of market structure measurements must be addressed. First, the product used to measure the market share of the competing firms in the market must be defined. Second, the appropriate geographic boundaries of the market area, given the relevant product, must be selected. Third, appropriate market structure measures must be chosen.

Magee (1997) discussed the relationship between firm size and market structure in the U.S. pulp and paper industry. He argued that attempts to control the market in

America extend beyond official organizations. The merging of firms and the construction of even larger mills was a major feature of the American industry from the end of the nineteenth century onwards. Although this trend was still in its early stages between 1890 and 1913, it had progressed far enough by then to start having some influence on the rate of technological accumulation achieved in the United States. This was particularly so amongst the largest of the American firms, which were able to attain the long runs and continuous production that were most susceptible to the economies of the practice. Most firms opted for expansion strategies and, as a result, the industry advanced as it never had before. Many new concerns were incorporated with capitalization of as high as several million dollars, while pre-existing ones increased their capitalization by similar amounts. Average firm size, measured in volume of output, increased by over 200 percent between 1895 and 1905, while average mill size grew by 121 percent over the same period.

Market concentration reflects market share and market share is best modeled at the firm level, bringing into play strategic choices made by firms. It follows that a useful approach to explaining concentration would be two-stage: (1) estimate firm size or market share as a function of firm level determinants, and (2) use the information in these estimates to assess the relative contributions of firm characteristics to concentration (Kattuman and Barbra, 2000).

Ohanian (1993) noted that the paper industry has traditionally been viewed as oligopolistic, dominated by a few large firms such as International Paper. Many economists have argued that economies of scale have led to an industry characterized by a few large mills that produce a high volume of standardized products. The benefit of large scale is explained by the high fixed costs of establishing a plant and purchasing expensive paper machinery, which represents a barrier to entry that limits the number of firms in the industry. In this regard, several analysts have suggested that an absolute decline from 879 pulp and paper mills in 1900 to 789 in 1940 was evidence of barriers to entry and increased concentration of the industry. Ohanian (1993) concluded that the most widely used indicator of industrial structure was the concentration ratio, the combined market sales of the top four or eight firms expressed as a share of total market sales. According to her, production capacity may be used to measure market share because individual mill or firm sales data are not easily available for most of a firm's operating periods. She measured two series of concentration ratios, one based on individual mill capacities and another based on total capacity of paper firms. Because many of the largest paper firms owned more than one mill, she concluded that the firm-based concentration ratios are often higher than the mill- based ratios.

Rowland (1999) concluded that the North American pulp and paper industry was somewhat less concentrated than the European paper industry overall. Most firms were trying to achieve capacity consolidation to cut cost and improve performance. Another compelling reason for consolidation in the pulp and paper industry was the growth in size (through internal expansion as well as mergers/acquisition activity) across different customer segments. A trend towards more significant multi-national customers was expected to continue and was widespread across many industries. He further concluded that kraft paper and sanitary paper, by and large, had a relatively high degree of concentration. With the highest degree of concentration of all segments, sanitary paper has, not coincidently, the best financial returns in the pulp, paper, and paperboard industry. The top five in this segment make up over 70 percent of the capacity in both North America and Europe.

Shephered (1979) described three main horizontal elements of market structure: (1) market share, (2) concentration among the leading firms and, (3) barriers to new entry. Every market has these elements in varying sizes and combinations. There may be vertical and conglomerate elements. He further argued that a firms' performance is a function of market position, internal efficiency, and external market conditions. The performance of a firm depends on prices and profits, efficiency, innovation and equity in distribution. Causation runs from structure to performance, but some reversed causation can occur also or instead.

Smith (1997) has presented a most interesting structural analysis of developments in the U.S. paper industry over the last two decades. Intensified recycling efforts have generated large volumes of high-grade waste paper, which partially due to a simultaneous expansion of wood pulp production capacity, has not been utilized locally in the paper industry. These trends have led to an increased availability of both bleached, wood-based pulp and high quality waste paper on the global market. A large part of this has been absorbed by the Asian pulp and paper industry. In particular, non-wood based pulp and paper mills were increasing their share of long fiber both from virgin and recycled wood pulp in their paper composition, to improve paper quality and expand paper production.

Dynamic efficiency advantage may rise from some characteristics of the firm, such as research and development intensity, management quality, and skilled labor force. For example, R&D focused on process technology may lead to lower cost techniques and allow a firm to increase its market share by producing a given quantity at lower cost than its rivals. Another source of efficiency may derive from a firm's ability to learn from experience. In particular, some firms have greater experience in certain types of production and have a greater ability to learn (Malerba, 1992).

If a firm achieves a large market share, there are additional reasons why efficiency advantage may be reinforced. Economies of scale can occur in cost components such as capital, marketing or research and development. These factors may maintain or extend efficiency advantage gained through some dynamic process. In the case of R&D, static factors may reinforce dynamic advantages. For example, a high market share may imply that a firm has a greater likelihood of benefiting from process inventions, thus increasing R&D intensity. Higher R&D intensity may result in more process inventions and larger market share. These ideas suggest that the positive empirical concentration-profit link can result from competition in which most efficient firms gain higher profits and larger market shares (Feeny and Rogers, 1999).

PPI (1999) has reviewed the major changes in the U.S. pulp and paper industry during the last 40 years, concluding that the industry today is totally different from that which existed 40 years ago in many respects. Technical advances have resulted in far more tons of paper produced for every ton of wood. A dramatic increase in recycling has reduced dependence on timberlands. Light-weighting has also led to dramatic changes in the make-up of paper products. The increasing globalization of customers has also been a catalyst for the spate of mergers and amalgamations that are currently reshaping the industry. Furthermore, the biggest change in the last 40 years has been in the behavior of the pulp and paper industry's top management. Their emphasis used to be on market share, but now they are focused on shareholder return. This change has been particularly noticeable in the last five years. The main effects of this new attitude are a drastic reduction in new capacity and consolidation in the industry. On the technical side, one of the major advances has been in the scale of production, which has dramatically increased. Also, fiber type has been changed with the significant rise of short-fiber pulp over the last 30 years. Filler content has also been steadily on the increase over this period, to the detriment of fiber usage. The pulp and paper industry experienced the significant changes in furnishes. Innovation dominated the 1960s, Environmentalisation the 1970s, "Europeanisation" took hold in the 1980s, while globalization was the watchword of the 1990s. The year 2000 and beyond will see the impact of "valorization" (shareholders value), with other changes including consolidation, integration, growth in demand, and increasing concentration and capital intensity in the industry.

Lynn (2000) explained the primary rationale for consolidation in the pulp and paper industry as improving price stability over the cycle by limiting the number of players and by giving the resultant larger companies a greater ability to adjust production downward during the weaker markets without major penalty to earnings. These changes in industry structure were also making the North American Industry more responsive to the new challenges. The larger companies appeared to have an edge in global markets, as their greater market recognition facilitated the ability of a company to penetrate new global markets efficiently. Furthermore, the larger companies tended to find it easier to establish marketing and/or production beachheads in developing markets in Eastern Europe and Asia, while at the same time minimizing the risk of such ventures to the corporation.

Feeny and Rogers (1999) argued that a firm's market share does not appear to have any significant linear association with profitability; however, a non-monotonic relationship was found to be significant. They suggested that, as market share increases to around 30 percent, profitability declines; when market share increases above 30 percent, profitability rises. The extent of diversification appears to have little influence on profitability, although, when loss-making firms are excluded from the analysis, more focused firms do appear to have higher profitability. They also concluded that lower cost through economies of scale, rather than higher price, are responsible for higher profitability being associated with greater market share.

Weston (1961) was another scholar who downplayed any relationship between merger activity and economic downturn. Weston (1961) correlated aggregate merger data with the Federal Revenue Board Index of Industrial Production, the Dow-Jones Industrial Average, and the Bureau of Labor Statistics Index of wholesale prices. The multiple regression equation Weston (1961) used is as follows:

$$X1 = -446.15 - 440.39X2 + 3.74X3 + 8.45X4$$

$$\text{Se} \qquad (461.60) \quad (0.98) \quad (2.87)$$

where X1= number of mergers per year, X2= industrial production index; X3= average stock prices, and X4= wholesale commodity prices. There were 13 degrees of freedom. The period covered in his study was 1920-1938. He concluded that the relationship between the level of business activity and the number of mergers per year was not statistically significant. Changes in general price levels had some influence on merger activity, but changes in the level of stock prices represented the greatest influence upon mergers during the interwar period. Furthermore, Weston (1961) added, " The timing of mergers did not appear to exhibit cyclical characteristics".

Kristensen (1999) studied changes in competitive environments, the market in which a firm acts. He argued that changes occur due to structural changes in the economy, an increasing pace of technological development, changes in demand, and an increasing globalization. These changes cause turbulence and instability in markets to which a firm must react in order to stay competitive. A flexible rather than a traditional organization was believed to enable the firm to respond faster to such changes. He further explored the concept of globalization and its possible impacts on the performance of firms, finding that globalization is a concept increasingly used as an explanation or as a definition of the present state of the economy. For some, the globalization of the economy is an effect of free-trade agreements, with the free movement of capital being a cornerstone in trade agreements such as those of the European Union (EU), North American Free Trade Agreement (NAFTA) and World Trade Organization (WTO). The globalization was said to increase competition and efficiency, mainly since the firms engaging in these globalization processes situate facilities in order to benefit from such things as low labor costs, thereby gaining cost reductions that can be used to lower prices or otherwise improve the competitiveness of the company product.

Kristensen (1999) used probit regression to estimate the performance of 1900 Danish firms under different market conditions. He concluded that the flexible or "learning" organizational firms in some part of the economy, characterized by innovation turbulence and cumulativeness, were the best performers.

Skog et al. (1995) discussed wood products technology trends and resultant changes in forestry. According to them, forest products technology changed in response to changing costs, market conditions, and the availability or scarcity of forest resources. In the future, technologies will continue to adapt as the types of raw materials from forests become more diverse. Technology will also seek to use wood and fiber from other sources, such as recycled materials. A number of key developments in structural wood products technologies, as well as pulp and paper technologies, are already changing the wood-manufacturing process and how timber is used. Skog et al (1995) concluded that, in the pulp and paper sector, some important technological changes could be traced to scarcity or abundance of fiber resources. For example, technological adjustments had allowed hardwood pulpwood to gain an increasing share of total pulpwood consumption in recent decades, partially because hardwood was generally cheaper than softwood in the United States. Other incentives for change included increased demand for recycled paper and paperboard products, the consumer's increased environmental concerns, capital cost and operating-cost advantages of alternative manufacturing processes over traditional ones, and a growing demand for paper products.

McMurran (1988) evaluated the market structure of the North American newsprint paper industry from 1870 to 1970. He tested the hypothesis that competitive market conditions, which resulted in price competition coupled with low and/or falling profits, created price and output agreements (mostly through trade associations) in order to rid the market of such competitive conditions. Two implications of his hypothesis were: (1) the evolution of market structure and behavior was brought about by competitive conditions and (2) a competitive market was inherently unstable and thus unable to achieve the equilibrium solution found in traditional price theory. He concluded that during two periods, 1840-1900 and 1925-1930, intensive price competition occurred. In each of these periods, competitive conditions resulted in collusions and mergers, which changed the newsprint market structure from competitive to oligopolistic. He further found that, by the 1950's, the newsprint paper industry had evolved into a price leadership arrangement in which price competition was effectively controlled.

Davis (1966) concluded that there was strong evidence, both factual and theoretical, to support the hypothesis that mergers can lead to economies of production and economies of marketing. However, evidence that showed firms benefiting from economies of scale following their respective mergers did not prove that firms merge for that reason. Mergers may take place for a variety of reasons. Once merged, the remaining managers may either reorganize to achieve greater efficiency, or economies can be achieved without any conscious efforts from these same managers. Davis (1966) further argued that a firm's desire for technical change relies on large-scale production.

Ince et al. (2001) have provided a detailed data reference for capacity trends of the pulp and paper industry in the United States based on a compilation of individual mill and process data from 1970 to 2000. Capacity estimates by mill location and process types were derived from industry directories and from other sources. The paper commodity group includes eight conventional categories: newsprint, four categories of printing and writing paper, tissue and sanitary paper products, unbleached Kraft paper, and other specialty packaging and industrial paper products. The researchers concluded that although total capacity among this commodities group had generally increased during the past 30 years, each commodity has had distinctly different growth patterns. On the basis of capacity estimates, the authors concluded that there had been a shift towards concentration of production capacity among larger firms between 1970 and 2000. In 1970, the top ten companies accounted for less than 35 percent of the total paper, paperboard, and market pulp capacity. By 2000, the top ten companies accounted for nearly half of the total capacity. The capacity of each of the top ten producers more than doubled from 1970 to 2000. The top two producers did not change rankings between 1970 and 2000, but the other eight rankings were either different companies or the same companies in a different order. On the whole, the production capacity of the U.S. pulp and paper industry expanded from 1970 to 2000, although the rate of growth gradually decelerated. Geographically, capacity growth shifted from the West to the East, and particularly to the South. Significant expansion occurred in production capacity based on recycled fiber, especially from the late 1980s to the late 1990s. The rate of overall capacity expansion has slowed since the late 1990s, with corporate consolidation and numerous mill closures, but average mill capacity more than doubled between 1970 and 2000.

Slatin (1985) found that many changes in the economic structure of the paper industry took place from 1974 to 1984. During this period, the US pulp and paper industry witnessed a willingness to face the changing condition of the market and to adapt products to meet those changing needs. It is upon this willingness to adapt, perhaps more than on any other factor, that the hope for the future of the industry rests. Slatin (1985) reported significant changes in the technology of the industry during 1974-1984, particularly in the manufacture of newsprint, coated papers, uncoated, free-sheet paper, and containerboard. In other grades, the trends of the ten years were simply extensions of the past. Changes in the technology resulted in the shifts in size distribution of pulp and paper mills.

Cody (2000) concluded that pulp and paper companies were getting much bigger and that the names of many companies that had operated in the past for years were disappearing. These changes reflected the unprecedented scope of merger activity that began in the mid-1990s, accelerated towards the end of the decade, and apparently continued unabated. Many firms disappeared from the corporate roll call due to acquisitions and mergers. Cody (2000) analyzed the question of being bigger and bigger in the paper business. According to him, in general, performance for the larger companies lagged that of small to medium-sized firms, based on return on assets (ROA) or similar gauges. For example, based on data through 1998, financial performance could be measured by comparing the return on assets over the period of ten years. Industry consolidation was having the desired impact on the market, according to some experts. In containerboard, the industry consolidation had allowed the recent market up-cycle to continue longer than it might have in the past and enjoyed a reduction in operational stoppages. This was due to the fact that the now much larger producers were able to monitor inventory levels and take downtime (in some cases huge amounts) to avoid inventory building. Finally, Cody (2000) concluded that the North American top 50 paper companies were becoming larger and more focused as they tried to improve financial performance amid global competition.

Armentano (1982) discussed the importance of merger and merger-related benefits to a firm. According to him, companies merged to enjoy the economies of scale in production, distribution, research and development, or capital financing, and the resultant economies could also result in growth, and in concentration relative to other firms. Armentano (1982) reviewed many mergers in this way. However, Stigler's (1968) view of the relationship between mergers and economies of scale was different from Armentano's (1982) view. Stigler (1968) argued that the survival of small firms in many industries is evidence that these firm's costs are smaller compared to larger firm's costs. He concluded that economies of scale were unimportant over a wide range of sizes in most American industries, for we commonly find both small and large firms persisting. Bain (1950) and Weston (1961) partially agreed with Stigler's (1968) point of view but disagreed with Stigler's conclusion about the subject. Both argued that small firms are capable of serving in many industries even with severe cost disadvantages. These small firms may survive on the merger, while entry remains unattractive. Geographical or other market imperfections may make it possible for small firms to succeed in supplying limited corners of the market while the mass markets can be successfully supplied only by large scale producers. The small firms in a census industry may be producing different products than the major firms.

The Financial Times (1999) found that overcapacity remained the pulp and paper industry's curse and was seemingly immune to even the best growth rates. While present pricing trends may prompt an unbeaten tone among the industry's leaders, most were aware that the structural problems of the sector, where the world's top five producers have a market share of only 15 percent, remain. In a capital-intensive industry, which is rapidly becoming global, the costs of fragmentation are clear. The Financial Times (1999) argued that if the companies were doing better there was no need of restructuring the industry, which was, of course a short- term view. Long-term thinking means it is worth considering, whatever the price cycle is. The competitiveness of larger companies was the main reason for consolidation, with the synergy benefits acquired in mergers clearly the leading factor. There were others too: many of the pulp and paper customers were consolidating and operating all over the world. They wished large companies to serve them whatever they were. Larger companies may also be in position to integrate new capacity into the market, which would help prevent price volatility. Finally, the trend to concentrate on fewer products should bring new discipline to investment.

Bergman and Johansson (2000) analyzed the effects of price and market size variables on investment properties in the pulp and paper industry using regression analysis for data on 15 European countries for 1984-1997. They found that wages, the US/ECU exchange rate, the price of paper, and the installed production capacity were the main determinants of strategic investments in this industry. Market size had no or only a very small effect. The authors also discussed the structural changes that have occurred in the pulp and paper industry in recent decades. The degree of vertical integration in pulp and paper production increased, as did the average production scale. New technologies and increasing environmental concerns have made recycled paper a more important source of raw materials which, in turn, has created a shift in the industry's center of gravity from forest-rich regions to densely populated areas. Their research tried to address the question of which factors have influenced investment decisions and analyzed the effect of price and market size variables on investment propensities in the pulp and paper industry.

Anonymous (1995) discussed the U.S global trading outlook for paper products, finding that the U.S. pulp and paper industry was maturing, yet dynamic. Faced with stagnating domestic shipments, it refocused on export sales and continued to gain global market share. The industry was the most modern in the world because of continued large capital expenditures. This spending was driven largely by production improvements, environmental concerns, and the goal of increased recycling. The most important issue for the U.S. industry has been the need to meet increasingly stringent air and water anti-pollution regulations. It has made progress in meeting these requirements. The industry is recycling more paper products. The U.S. is the leading exporter of recovered paper. Relatively low-cost raw material and energy, combined with modern facilities, have made the U.S. paper producers competitive worldwide.

Haizheng, Banerjee, and McCarthy (2001) stated that significant and unpredictable paper and pulp price movements have had a number of serious consequences for the pulp and paper industry, including excess capacity, unintended inventory build-up, and financial losses. In the long term, unanticipated price behavior could threaten the economic viability of the industry. They discussed an approach to analyzing the pricing behavior of pulp and paper products, focusing primarily on the containerboard sector. Using modern econometric techniques, they analyzed price movement in three separate ways. First, to identify the underlying process that governs containerboard price movements, their approach was based on a pure time series model using historical data. The second direction was to analyze the effect of industry consolidation on price movement and price volatility, asking whether consolidation would help stabilize prices and reduce price volatility. If consolidation has had its intended effect upon prices, the magnitude of the effect is still largely unknown. The third direction was to construct structural models of market demand and supply in order to study the causative factors of price movements and to estimate various price elasticities.

Jaffe (2000) discussed a recent shift in the U.S. pulp and paper industry strategy. According to him, a considerable change in the industry's operating strategy has played a big part in the more positive outlook for coming periods. The paper sector has begun to focus on consolidation, which means slower capacity growth. Consolidation also widens profit margins by spreading administrative and research and development costs over a larger fixed-asset base and by eliminating redundant operations. The adoption of "best practices" can also boost productivity by comparing the combining companies' methods of running their businesses, and then applying the most successful practices to the newly managed firm. He further added that, in recent years, most companies with a desire for greater operating capacity have sought to take over existing mills rather than construct new ("greenfield") mills. The advantage for the industry pricing levels is that such combinations increase the capacity of the firm involved, but not of the industry overall. Most consolidation involving domestic companies in recent years has been conducted in North America. However, in the early 2000s, agreements were reached for the industry's two remarkable deals. According to Jaffe (2000), many firms in the industry have recently changed their product strategy. For a number of years, paper and forest products companies thought that they were best served by offering a wide array of products. The strategy was based on the belief that it was easier to get business if you offered something for everyone. Now, however, many of the industry's big names have concluded that there's more money to be made by being a leader in a small number of product categories. They feel that strict attention to being a lower-cost producer and a major factor in a few highlighted grades leads to a much better profit picture. The recent corporate takeovers evidenced this change in strategy. Finally, Jaffe (2000) concluded that the performance of the paper industry has been driven mostly by the interaction of supply and demand. However, because the sector is dependent on factors such as global economic health and industry capacity, demand frequently exceeds supply, and vice versa. Although the industry cannot do anything about the global economic situation, it can take actions to try to make sure it does not allow supply to far exceed demand.

Closset (1998) has concluded that three key forces have been driving changes in the U. S. pulp and paper industry. These forces are globalization, capital intensity, and economic performance. Globalization is a reality today, the result of a powerful drive towards international free trade. A consequence of globalization is that the economies of countries around the world have become more concentrated. Closset (1998) concluded that the U.S. pulp and paper industry is the most capital-intensive industry in the world. It has the longest capital investment cycle (30+ years) among manufacturing industries. The American Forest & Paper Association (1999) has reported that, since 1980, the industry has spent in excess of US $ 130 billion in capital. It is sobering to realize that, despite this investment, economic performance has been poor and historical returns on assets disappointing for major producers. Since 1995, in fact, the industry has only met its costs of capital once, in 1995.

Pesendorfer (1998) has studied horizontal mergers in the paper industry. His research revealed the implications of horizontal mergers in the paper and paperboard sectors and examined the merger effects on consumers, rival firms, and welfare of society. This analysis was based on a model of investment behavior. According to the author, there were two reasons for examining investment decisions. First, mergers alter the capital allocation within an industry, which affects investment decisions. Second, investment decisions were the main strategic choice variables in the paper industry. Horizontal mergers and acquisitions constituted an important contribution to firm level growth, and firms involved in an acquisition tended to be among the largest in the industry. According to the data collected, in more than half of the occurrences of mergers during 1978 and 1991, the acquiring firm was among the largest 15 percent of the firms. Moreover, the acquired firm was among the top 25 percent of the firms in size distribution. The pulp and paper industry restructured itself from1985-87 through merger activity. Horizontal mergers may have two impacts--anticompetitive effects on price and investments and cost reduction. The merger of Scott and Kimberly Clark was the good example of the second effect.

2.2 Profitability

Harad (2001) has described the financial performance of the pulp and paper and wood products industries, finding the historical performance of the pulp and paper industry to have been poor. There are a number of reasons for this dismal performance but clearly, one of the root causes has been the historical fragmentation of the industry. The paper industry has been one of the most fragmented industries in world commerce. Even with consolidation, the top five companies account for just under 30 percent of the global sales. By comparison, the top five companies in the automobile and energy industries account for 80 percent of the global sales in their respective businesses. Harad (2001) concluded that fragmentation has had a number of consequences for ongoing operating management, including limiting producers' ability to infer actual demand and creating incentives to manage for marginal cash flow rather than long-term return on capital. But perhaps the most damaging impact has been in the area of capital management. Historically, a series of capital investment booms when the cash flows were good, followed by periods of excess supply and sharply falling prices, have been experienced in the pulp and paper business.

For all these reasons, Harad (2001) observed that merger and acquisition activity has gathered considerable momentum in the last few years and consolidation has dramatically altered the relative position of competitors in the global markets. The largest pulp and paper companies in the world, measured by sales (International Paper, Georgia-Pacific, and Weyerhaeuser), have seen their market capitalization increase by 60 percent since 1995, to $40 billion. The market capacity of the top five companies in the world is now nearly equivalent to the combined market capacity of the next 40. Consolidation has also accelerated the trend to globalization. European and North American firms have acquired positions in each other's home territory and have taken positions in Asia and South America as well. Consolidation appears to have changed the focus and behavior of companies even when they had not been directly involved.

Kaltenberg and Buongiorono (1986) discussed the growth and decline of the paper industry by using econometric analysis of U.S regions. The researchers estimated the regional demand for, and supply of, pulp and paper products. Elasticities of regional production with respect to important supply and demand factors were then calculated using data for 1950-78. These elasticities were used, together with the average annual percentage changes of the corresponding variables, to determine the contribution each had on the growth of production. The results indicated that demand was the major factor causing differences in growth rates. The rapid growth of paper and paperboard production in the South and West seemed to be spurred mostly by high economic and demographic growth in the market area. Supply (cost) factors, and prices of substitutes were found to have played a minor role by comparison. Furthermore, it was also concluded that the measure of the effect of a variable on regional production depended on two things--the rate of change of that variable, and its elasticity.

Christensen and Caves (1997) analyzed investment rivalry in the North American pulp and paper industry. In the industry, additions to capacity occur principally in large lumps and these sharply delimit the investing firm's short-run output and marginal cost. In the authors' opinion, in Cournot rivalry, the larger firm loses more profits on existing capacity than its smaller rival when either firm depresses prices by installing a new unit of capacity. Larger firms were more sensitive to market-spoiling considerations, in that their investments were deterred by low rates of capacity utilization. Unexpected announcements of new projects by rivals promote abandonment only in less concentrated industries; elsewhere competition is encouraged. Short-run price competition is found to be highly sensitive to capacity utilization, and the market's geographic scope is tested. The authors also discussed the impact of foreign exchange rates on the health of the U.S. pulp and paper industry. Consistent with North America's net export status, the larger and generally unanticipated swings in real exchange rates during the past decades have strongly affected export prices and the firm's profitability. Domestic and export transactions prices are not directly tied to each other in the short run, but a strong indirect tie arises from mills shifting their sales to higher-profit destinations.

Buzzel, Gale and Sultan (1975) reported a positive correlation between market share and ROI. The authors discussed why market share affected profitability, listing economies of scale, market power, and quality management as possible reasons. Using the Profit Impact of Marketing Strategy (PIMS) database, they showed how market share was related to ROI. As market share increases, a business is likely to have a positive profit margin, a declining purchases to sales ratio, a decline in marketing costs as a percentage of sales, higher-quality, and higher-priced products that are purchased infrequently by a fragmented consumer group. They also analyzed the strategic implications of the market share to ROI relationship. They advised companies to analyze their positions in order to achieve the best balance of costs and benefits of different strategies.

Chakravarthy (1986) stated that traditional profitability measures for evaluating a firm's strategic performance are inadequate at discriminating excellence. He found that accounting data measure past performance, while strategic performance needs a more forward-looking measure. Alternative measures were examined and proposed as being more efficient discriminators of a company's strategic performance. One measure is the firm's ability to satisfy all its stockholders, not just a stockholder. Another assesses the quality of the firm's transformation process, which involves the company's adaptation both to the current business environment and to uncertain or unknown future environments.

White and Hamermesh (1981) examined the possibility of obtaining a satisfactory answer to the question of what factors determine the level of a business's performance. A number of largely independent areas of research have tried to explain business performance, often emphasizing different factors, using different conceptual schemes, and examining different organizational units. A model of performance was developed that integrated overlapping and common explanatory variables from industrial organization economics, organization theory, and business policy, such as business position, industry environment, strategy, and structure. The model worked toward a testable synthesis of these elements. By using the business unit as the unit of analysis and by using the concept of strategy and structural context corresponding to the business unit, it was possible to take into account different industry conditions and competitive positions, while examining the effects of strategy and of structural context.

Hseu and Buongiorono (1997) found that the pulp and paper industry plays an important role in the forest economies of the United States and Canada in terms of employment, foreign exchange earnings and use of forest resources. Much research in forestry economics has tried to gain a better understanding of this industry, to make forecasts of the supply and demand of its products, and thus to predict the derived demand for pulpwood and recycled paper. Some elaborate models have been developed to make those forecasts, such as the North American Pulp and Paper Model (Zhang, Bungiorono, and Ince,1996), which is a dynamic spatial equilibrium model involving many parameters, including elasticity of demand and supply.

Lamberg (2001) explored strategy and the strategy process in the paper and pulp industry in Scandinavian countries and in the United States in the 20th century. In his studies, he tried to understand which factors had been decisive for the success of pulp and paper companies. In his opinion, both competitive and institutional elements affected an organization's strategy process. He concluded that the pulp and paper industry business is cyclical in nature and motivates producers to try to manipulate markets. (During the whole 20th century, producers had complained that the over-capacity in the industry prevents competition.)

Jensen (2000a) discussed the role of capital investments in the competitive advantage of the U.S. pulp and paper industry. According to him, the North American industry is going to find itself at a disadvantage because new technology around the world will be competitive. On the other hand, for decades the industry has not earned a return on the capital that pulp and paper firms have invested. He further concluded that slow growth in the industry is another major problem. U.S. pulp and paper firms will end up having to compete using assets that are not as big as the Asian assets nor as technically capable as used by competitors in Europe. The U.S. will find itself in a very, very tough competitive situation as a result. A question that the U.S. pulp and paper industry has to answer is how to keep making those investments and grow, but in a mature market that is not easily done. Jensen (2000a) also discussed the timberland productivity and commercial forestry challenges facing the pulp and paper industry. He concluded that recycling had reduced the timber supply problem to a greater extent in North America and did not expect any supply shock in the future.

Eamer (1998) reviewed the possibilities for value creation in the mature paper industry in North America over the business cycle from 1989 to 1995. He stated that the returns from the paper industry were currently very poor for investors because of lower prices and overcapacity. (Earlier, the pulp and paper industry used to compare its financial performance with U.S. Treasury bills). Generally, the industry has been competitive, but the fact remains that a typical paper company return on capital was over

10 percent in Canada while the typical bond yield was 14 percent. The Standard and Poor's 500 index during 1989 to 1995 was 15.3 percent. In 1997, the Standard and Poor's index increased almost 34 percent.

The pulp and paper industry has a high debt load, which is the major problem leading to poor financial performances. Eamer (1998) stated that price and exchange rate fluctuations also impacted the financial performance of the firms. According to his estimates, a U.S. $10/metric ton change in wood pulp meant U.S. $280 million to the U.S. industry. For newsprint, a U.S. $10/ metric ton change in selling price may reduce the profitability of U.S. pulp and paper industry by $46 million. Eamer (1998) concluded that decreasing capital costs, decreasing operating costs, increasing process efficiencies, improving forest management practices, looking at alternative fiber supplies, adding value to products, and creating mass customization all contributed to performance.

Stanley (2000) found that a global paper and allied products industry was an important contributor to the total health of the U.S. economy. Although viewed as a mature sector, the industry has very dynamic product development and technological improvements covering distribution, handling, processing, converting, and environmental protection. The industry is currently continuing a globalization process in which producers are expanding their raw material holdings, improving product manufacturing, converting, and distribution networks, and streamlining order procedures to foreign markets. Leading world producers, especially in the developed, industrialized nations can no longer be content with simply focusing upon the domestic market for their sales growth. They must expand their customer base to the world marketplace as globalization in the paper and allied products industry continues into the new millennium. The globalization of the world paper and allied products manufacturers has been a continuing development for more than a decade. Many U.S. paper and allied paper products companies are active exporters, but are also engaged in foreign production, converting, and packaging operations and have joint ventures and direct foreign capital investments in partnerships and ownerships. Stanley (2000) described the major elements of the U.S. pulp and paper industry's advantage over its competitors. These include a large domestic consumer market, the world's highest per capita consumption, a modern manufacturing infrastructure, adequate raw material, water and energy resources, a highly skilled labor force, and an efficient transportation and distribution network. The industry is among the most modern in the world because of continued capital expenditures. He forecasted that, by the year 2004, the U.S. global paper market share might decline from 29 percent as a result of competition in the world markets.

Academic research on pricing in the pulp and paper industry has almost exclusively focused upon the relationship between exchange rates and prices (Haizheng, Banerjee, and McCarthy, 2001). For example, Alavalapati, Wiktor and Luckert (1997) used co-integration analysis to investigate the effects of the U.S.-Canada exchange rate and U.S. pulp price on the price of Canadian pulp. Hanninen and Topinen (1999) estimated the pass-through effects of exchange rate variations on Finnish pulp and paper exports.

Uusivuori and Buongiorno (1990) investigated the short-run and long-run effects of changes in exchange rates on U.S. imports of paper from Finland and Sweden. These studies certainly further the understanding of how exchange rates influence price movements, but they do not develop a general framework that focuses on determinants of price behavior and their associated elasticities. Similarly, many other research workers have examined factors that influence the price and elasticities of demand for pulp and paper products in Canada in selected regions (Nebebe and Kira,1992). These studies provide useful estimates of price and income demand elasticities and identify those factors that affect price.

The pulp and paper industry is generally considered a chemical industry, and financial industry experts compare its performance with other chemical industries. Anderson Consulting (1999) discussed the changes in the global chemical industry. According to this consulting group, global forces are reshaping the future of the chemical industry worldwide. The analysis of long-term financial performance indicates that the value-added performance of the industry has barely improved, sales growth has been modest at best when corrected for inflation, and the contribution of research and development to growth and new sales has been limited. But, as overall markets were growing faster than GDP in the 1960s, 1970s, and early 1980s, this absence of strategic effectiveness was masked by overall demand growth. Sales growth brought good profit growth. Sales growth also brought demand and supply into balance quickly when overbuilding occurred. According to this report, the chemical industry has suffered from a high degree of “me-too-ism”. As one company put growth, market share, value-added or size at the top of its strategic agenda, the others followed suit. This behavior served to perpetuate the cycle of boom and bust that has characterized the industry for decades. Management of the industries is under sustained pressure to deliver profit growth, often in the absence of sales growth.

McDermott (2000) discussed the impact of additional capacity on profitability. According to him, a deadly, double-edged sword in the paper industry is the topic of incremental tons. The incremental ton can lead to an oversupply situation and ultimately influences the total market price for all tons produced. The question is how a firm can decide how many incremental tons to produce? These incremental tons are only one way that mills continue to receive challenges during these changing times. He described some of the factors influencing the value of tons produced and incremental tons especially. These factors, which include machine productivity, efficiency, and cost-related information, are crucial when determining the profitability of given grades and an entire facility. He further explained that the total viability of producing a particular grade at a given facility depends on future market price, fixed costs, and variable costs.

Paun et al. (2000) reported the results of a financial analysis of the North American pulp and paper companies. According to them, The United States remained the world's largest pulp and paper producer during 1998, supplying over 33 percent of world production. In 1998, about 58 million tons of pulp were manufactured, down two percent from 1997. The United States accounts for 29 percent of global paper products and production abroad. For the first time in 20 years, global paper and board production declined 0.7 percent, from 299.07 million tons in 1997 to 297 million tons in 1998. In 1998, U.S. mills produced and shipped almost 95 million tons of paper and board, slightly less (0.6 percent) than in previous years. This was the first decrease in production in almost 15 years and happened despite an almost two percent increase in U.S. paper and board consumption. All the grades experienced a decline in production except tissue and specialty paper. The U.S. pulp and paper capacity reached 103 million tons, up 1.2 percent from the previous figures. Capacity utilization was about 92 percent. The best performing firms manufactured tissue and specialty papers as well as non-wood products. According to the authors, solid performance of the tissue industry was thought to arise from new products, strong branding efforts and continued divestment of pulp operations.

Bjorkman, Paun, and Jacobs-Young (1997) reported that the 1990s were turbulent times for the pulp and paper industry. Within a period of approximately 18 months, the North American pulp and paper industry passed through historically best and worst financial returns. A global recession and cyclical oversupply at the dawn of the decade plunged the industry into a severe and prolonged market decline. Stagnant demand and depressed demand and prices led many firms to remove marginal production or merge with larger companies. In 1994, the market changed dramatically. As economies throughout the world recovered and paper inventories grew increasingly thin, the pulp and paper industry began a steep but rapid climb out of the financial abyss. In 1995, pulp and paper prices hit a record high of nearly US $ 1000 per metric ton for northern bleached softwood Kraft pulp. During the late 1980s and early 1990s, the U.S pulp and paper industry invested heavily in technological upgrades and capacity expansion, only to face a subsequent economic recession. The austerity measures adopted during 1990-95 appear to be having lasting impacts. Between 1990 and 1995, many U.S firms redefined their core business and divested non-core businesses, focusing instead on production effectiveness and efficiencies.

Butner and Stapley (1997) noted that the annual capital intensity of the pulp and paper industry had grown twice as much as any other major industrial sector. Some experts believe that capital intensity could decrease by 60 percent if the industry adjusts its spending habits. Unfortunately, pulp and paper has not achieved a higher production index. Since 1982, this sector lost ground to the chemical and allied sector and only equaled manufacturing as a whole. The object of pulp and paper investment has apparently been cost reduction rather than production expansion. Other reasons for higher capital spending in the pulp and paper industry may be a higher rate of technology change and decreasing asset life. The pulp and paper industry sector must improve capital productivity. This is especially important in North America. Butner and Stapley (1997) estimated that in the next price cycle, North America will have lost its product cost advantage to subtropical producers in South America and Indonesia. "Smart spending will allow competition to continue".

Buongiorono and Hasien-Chih (1989) estimated the effects of costs, demand, and labor productivity on the prices of forest products in the United States (1958-1984). The objective of their study was to investigate the reason for changes in the prices of forest products. To do this, a mark-up model of price formation was proposed that linked yearly price changes to changes in variable costs and changes in demand. The model used annual data on prices, variable costs, and inventories-output ratios, from 1958 to 1984. The results showed that, depending on the industry, the theory explained 83 to 98 percent of the variation in annual price change. Rises and declines of variable costs had symmetric effects on prices, except for pulp mills, the most concentrated industry, in which downward price-inflexibility was apparent. Decomposition analysis showed that, over the interval 1958-1984, the rise in variable costs explained most of the rise in product prices. Further decomposition analysis indicated that, within variable costs, increases in material costs led to increases in prices that were much higher than increases due to labor costs.

Parker (1997) reviewed the relationship between concentration and prices/profits. He noted that most concentration-price level studies investigate the functional form of the relationship, usually finding that a 40-percent, four-firm concentration is a level after which prices begin to be higher. These findings were further supported by Scherer (1980), who concluded that profit increases when the four-firm concentration ratio passes through a range somewhere between 45 and 59 percent. The higher profits were assumed to be a reflection of the ability of firms in the concentrated markets to charge higher than competitive prices (More recent literature on structure- performance relationship appears to cast doubt on the monopoly pricing inference of the concentration-profitability studies).

Extensive research in the marketing, accounting, and strategy literature has studied the market share-profitability relationship. Buzzel, Gale, and Sultan (1975) reported a strong, positive relationship between market share and profitability. Hergert (1984) reported that market share and profitability appeared to be positively related on average, but that the relationship was weak overall and non-existent in many industries. Markell, Neely, and Strickland (1988) concluded that the link between market share and profitability is an occasional phenomenon rather than a universal law. Fraering and Minor (1994) suggested that the link is so unclear that a firm should take heed before embarking on a strategy of increasing market share in order to increase profitability. These studies used various measures of profitability, including return on investment (ROI), return on assets (ROA), and cash flow from investments. In sum, results of research into the relationship between market share and profitability have ranged from no significant association to a strong positive association.

Ince (1999) found that, as with other industries, the fortunes of the U.S. pulp and paper industry are closely tied to the global economy. The U.S. pulp and paper sector has exhibited fairly steady production and growth trends, but its economic fortunes have become intertwined with the" global cycle" of supply and demand. Exposure to the global cycle has increased for the U.S. in recent decades with increased levels of U.S. product exports. One effect of this exposure in recent years has been increased market volatility associated with trade-related adjustments in export demands and capacity utilization. Price volatility and sensitivity of profits to the global cycle are related to capital intensity and competitiveness in the pulp and paper sector. Ince (1999) further explained that the behavior of product prices and industry profits in recent years has been tied to capacity utilization levels and shifts in exports, determined in large part by the global cycle of supply and demand. The variability in profits for the pulp and paper sector has reflected market variability and volatility in product price. Volatility can be traced to the capital intensity of the industry competitive behavior, and the effects of changes in export demand on capacity utilization and prices. In general, as capacity utilization has gone up or down by just 12 to 13 percent, prices have gone up or down by 30 to 40 percent or more. An important observation was that competitive price volatility has a three- to four-fold amplification relative to the level of capacity utilization. Furthermore, with increased exposure to global markets, it appears that capacity utilization in the U.S. pulp and paper sector largely follows trends in export demand.

King (1977) analyzed the trend of the North American pulp and paper industry during the last two decades, finding that it had moved toward greater backward and forward integration. The top twenty companies in pulp and paper, taken as a whole in North America, accounted for about 65 percent of the region's total production. In this respect, they were less dominant than the top 20 companies in other basic industries. For example, in the petroleum, coal, primary metals, chemical, and rubber industries, the top 20 companies accounted for more than 90 percent of production. Nevertheless, there was a growing tendency for still greater concentration of control in the pulp and paper industry. King also stated that, since 1969, the consumption of paper and paperboard has increased at a rate of between five and six percent per annum. A recent assessment made by FAO suggested that, because of the current world economic situation, the rate of growth in the foreseeable future will be between two and three percent per annum overall, with lower rates of growth for specific products, such as newsprint.

Nehrt (1996) examined investment timing and intensity conditions under which advantages may exist for first movers in environmental investments. The potential advantages on which the study focused were timing and intensity of investments in recent pollution-reducing manufacturing technologies that produce salable products at the same time that they reduce pollution. The data came from 50 chemical, bleached paper-pulp manufacturers in eight countries. The model measured the impact of the independent variables on growth in profits from the mid-1980s to the early 1990s, controlling for national differences in environmental regulations. Results indicated a positive relationship between timing of investments and profit growth. There was also evidence that the more intensive patterns, when not tempered by sufficient time to absorb the investments, may have led to lower profit growth.

The global market for market pulp now exceeds 39 million tons, involving over 35 producing companies in 22 countries. Over 100 different grades of pulp are produced from a variety of long and short fiber species. Since the 1980s, the emphasis has been in promoting single-species pulp and plantation grown pulps, with new fibers such as Acacia, Gmelina, Aspen, Radiata Pine and hybrid Eucalyptus species. World-class-sized mills, incorporating the newest technology in pulping, screening, cleaning, and bleaching have become major suppliers around the world. In Indonesia, Thailand, Chile, and Brazil, lower labor and wood costs along with lower environmental restrictions have provided a distinct advantage over U.S. market pulp mills. Not only are U.S. domestic costs higher, but also U.S. mills are older and have lower tonnage capacities. Also, all U.S. mills must harvest from a broadly mixed fiber basket, ruling out any chance of being on a par with single-species producers. These differences have put all U.S. market pulp mills at a distinct disadvantage and have caused them to lose market share in all overseas markets. It is becoming increasingly apparent that more non-traditional markets must be created and, in addition, technology created that will permit the production of newer/functional value-added pulps (CPBIS, 2002b)

Datta and Narayanan (1989) discussed the relationship between concentration and performance, which lies at the heart of many strategy-content models. They used a technique of meta-analysis to evaluate the nature of the relationship and to empirically assess the controversies using the existing data. According to them, a comprehensive review of published articles on the concentration-performance relationship yielded a total of 22 usable studies involving 45 correlations. The results indicated that: (1) cumulatively, the empirical studies on the concentration-performance relationship yielded a positive estimate, (2) inter-study differences in measures did not significantly affect the estimates, and (3) the relationship was moderated by the time period of data and level of aggregation. The analysis underscored the importance of systematic and objective aggregation of strategic management research.

The U.S. paper and allied products industry is the world's leading producer and exporter of a variety of consumer-directed commodities to more than 125 countries worldwide. The large, modern, manufacturing base, combined with an adequate transportation and distribution network and a highly skilled labor force, places the U.S industry as the most competitive and highest volume supplier in the world. Although the domestic market consumes as much as 90 percent of the industry's output, the industry has become a major player in the world paper and allied market. More than 60 percent of the industry's growth in shipment over the past decade has been directly attributable to increase in foreign shipments of paper and allied products (U.S. Industry and Trade Outlook, 1998)

Forbes (2000) evaluated the major goals of capital spending in the pulp and paper industry. He found that most of the firms spent capital to improve mill-cost effectiveness, to produce a high quality product, and to comply with environmental regulations and extend the life of the mill. He concluded that constraints on available funds should be considered with a critical eye. Forbes (2000) also compared the assets to sales across several industries and concluded that the pulp and paper industry had the highest asset/sales ratio (about 1.25) compared to chemical, electronics, automotive, petroleum and food industries.

Jensen (1999) concluded that, in order to reduce volatility in pulp and paper markets, companies have focused on consolidation to reduce the production costs. Most of the firms have reduced their capital spending and prefer the purchase of new paper mill assets rather than building new “greenfield” operations, a trend which has been pushed by Wall Street observers for years.

Jensen (2000b) concluded that a continuing focus on corporate restructuring to improve long-term earnings in the North American pulp and paper industry has resulted in many companies limiting capital expenditures in the U.S. and Canada for several recent years. Project spending was tallied by Pulp and Paper's exclusive 36th annual spending survey, for the period 1999 to 2001. However, investments in Canadian operations showed a large decrease of 23 percent to C$ 2.5 billion. While up slightly from last year, the current U.S. figure was still among the lowest recorded during the past 20 years and was down over 45 percent from the most recent spending peak of 13.6 billion in 1996.

Paun et al. (1999) described the results of a comparative financial analysis of North American pulp, paper, and packaging firms. They concluded that the pulp and paper industry experienced disappointing results in 1997. A decline in prices, due to production increases coinciding with declines in demand, continued to weaken profits. The 100 largest publicly traded forest and paper products firms in the world experienced a two percent decline in sales which, unfortunately, resulted in a 60 percent decline in income. This severe decrease in profitability was due to lower prices, the collapse of Asian markets, oversupply, and excessive inventory.

Pulp and paper prices significantly affect the world demand for these products. According to Buongiorono (1978), price elasticities of demand have ranged from a low of -0.2 for writing paper in high-income countries to a high of -0.8 for newsprint in lower income countries. However, since the real price of pulp and paper products did not begin to increase until the seventies, and actually declined during the sixties, there was justifiably little concern regarding their effect on demand. Pulp and paper prices literally exploded after the oil embargo of 1973. These price increases, and the general slow-down of economic growth, caused a tightening up of demand. The result has been an increase in competition among the producing countries, in which the key to success is the ability to produce at low cost. The international perspective taken here is justified because, to a large extent, the future of any national pulp and paper industry depends on its ability to compete on the world market.

Kinstrey (1998) discussed the influence of different variables on the profitability of the paper industry. He concluded that the selling price of paper products has the largest influence on the return on investment (ROI), but total installed capital cost has the second largest influence. Sales volume, purchased fiber, chemicals, markets, and utility costs are also important variables in determining the profitability of the paper industry.

Christensen and Caves (1997) reported the results of a study about a firm's announcement of new projects in the pulp and paper business. According to their study, when a firm announces and completes investment projects, it indeed increases its share value, although on average by less than one percent. They found no negative correlation, however, between share changes and the combined share changes of the multi-market in that "base" activity (the correlation is positive though insignificant). There was a significant negative correlation between the share change of the announcing firm in the base market and in other markets where it operated and faced multi-market rivals (-0.41). However, short- run constraints of finance or organizational capability sufficed to explain that relationship, and multi-market contact was not necessary

Ravenscraft (1983) explained that although much research had been done on the relationship between industrial structure and performance, important puzzles persisted. It remained unclear whether profits rise with industry concentration when other structural variables, such as market share, are constant. Also, what economic phenomena underlie the observed positive profit-market share association? He concluded that the profit-concentration relationship in industry regressions almost surely reflected advantages that larger sellers enjoy relative to smaller rivals.

Amir (2000) discussed an extensive and general investigation of the effects on industry performance (profit and social welfare) of exogenously changing the number of firms in a Cournot framework. This amounted to an in-depth exploration of the well-known trade-off between competition and production efficiency. He established that, under scale economies, welfare was maximized by a finite number of firms. His results shed light on several theoretical issues and policy debates in industrial organization, including the relationship between the Herfindahl concentration index and social welfare, free versus socially optimal entry, concentration and profitability, destructive competition, and natural monopoly. He further described the concentration and profitability relationship. He concluded that the actual number of firms is determined in part by historical and other random events in the markets and no clear correlation could be expected between profits and industry characteristics.

Boulding (1948) developed two models of price leadership, one a market consisting of high-capacity, low-cost firms and one or more low-capacity and high-cost firms, producing similar but not homogenous products. In this case, with the firms on different marginal cost curves due to differences in cost structures, a single equilibrium price could not be determined, since the profit maximizing price leadership arose to fill the price void, with the low-cost firm being the prime candidate. The second model represented markets of at least two firms with the same cost structure but different market shares, producing similar but not homogenous products. He found that with different output levels, the firms would operate on different levels of marginal costs. Again, there was no single profit-maximizing (equilibrium) price. Thus, again, a price leader was needed to bring about a single equilibrium price. In this case, the leader would be the firm with the largest market share, since this firm would produce at the lowest marginal cost. In Boulding's models, price leadership was neither the result of firms obtaining "monopoly profit" nor the result of intense competition. Rather, price leadership occurred due to a lapse of the market forces, supply and demand, to bring about a single market price.

Diverrio (1999) concluded that the paper and forest products industry had been fighting an uphill battle to achieve acceptable returns during the 1990s. What was most puzzling was that the industry had recorded arguably its worst financial performance in a decade when overall economic growth worldwide had generally been quite strong. One would have anticipated that this GDP-sensitive industry would have fared well in this type of environment. While some factors impairing paper and forest products industry market conditions have clearly been macroeconomic in nature (i.e. volatile currency swings accompanied by financial meltdown in various parts of the world, a prolonged period of low inflation, changing trade patterns, a global recession during 1991-1992, and increasing environmental pressures), Diverrio (1999) concluded that the industry had caused its share of self-inflicted wounds.

Olivera et al. (1997) analyzed the evolution of market prices and flows of the international pulp market, considering the chief exporting and importing countries. A model for the international pulp market was built assuming that goods from different countries are not homogenous, from the consumer's point of view. The model simulated various shocks in exogenous variables, such as changes in demand and supply shifters and of pulp import tariffs. The results suggested that exogenous changes that simulate pulp demand growth in Japan and Europe benefits all exporting countries, with higher advantage for Canada and the US. Pulp taxation by European markets is harmful to all exporting countries, due to price and trade flow lowering with that market. The increases in pulp production by Canada and Brazil reduce the pulp exports income of the US.

Norberg and Rossi (1998) explored environmental regulation as a driver of technological change through a case study of the U.S. pulp and paper industry. They analyzed two sets of variables that influence the pace and direction of environmentally oriented technological change-industry structure and regulatory design. As would be expected from a mature productive unit, when confronted with environmental challenges, the U.S. pulp and paper industry has demonstrated a strong preference for incremental technological change. The case study suggests that the traditional approaches to standard setting in the United States have not challenged this preference. For the pulp and paper industry, there is considerable uncertainty in future environmental regulation and relatively small differences in cost between incremental and radical innovation for many mills. This suggests that an alternative approach for promoting the diffusion of environmentally enhancing radical innovations in a mature productive unit is to set long-term goals for continual environmental improvement.

2.3 Timberlands

Forest products firms own about 70 million acres of timberland in the US., about 13 percent of the country's total. About 62 percent of total industrial holdings belong to the 16 largest companies, with each having more than one million acres (Yin et al. 1998). Because of the poor performance of the pulp and paper industry, investors have been questioning timberland ownership and management decisions. On the other hand, the better performance of institutional timberland investments has inspired the belief among the investors that pulp and paper assets are not being fully utilized to earn a better return from the invested capital. From the mid 1980s to the mid 1990s, major forest products firms lost about $29 billion worth of economic value (Null and Cenatempo, 1997).

FAO (2002) reported that United States forest area increased by about 10 million acres between 1987 and 1996. In general, United States forest land area has remained relatively stable over the past 50 years. The data also show that total forest inventory of timberland has increased approximately nine percent since 1987, while removals remained essentially flat. The data also depict a highly sustainable forest resource. In 1996, net growth exceeded removals by 42 percent. The growth to drain ratios were

1.26:1 and 1.69:1 for softwood and hardwood respectively. Since 1953, net growing stock on U.S. timberland has increased by 36 percent.

Productivity on industry and other lands has been increasing dramatically through intensively managed plantations, particularly in the southern United States. About 11 million ha in the southern United States and an estimated 1-2 million ha in the Northwest are planted in short-to-medium rotation stands. Genetically improved seedling stock, coupled with intensive site preparation, weed control, and fertilization is increasing yields by three to four times over natural pine stands. Companies are beginning to capitalize on research in genetically selected or manipulated plant genes. These hold tremendous promise for increasing yields while reducing the need for various pesticides.

Some financial analysts and investment bankers have generally accepted the notion that forest products companies should not own timberlands. Studies have shown that the Stock Market generally does not recognize the full value of timberlands held by the industry, and that privately held timberlands earn a better return than do those held by forest products firms. Some companies have already started restructuring their timberland assets, partially as a result of this "conventional wisdom" (Lutz, 1999).

Skog et al. (1995) discussed wood products trends and resultant changes in forestry. According to them, forest products technology changes in response to changing costs, market conditions, and availability or scarcity of forest resources. In the future, technologies will continue to adapt as the types of raw materials from the forest become more diverse. Technology will also seek to use wood and fiber from other sources, such as recyclable materials. A number of key developments in structural wood technologies, as well as pulp and paper technologies, are already changing the wood manufacturing process and affecting how timber is used.

In the pulp and paper sector, some important technology changes can be traced to a relative scarcity or abundance of fiber resources. For example, technological adjustments have allowed hardwood pulpwood to gain an increasing share of total pulpwood consumption in recent decades, partly because hardwood is cheaper than softwood in the United States. Other incentives for change include increased demand for recycled paper and paperboard products, consumers' increased environmental concerns, capital cost and operating cost advantages of alternative manufacturing processes over traditional ones, and a growing demand for paper products.

Prestemon and Buongiorono (1997) have studied comparative advantage in U.S. interstate forest products trade. According to the authors, a standard index of the comparative advantage of a region in trade is the ratio of its net exports to a measure of the size of the domestic market (e.g. GNP in the case of countries). Their results indicated that few states dominate the revealed comparative advantage (RCA) rankings and showed how stable these rankings were over the period of observation. For example, the State of Maine kept its position in the RCA ranking in both 1976 and 1991. Contrary to this, a number of the states have negative RCA in the pulp and paper business. Comparative advantage depends on the characteristics of the goods in question, geography, market efficiency, the resource used to make the good, and the policies of interacting economies. The authors concluded that a strong positive relationship exists between a state's net exports and their forest endowments. This relationship showed consistency over time, implying that the location of the forest resources remains important in explaining the geographical distribution of the forest industries within the United States.

The U.S. International Trade Commission (1999) has provided detailed information about the U.S. pulp and paper industry. The industry is integrated both horizontally and vertically, with many companies operating various solid-wood processing mills and converting facilities making a variety of end products. A typical pulp and paper company may have a solid wood products division, several pulp mills, and several paper mills. The company may manufacture different products in different regions. Some firms have land holdings for timber supply, while other companies generally purchase timber from private and government landowners. The larger U.S. firms have invested in many parts of the world in the pulp and paper business.

In recent years, significant consolidations have taken place among the larger firms. These consolidations have often included significant landholdings. From 1997-98, there were 26 mergers involving wood and wood products companies and 29 mergers involving pulp and paper companies. Overall, demand for paper and wood products generally correlates to GDP growth. During general economic downturns, certain segments of this group are adversely affected (those papers used as input to industrial container fabrication) while other segments are less affected (household tissue).

Cubbin and Hall (1979) explained the use of real cost as an efficiency measure of merging firms. Generally, a recurring theme in industrial economics is firm efficiency, yet the state of the art of its measurement is not very advanced. At one extreme are theoretically elegant methods, based on the estimation of production or cost functions, that present daunting estimation problems. At the other extreme are measures straightforward enough for practical use, such as the rate of return on capital or labor productivity, but that actually measure efficiency in only the most unusual circumstances. The authors recommended the use of real cost as a way to measure changes in a firm's efficiency, with some limitations. They further suggested that price data should refer specifically to the firm in question, rather than the industry, cover the whole accounting year and be adjusted for quality change, changing product mix, and changing input proportions.

Many industry experts emphasize that duration represents the big difference between ordinary investments and timberland investments. Ordinary investments have a 1-25 year life; timber investments require 30-50 years to mature. Traditional investment analysis tools must be used very carefully in evaluating investments where there is little cash flow until the end of the period, especially when it is 50-years out. Investments with a 50 years horizon may be more an act of a hard-nosed investor. A critical assumption in any long-term forecast is that the future will be about the same as the past (Michaelis, 2002).

Multiple arguments exist for forest products companies to hold timber assets. However, these arguments rarely consider the relevance of timberland holdings in the context of the overall manufacturing business operation of forest products companies. Yet, it is almost impossible to understand the functionality of a timberland holding without understanding these business operations. Yin et al. (1998) described three key features of the pulp and paper industry. First, the industry is highly capital intensive, rather than labor intensive. Second, it has a high degree of asset specificity and is also factor oriented, meaning that firms tend to locate close to large supplies of raw materials (trees, water, and energy are most important to the pulp and paper industry) rather than close to their output markets. Third, pulp and paper products indeed have cyclical prices. Yin, Harris, and Izlar (2000) found that timber holdings could result in favorable decisions regarding entry, exit, mothballing, and reactivation and concluded that timberland ownership is an important factor in the success of forest products companies.

Timberland is an attractive alternative investment that can provide competitive returns, lower risks and volatility, an effective inflation hedge, and effective diversification from financial assets. A rate of return of 12-15 percent can reasonably be expected, depending on timber and property characteristics. Timberland is relatively illiquid, however, and requires long holding periods to optimize returns (Forestland Investment Group,2001).

Ohanian (1993) found that timberland ownership may be motivated by transaction cost economies, to avoid the necessity of negotiating pulpwood prices and other contractual issues with an outside supplier, and to assure a supply of pulpwood. In particular, a pulp mill is vulnerable to opportunistic behavior by a supplier if the timberland is specialized to the pulpwood requirements of that pulping facility. Technical explanations for integration with timberland are less obvious than in the case of integration with pulping, since the process of bringing pulpwood to the pulping facilities is not continuous. Ohanian (1993) further explained that integration with pulping is associated with timberland ownership. Timberland ownership is also related to paper grades. Mills producing newsprint, Kraft paper and pulp and sanitary paper are more likely to hold timberlands. In the same way, larger firms are more interested in timberland holdings. This means that capacity has an important role in a decision to manage and own timberlands.

Carlton and Perlof (2000) mentioned a number of reasons that influences a firm's decision on backward or forward integration. A common reason for vertical integration is to assure the supply of important inputs. Assurance of supply is important in a market where price is not the sole device used to allocate goods. Other reasons for opting for integration include lower transaction costs, elimination of externalities, avoiding government intervention, and increasing monopoly profits. In light of these factors, a decision by pulp and paper firms to own timberlands seems to be based on the assurance of raw material supply. Furthermore, wood supply from company-owned timberland helps firms to achieve stabilized pulpwood prices in the market.

The Pulp and Paper North American Fact book (PPNAFB,1988) indicated that two factors that helped firms to manage and own timberlands were interest rates and currency exchange rates. In the past, despite lower interest rates and the effects of a weak U.S. dollar, many U.S. firms have been reluctant to hold timberlands. Selling timberland was a quick way to raise cash-- a handy thing to have in a market rampant with takeover and mergers. The Pulp and Paper North American Factbook (1988) further explained that tax laws also influence the decision to manage and own timberlands. New Federal income tax laws have made it less desirable to hold large tracts of timberland. Until the eradication of a favorable capital gains tax for corporations in 1987, companies that harvested timber enjoyed a tax advantage. Since the late 1970s, timber values in the U.S. have declined and companies with large timber tracts have not usually performed as well as those that focus more on manufacturing. In 1987, however, large timber holders benefited from an extremely strong world lumber market.

The Pulp and Paper North American Factbook (PPNAFB,1984) discussed timber resources and pulpwood costs in the U.S. The attractiveness of timber ownership for U.S paper companies diminished somewhat in the1980s due to high interest rates. High interest rates affected the housing market and reduced the demand for timber. Similarly, a higher dollar value increased the import of lumber to the U.S. market. Disinflation caused the timber ownership to lose some of its luster as a hedge against inflation. Firms responded to the situation by putting large blocks of timber up for sale.

Stoves and Flanders (1992) estimated the lowest cost fiber to the pulp mill by developing an analytical model. According to them, the model could be used to determine fiber cost for various forms of wood and methods of delivery, and for predicting the impact of capital investments on the total cost of fiber delivered to the pulp mill. They further noted that economic factors in the "stump to digester" fiber supply are subject to continual change. Other factors, such as wood supply demographics, available real estate for wood processing, and available modes of transportation force mills to consider alternatives. Most of these factors are highly site specific so that what appears to be an optimal combination of fiber supply variables at one location will not necessarily be the optimal combination at another.

Technological advances in pulpwood harvesting and processing in recent years offer major opportunities for reducing present and future fiber costs to pulp mills. Stoves and Flanders (1992) further noted that harvesting, transportation, debarking, and chipping of tree-length wood have proven to offer significant savings and quality improvements in both the woodlands and wood yard operations. Realization of the total benefits of these opportunities requires involvement of both the company woodlands and mill management.

The Paper Task Force (1995) concluded that pulpwood production costs on forest industry land demonstrated that costs of increased management intensity were a relatively small portion of total production costs on industry lands--considerably smaller than the sum of expenditures for harvesting and transportation and land carrying costs. According to the Task Force, increasing recycling was expected to impart greater stability on pulpwood prices well into the 21^{st} century than would otherwise be the case. Furthermore, management practices and rotation ages are driven in large degree by the relative profitability of sawtimber versus pulpwood production. Demand for virgin fiber, which drives pulpwood production and the intensity of forest management, is shaped by patterns of overall paper consumption and by waste paper management. How the pulpwood is supplied, in turn, reflects the distribution of forest management activities and intensities across regions, among different forest types and ownerships, and among tree species.

Lamberg (2001) reviewed strategies and strategy process in the pulp and paper industry in Scandinavian countries and the US in the 20th Century. He discussed strategic concepts and analyzed how firms adapted to environmental changes, as well as the role strategic choices play in organizational development. He argued that both competitive and institutional elements affect an organization's strategy process and that strategy processes have a path-dependent character. Past decisions shape the set of possible strategies in the future. He argued that from a game theoretic perspective, a competitive environment constitutes the physical space for strategic management. Competitive forces affect the decision making process through the price mechanism. Thus a structural analysis of the competitive forces in the paper and pulp industry is the conventional starting point for managerial purposes. He said that the development of the pulp and paper industry has been dependent on three crucial factors. First, the demand for paper has correlated with population growth and with higher literacy and consumption rates. Globally, the industry did not mature in the late 1990s, although the demand in western markets was more stable than a hundred years ago. Secondly, papermaking was entirely dependent on the large and accessible supply of wood until the 1960s-1970s. After that, recycled waste paper became more important. Consequently, the old paradigm that paper production has to be located near large forest areas has partly lost its credibility. Third, the wood-processing industry has been strongly dependent on international business cycles. These three facts highlight the advantage of North America and northern Europe in the pulp and paper business.

Yin, Harris, and Izlar (2000) stated that the poor performance of forest firms has resulted in intense pressure from the investment community to restructure assets not only to achieve returns but, more specifically, to enhance shareholders' value. According to them, over the last decade, the average cumulative total shareholder returns for the forest products industry were only approximately 60 percent of the level of such returns for all companies comprising the Standard & Poors 500 stock index. Moreover, the forest products industry has earned its cost of capital in only 3 of the last 10 years. One study of 43 major companies indicated that they had lost $29 billion worth of economic value in the last decade (Null and Cenatempo, 1997). As a result of the disappointing financial performance of forest products companies, industrial timberland ownership has been the subject of serious scrutiny.

CHAPTER 3

VARIABLES AND LOGIC BEHIND THEIR SELECTION

This study has investigated the historical performance of U.S. pulp and paper manufacturing firms, evaluated possible structural changes in the industry as a result of shifts in market shares and examined the importance of owning and managing timberlands. With these issues in mind, this chapter describes the motivation for choosing the explanatory variables included in the study and discusses the expected role of these variables in explaining performance and structure and the role of owning timberlands at the firm level.

3.1 Net Income (N.INC)

Net Income is defined as a firm's total earnings less the costs of doing business, depreciation, interest, taxes and other expenses. Net Income is often referred to as the "bottom line." Net income was selected as a dependent variable in order to avoid problems stemming from different calculating approaches to profitability estimations. This measure captures the performance of ordinary production in the companies. Net Income of the firms may vary depending upon the assets involved in production. Furthermore, a firm's performance may be influenced by a number of microeconomic and macroeconomic variables at a particular time. Different measures of profitability may indicate different performance levels for an individual firm depending upon the measure applied. However all the measurement procedures will show the same pattern due to high correlation. The variety of performance measurement variables may be traced in the economics and industrial organization literature (Feeny, 2000; Feeny and Rogers, 1999; Shephered, 1972; Ravenscraft, 1982)

3.2 Minimum Efficient Scale (MES)

Empirical studies have found a dominant role played by technological factors in explaining variations of concentration across industries. These results are consistent with both the traditional structure-conduct-performance (S-C-P) paradigm, and the contemporary theoretical approach of Sutton (1991). The S-C-P approach emphasizes that technology determines entry barriers in the form of a 'minimum efficient scale ("MES") of plant size (Amess and Gourlay, 1998). The minimum efficient scale is widely used as a measure of scale economies in a market. MES is the size of the firm at which long-run average costs are at a minimum and after which the cost advantage of adding capacity becomes minimal. If an industry has a very large minimum efficient scale, this may discourage potential firms from entering that market.

In the pulp and paper industry, the size of the mills producing most paper grades has increased with the passage of time. As a general rule for bulk grades, such as pulp, newsprint, wood-free and wood-containing printing paper, kraft liner, etc., building a new line that is of maximum size or close to it is necessary to use economies of scale to the utmost. The main machinery, such as digesters, recovery boilers, and pulp driers, determines the economies of scale in a pulp mill. In 1995, the largest single line in operation had a capacity of 600,000 tons/year; by the end of 2000 it was expected to increase to 800,000 tons/year. Economies of scale will probably increase the maximum size of both pulp and paper machines in the future (Gullichsen and Hannu, 1998).

Generally it is thought that a high MES may act as a barrier to entry, and firms having a capacity above the MES will enjoy the benefits of economies of scale.

Carlton and Perlof (2000) defined the minimum efficient scale as the smallest output that a plant can produce in such a way that its long-run average costs are minimized. The MES is the measure of the cost disadvantage incurred by a plant that is smaller than the MES. If this disadvantage is small, then economies of scale are unimportant. A natural measure of economies of scale is the ratio of average cost to marginal cost. It is evident that, at MES, this ratio would be at the minimum level. Normally, survivorship technique is used to measure the economies of scale and MES (Stigler, 1968). If a particular plant size is efficient, eventually all plants in the industry should approach that size. Any plant or firm size that survives for a longer period of time is an efficient size. If all the firms face similar cost conditions, a survivorship study reveals the efficient plant size as the industry replaces its obsolete plants. If the firms face different costs or produce different products, their optimal scale will vary, and a survivorship study can only identify the range of efficient plant sizes. In other words, economies of scale measure how costs fall as output expands, holding all else constant. If other factors are not constant across plants, a survivorship study does not reveal the efficient plant size but merely describes the range of efficient plant sizes.

Vlachvei and Oustapassidis (1998) estimated MES by using Florence median estimates. The Florence median is a hypothetical size firm such that half of an industry's size measure comes from larger firms and half from smaller ones. The basic argument for using it is that the observed distribution of firm size will be clustered in some way around the optimum size, so that some measure of central tendency will provide a reasonable approximation of the MES.

Buongiorno, Stier, and Gillies (1981) explained the phenomenon of economies of plant and firm size in the United States pulp and paper industry based on statistics from the Census of Manufacturers for 1972 for the pulp and paper industries. They concluded that profitability and productivity appeared to decrease sharply for mills with more than 500 employees. Integration seemed to influence the profitability of firms positively. For paper mills, a small increase in the relative number of plants with more than 250 employees seemed to increase productivity. Survivor data for paper mills indicated a strong increase in the frequency of plants with 250 to 500 employees, and a large decrease in plants with 100 to 250 employees. They finally concluded that survivor data for the rest of the groups based on workforce or employees did not show any trend and could be regarded as inconclusive results. Bigger segments of the paper industry based on the number of employees did not show evidence of economies of scale at the firm level offsetting the stagnation or decline of productivity in large plants. Plant size appeared to explain most of the variation in productivity among firms.

3.3 Capital Intensity (CI)

Capital intensity is the ratio of capital investment/sales, expressed as a percentage. Capital intensity may help to identify over-investment (Lehman and Weigand, 2000). If a firm enjoys the benefit of economies of scale, it is expected that capital investment will further reduce the cost of product and improve profitability. If there are diseconomies of scale, then capital investments are not expected to make any significant change in the profitability. Capital investments in research and development lead to innovation and profitability and enhance the overall competitiveness of a firm. Capital spending in the pulp and paper industry has been questioned on various occasions. Flicker (1998) presented a paper at the 1998 TAPPI Engineering Conference and discussed the capital intensity issues of the U.S. pulp and paper industry. According to his estimates, the capital intensity level in the pulp and paper industry was then at the highest and return on capital was at the lowest level compared to other U.S. industries. He raised a number of questions about capital investments in pulp and paper industry projects.

3.4 Foreign Exchange Rate (FEXR)

Exchange rates relate the price of one currency in terms of another and are determined mainly by supply and demand. The exchange rate reflects trade and other international payments. The prime indicator of market pressure on a currency is the figure for total currency flows in the balance of payments account. Other important influences are relative interest rate and yields and inflation. The most immediate effect of a weaker currency is higher domestic prices owing to more costly imports. At the same time, exports priced in foreign currencies and inflows of rents, interest, profits, and dividends generate more income in domestic currency terms. But those exports priced in the local currency generate the same revenue as before. The net effect of this is for the trade and current account balances to deteriorate.

The Foreign Exchange Rate (FEXR) is the number of units of foreign currency that a dollar is worth. An increase in the exchange rate is an appreciation of the dollar; a decrease in the exchange rate is a depreciation of the dollar. The real exchange rate measures the relative purchasing power of the dollar by adjusting the nominal exchange rate by the price level in the respective countries. When the real exchange rate is high, U.S. goods are expensive for foreigners and foreign goods are inexpensive for U.S. buyers. The strong U.S. dollar provides a cost advantage to foreign producers. (Fig 3.1).

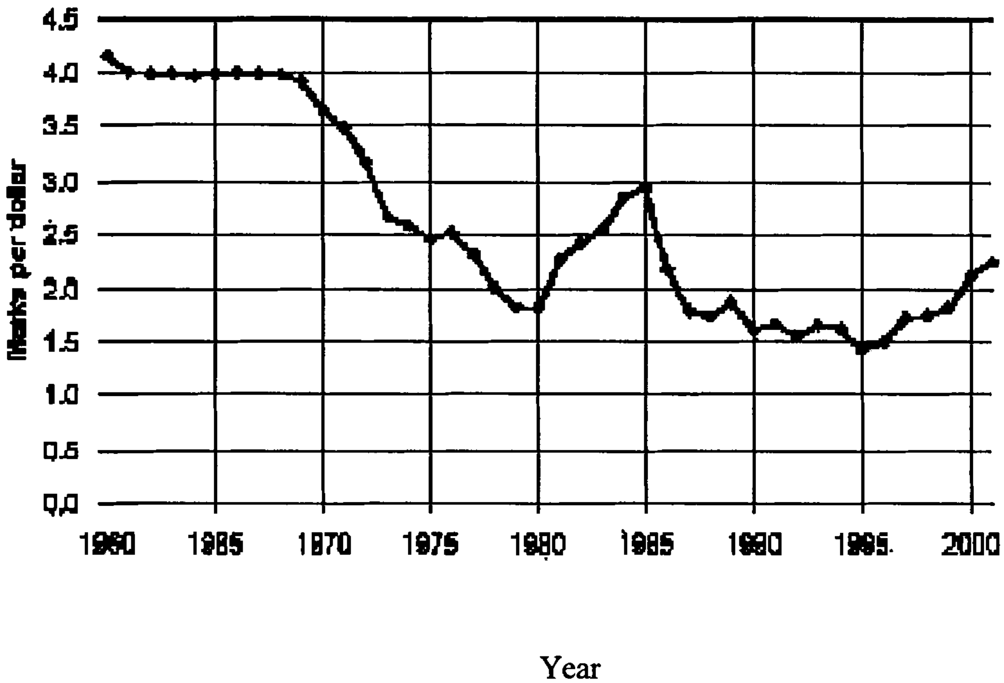

Fig 3.1: Exchange Rate, German Marks per U.S. Dollar (1960-2000)

Fluctuations in the exchange rate affect the demand for imports and exports. Net exports depend negatively on the real exchange rate and real income in the United States (Hall and Taylor, 1997). The real exchange rate and net exports move at the same time, but in opposite directions. When the real exchange rate falls, net exports rise (Economic Report of the President, 1996, TableB-2 and B-106). Gullichsen and Paulapuro (1998) explained that lowering of the exchange rate in relation to foreign currencies improves the competitiveness of the domestic industry, thereby increasing exports and the currency reserves. However, imports become more expensive, usually lowering the volume of imports and the demand on the currency reserve. The input of imports for domestic production increases in price, foreign debt becomes instantaneously more expensive, and the inflation rate often, but not always, increases. The authors also discussed the factors that affect the exchange rates. These factors include inflation rates and expectations, interest rates and expectation, growth expectations, demand and supply of currencies, and political stability.

Campa and Goldberg (1998) found that the exchange rate can cause large shifts in relative unit labor cost and influences the prices of goods sold in domestic and foreign markets. If producers are not perfectly hedged against exchange rate movements, their short-and long-run profitability, overall levels of investment, and location of production facilities could depend on exchange rates. They further argued that exchange rate changes could affect the expected marginal profitability of capital, producers' profits (by passing through into home market prices), export market prices, and imported input prices. The importance of exchange rates for marginal profitability and investment was shown to depend explicitly on the firm's international orientation through the imported fraction of its productive inputs. Another explicit implication of the theory is that the industry's competitive structure depends for investment responsiveness on exchange rates. Highly competitive industries are expected to exhibit larger responsiveness to exchange rates, all else being equal.

Winter (1998) discussed the impact of foreign exchange rate fluctuations on firms. He found that the impact of currency exchange rate fluctuations on present and potential profitability is different for different firms. At one extreme, a firm with both assets and liabilities denominated in the same currency has little risk. At the other extreme, firms whose assets and liabilities are denominated entirely in different currencies are at greater risk. While firms cannot generally affect foreign exchange markets themselves, they may be able to influence the effect of those markets on firm profitability and viability. He further emphasized that firms in nations with a recent history of high exchange rate volatility may find themselves in a dilemma. In his opinion, foreign exchange rate volatility may affect the distribution channels and market structure. Therefore, an awareness of what drives local markets and the effect of external forces is important.

3.5 Concentration Ratio (CR4)

Economists use concentration ratios as an approximate measure of the structure of an industry. The four-firm concentration ratio (CT4) shows the percentage of total industry sales accounted for by the four largest firms. When the largest four firms control 40 percent of the total market, that suggests an oligopolistic structure. The concentration ratio provides useful insights on competitiveness, but has many shortcomings. Unfortunately, the concentration ratio does not take into account the import competition of foreign suppliers. Furthermore, concentration ratios tell us little about the actual market performance of various industries (McConnell and Stanley,1996). A concentration ratio provides a simple and crude indicator of the extent of monopoly power. It says nothing directly about the pricing behavior of firms in the industry and nothing about the extent to which firms in more or less concentrated industries produce a greater or smaller rate of innovation. Economies of scale, MES, mergers and acquisitions, demand, technology, input price, regulations, capital investment, capital availability, and marketing may all impact the concentration ratios directly or indirectly.

Aiginger (1999) defined the concentration ratio as an indicator that calculates the share of the largest n units in the total, using the symbol CRn, (e.g. CR3 if we are talking about the market share of the largest three companies in the industry). Its disadvantages are that it makes use only of the information provided by the largest units, that the relative size of each unit within the group of large units is not accounted for, and that there is no good guide as to how large n should be. He also mentioned some other indicators to measure the concentration and resultant market powers. These indicators include the Herfindahl Index (HHI) and the Standard Deviation of the market shares (Sd-Shares).

The Department of Commerce, Bureau of the Census, and Census of Manufacturers (1997) estimated that, in the paper market, the four largest firms had 29 percent market share while during 1987 the paper market was more concentrated and the four largest firms had 33 percent market share. The pulp market is comparatively more concentrated than the paper and paperboard markets. The concentration ratios for the three profiled industry sectors remained stable between 1987 and 1992.

Ince (1999) reported that the top five U.S. firms controlled 38 percent of production capacity, with a higher concentration in individual product lines due to targeted consolidation and specialization. Reported capacity concentration for the top five firms was 60 percent in newsprint, 58 percent in uncoated ground wood, 65 percent in coated groundwood, 43 percent in containerboard and 40 percent in paper-grade market pulp.

3.6 Market Share (MS)

Market share is defined as a firm's sales/total industry sales in $ value. Extensive research has been conducted in the marketing, accounting, and strategy literature to study the market share-profitability relationship. Buzzel, Gale and Sultan (1975) found a strong positive relationship between market share and profitability. Hergert (1984) explained that market share and profitability appear to be positively related on average, but the relationship is weak and non-existent in many industries. Markell, Neeley and Stickland (1988) concluded that the link between market share and profitability is an occasional phenomenon rather than universal law. Fraering and Minor (1994) suggested that the link is so unclear that a firm should take heed before embarking on a strategy of increasing market share in order to increase profitability. These studies used various measures of profitability, including return on investment (ROI), return on assets (ROA), and cash flow from investments.

Ravenscraft (1982) argued that market share might be related to profitability for three reasons. First, a firm with a large market share might have higher quality products or market power, enabling them to charge higher prices than their smaller rivals. Second, a firm with a higher market share might be more efficient because of scale economies or because an efficient firm tends to grow more rapidly. Third, a firm with higher market share might be more innovative or better able to develop innovation.

3.7 K-FACTOR (KF)

The K-Factor is a measure of the interaction between the ratio of a firm's capacity/industry capacity and the four-firm concentration ratio (CR4). This interaction factor explains the position of the firm in the industry in light of market concentration. If a firm has appreciable capacity in the overall market, it is supposed to behave in a different manner in the industry than if it does not have an appreciable position in the overall industry. If smaller or bigger firms enter the market, this will change the overall balance in the market and a firm's position will be influenced. Any change in the firm, industry or concentration level will change the K-Factor. An increasing or decreasing correlation between K-Factor and market share and profitability seems to reflect the changes in firm's capacity/industry capacity ratio and four-firm concentration ratio in the proposed econometric model. Feeny and Rogers (1999) suggested that past research has revealed that market share is positively and significantly associated with higher rates of return and that this effect dominates any concentration-profitability relationship. However, because both efficiency and oligopolistic coordination (as a result of concentration) affect profitability to some extent, the task is to find the relative explanatory power of each effect. An interaction term (the product of market share in terms of capacity share and concentration) can be included in a regression to test this idea. The K-Factor is a similar type of interaction term, which finds the relative power of capacity market share of the firm and the four- firm concentration ratio (CR4).

3.8 Firm Size (FS)

In this study, firm size is measured in terms of assets that a firm owns and uses for production. Assets positively influence profits, reflecting barriers to entry. If there is a negative relationship between profitability and assets, that implies an inefficient use of assets. Feeny and Rogers (1999) found a significant positive correlation between a firm's profitability and the assets of a firm. The profitability and firm size (assets) relationship was further confirmed by another study carried out by Feeny (2000), who found that the size of an entity was positively correlated with profitability. Symeonidis (1996) discussed the advantage of large firm size. According to him, research and development projects typically involve large fixed costs, and these can only be covered if scales are sufficiently large. There are scale and scope economies in the production of innovations. Large diversified firms are in a better position to exploit unforeseen innovations. Large firms can undertake many projects at any one time and hence spread the risks of R&D, and large firms have better access to external finance.

Banerjee, Cronan, and Thomas (1990) concluded that the ratio of working capital to assets was smaller for failed firms, and declining current assets in relation to total assets is an indication of moving toward failure. Retained earnings to total assets, a profitability ratio, measures the extent to which profits accumulate over time. It was also negative for failed firms. Similarly, firms that suffered losses had smaller net sales to total asset ratios. All of these examples clearly indicate the importance of firm size to profitability. Aivazian and Xinhua (2000) discussed the firm's size choice with regard to investment flexibility under taxation. According to them, a firm's choice of capacity sizes is a key issue in investment theory and corporate finance. The widely accepted theory is that a firm should operate at its efficient scale regardless of changes in technology, output demand, and input supply. Another approach to the size choice involves strategic considerations, such as a firm could build excessive capacity as a barrier to the entry of potential competitors in order to acquire the " first mover's" advantage.

3.9 Growth (GR)

Sales growth is the percentage increase or decrease in sales with respect to the previous year's sales {(current year's sales-previous year's sales) / (previous year's sales)} *100. Conventional microeconomic theory assumes that a business firm acts to maximize profits. Some writers have suggested that firms attempt to maximize sales rather than profits (Baumol, 1972). Still others have hypothesized that the primary objective of the firm is survival through growth (Drucker, 1958). Sales growth may be a firm's corporate strategy, but it may or may not lead to profitability. Assuming perfect competition, a firm opting to maximize profit will prefer to produce at that level where marginal revenue equals marginal cost. When firms experience slow growth in sales, they start looking for new markets. A firm that opts for the sales growth strategy sets the lowest price, assuming that the market is price sensitive. Such a firm further believes that higher sales volume will lead to lower unit costs and higher long-run profit. Shephered (1972) believed that growth is likely to associate positively with profitability. Yet, extreme growth may reduce profitability; also, growth may be achieved via pricing strategy, which sacrifices current profitability (Gaskins, 1970).

Ambler (2002) has discussed the various strategies to achieve accelerated growth with sustained profitability. According to him, to achieve accelerated growth, a business must be able to sustain its profitability. Then various growth strategies can be explored. Growth strategies include improved marketing, diversification, merger, finding new markets, specialization, acquisition, new product development, joint ventures, strategic alliance, improved service, licensing, geographical expansion, improved quality, franchising, and control over channels of distribution. Gartner and Markman (2000) offered reasons why a firm's growth might be negatively correlated to profitability. They suggested that a firm's growth might be inappropriate for many organizations. Therefore, entrepreneurship research should empirically test the assumption that high and rapid firm growth, and its associated consequences, creates value. They reported non-significant correlation between change in sales and change in profit of the 500 fastest growing companies. They concluded that a firm's absolute growth is not a significant predictor of its profitability.

3.10 Timberland (TL)

In the present study, a firm's timberland holdings were included as a variable in the regression model. In one model, timberland ownership was used as an independent variable, and in the logit model, the probability that a firm owns timberland was used as the dependent variable. It was hypothesized that firms that own and manage their own timberlands are more profitable than those that do not. Timberland as a variable was included to evaluate the relevance of timberlands in building a firm's competitive advantage. Timberland holdings can result in favorable decisions regarding entry, exit, mothballing, and reactivation. It is believed that timberland ownership is an important option to the success of forest products manufacturers (Yin, Harris and Izlar, 2000). Of the 490 million acres of commercial timberlands in the United States, forest products companies own about 70 million acres, or 13 percent of the country's total. About 62 percent of the total industrial holdings belong to the 16 largest companies, with each having more than one million acres (Yin et al, 1998)

Crossely and Points (1998) concluded that recent financial problems in the forest products industry were not due to the management of forests and the harvesting of trees.

They found that these activities have been more profitable than wood processing and pulp and paper manufacturing. So, the argument that is sometimes advanced that forest managers cannot afford to improve their forest management because of weak cash flow or low profitability hold little credibility in the context of managing the forest business alone.

3.11 Exports (EXP,I)

Exporting helps a firm by increasing sales income, diversifying markets, reducing vulnerabilities to lags in domestic demand, extending product life cycles, using idle capacity, and reducing unit cost through economies of scale. Exports also help sharpen competitiveness in global markets.

Pulp and paper exports from the U.S. play an important role in the overall financial health of the industry. The United States is among the world's largest market wood pulp exporters and the largest recovered paper supplier to the world market. In the United States, as well as globally, international trade in wood and paper products is growing at a faster rate than the industry's output (e.g. global exports increased at more than twice the rate of world paper and paperboard production during 1990-98). The U.S. pulp and paper industry has great opportunities in the world market because of a number of competitive advantages, including a large fiber base, highly skilled labor force, state-of-the-art technologies, and adequate energy and water resources (FAO, 1998). In this proposed econometric model we expect a positive correlation between profitability and exports.

3.12 Number of Units (NOU)

Generally, it is believed that, if a firm has a number of production facilities it may improve its financial performance by capturing more market share through serving different customer groups in different regions. Those firms that have a number of production facilities producing a variety of paper grades are more likely to survive during the market downturns because not all of the paper grades follow similar cycles in the market. Furthermore, economies of multi-plant operation differ from economies of single plant operation (Amess and Gourlay, 1998). In order to capture the effect on profitability and structure of differences between the firms operating a single-plant and those operating more than one plant, number of units was included as an independent variable.

3.13 Number of Firms (NOF)

The number of firms in a market is an important and basic unit of industry structure. Increasing the number of firms in a market not only erodes profits but also changes the structure of the market. When there is high demand for the product, and incumbent firms are making a profit, there is a possibility of new firms entering the market. When profits are declining, firms try to leave the market. It helps the remaining firms to maintain or improve their profitability. Increasing the number of firms in a market leads to excess competition, and a declining number of firms enhances the market power of the remaining players. The number of firms as a variable was included in the study to investigate its impact on profitability and market share. Industry experts believe that the U.S. pulp and paper industry is a highly fragmented industry and that this is one of the reasons for its poor performance. The impact of entry on profitability depends on the number of the firms that enter. Modest increases in the volume of entry tend to enhance industry profit, but if the number of the entrants is sufficiently large, then industry profits fall.

3.14 Exporting Firms (EXPFIR)

In order to understand the roles of those firms that export their products and influence the overall profitability of the industry, the variable "exporting firms" was included in the model. Certainly, export relations reflect the firm's competitive advantage in the market. From historical statistics it appears that exports improve the overall financial health of firms and the overall performance of the U.S. pulp and paper industry. Generally, it is believed that exports are more profitable than the domestic markets and help in achieving growth in sales. Firms that are in the export business are more likely to capture the advantages of economies of scale and other cost reduction strategies by acquiring the latest technologies and implementing strict quality control measures to compete in the global markets.

3.15 PriceIndex (PRI.IND)

The Price Index (Producer Price Index, PPI) is a family of indexes that measure the average change over time in the selling prices received by domestic producers of goods and services. The PPI captures price movements prior to the retail level. Therefore, they may foreshadow subsequent price changes for businesses and consumers. PPI data are commonly used to adjust other economic time series for price changes and to translate those series into inflation-free dollars. For example, constant dollar gross domestic product data are estimated by using deflators based on PPI data. The price index was included in the econometric model to evaluate profitability change as a result of real price change.

3.16 Lagged Concentration Ratio (CR4t-1)

The Lagged Concentration Ratio (CR4t-1) was included to estimate the effect of the previous year's concentration ratios on the current profitability of the firm. Many research workers have reported a spillover effect of previous concentration ratios. Amess and Gourlay (1998) argued that industry concentration may not be in equilibrium due to changing market conditions. Moreover, an adjustment in concentration to changing market conditions is not instantaneous, because there are costs for incumbent firms and potential entrants in responding (Levy, 1985). For example, some firms may respond to increases in market demand more quickly than others. Thus, there will be an initial increase in industry concentration followed by a decline as other firms in the industry respond accordingly. There are also adjustments to changes in technology. If firms receive information at different times as to how to attain the lowest possible production cost, there will be an initial period of high concentration (Klepper and Graddy, 1990). High concentration is a disequilibrium phenomenon eliminated by competition. Given that profitability and market structure may be in disequilibrium, the concentration ratio lagged by one period is included in the set of regressors in the profitability model to capture adjustment to equilibrium.

3.17 Product Mix (PR.MIX)

It is believed that if a firm is satisfying more than one group of customers, its profitability will be higher than a firm that only targets one customer group. The right mix of product offerings to the market maximizes the profitability of the firm. Those firms that align themselves to the needs of the customers create stronger margins and sustainable shareholder value. Most firms are becoming increasingly aware of the fact that offering a variety of products will strengthen their position in the marketplace.

3.18 Equity/Sales (ES)

Equity is defined as the residual interest in the assets of an entity that remains after deducting its liabilities. In a business enterprise, equity is the ownership interest. Stockholders' equity represents the cumulative net contribution by stockholders plus retained earnings. A higher equity to sales ratio is an indication of better utilization of capital resources. An increase or decrease in equity is related to the performance of the firm. Equity/sales ratio was included in the profitability model as a " control variable".

Thompson (2000) explained equity capital financing. Equity fundraising involves selling equity through offering stock in a corporation, either publicly on the stock market or privately to investors. This could take the form of selling the existing corporate stock that is held by the corporation itself, or through a new stock issue. The advantage of equity fundraising is that the money does not have to be repaid. Its disadvantage is the tendency toward dilution of existing shareholder equity, a tendency that must be carefully managed in order to avoid angry feedback at the shareholders' meeting. Improved sales and profits in the pulp and paper industry are basic drivers for future investments to improve volume and quality.

3.19 U.S. Advantage (USADV)

The "U.S. advantage" is a ratio of U.S. pulp and paper exports to world pulp and paper exports. Presumably, when pulp and paper exports increase this increases the profitability of U.S. pulp and paper manufacturing firms increases and the overall competitiveness of the U.S. pulp and paper industry in the world market increases.

The FAO Advisory Committee on Paper and Wood Products (1998) concluded that the United States paper market had become much more global during the previous two decades. The 1980s saw a sharp influx of printing and writing paper, which continued to rise at a reduced pace during the 1990s. On the other hand, rising exports have underpinned production growth in the past decade. Not only did exports of Kraft linerboard, the industry's traditional export commodity, increase but exports of bleached paperboard and newsprint and printing paper also increased. On a volume basis, the United States trade deficit in paper and paperboard stood at 2.3 million tons in 1997, compared to a 5.6 million ton deficit in 1990. Much of the volume growth has been in exports to developing countries in Asia and Latin America, as well as to Canada and Western Europe. The United States is among the world's largest market wood pulp exporters and the largest recovered paper supplier to world markets.

Prestemon and Buongiorono (1997) discussed the comparative advantage of the U.S interstate forest products trade in the light of the Heckscher-Ohlin-Vanek theorem. According to them, the net exports of a region are determined by the relative abundance of the immobile factors of production. Empirical tests of this theory, usually at a high level of aggregation, have frequently not supported it. Prestemon and Buongiorono concluded that data on interstate trade in wood products within the United States were in strong agreement with the theorem. Other things being equal, net exports of wood products are strongly and positively related to the stock of forest resources. The simplest evidence was the correlation of net exports with forest growing stock per dollar of state products. A more formal development of theory led to a linear model where net exports were negatively related to gross state products and positively related to forest resources. Their model predicted better net exports of lumber and wood products than those of paper and allied products. They further found that comparative advantage embodies a region's endowment of factor inputs, level of technological development, factor productivity, transfer costs, and other variables. According to them, the potential manufacturing cost and productivity advantage enjoyed by the regional concentrations of firms may also help better explain why some states dominate net exports of forest products.

3.20 Mergers (MEG)

The United States pulp and paper industry has experienced growing merger activity in response to the fact that the pulp and paper industry is highly fragmented. The industry has unplanned capacity and investment activities. If the U.S. pulp and paper industry is to remain competitive, firms will have to consolidate. It is believed that firms merge vertically to reduce their cost and ensure inputs, while firms merge horizontally to increase their size and to attain market power. Merger is one way of growing in mature markets. Mergers have significant impact on the structure of the industry and the firm's return on their investments. Merger has been included as an independent variable to evaluate the firm's decision to acquire timberlands through mergers. It is believed that timberlands are the most attractive assets in merger or acquisitions. In this regard, dummy variables were used to show the merger activities in the pulp and paper industry. If a firm merged with another firm or any firm made any acquisition in a given year, a value of 1 was assigned. If a firm did not make any acquisition or perform any merger activity, then 0 was assigned.

3. 21 Asset/Sales Ratio (AS)

The asset over sales ratio explains how a firm is utilizing its available resources. A ratio of more than one indicates that the firm is underutilizing its resources. A ratio of less than one indicates that, through proper management, the firm's resources are being fully utilized to increase the value of the investor's share. Many experts believe that the pulp and paper industry is unable to capture the maximum value from its investments. This hypothesis further leads to the selling of timberlands by the pulp and paper companies. Unfortunately, there are few examples of internal growth in the pulp and paper business. The Assets/Sales ratio is an important variable for investigating how the sales and assets relationship impacts the structure and performance of firms.

3.22 Firm Capacity (FC)

A firm's capacity is an important parameter for measuring overall competitiveness. When demand is high and the gap between shipments and capacity narrows, firms think about adding new capacity. Generally, when operating rates reach about 98 percent, new capacity is added. Unfortunately, there is a lag between demand and capacity addition, because it takes two to three years to introduce new capacity. When the new capacity appears in the market, in due course demand changes. Surplus capacity exerts a negative pressure on the prices, and overall profitability of the industry is impacted. It is believed that if excess capacity exceeds 20 percent, profitability suffers (Ince, 1999). If a firm adds additional capacity, it is not going to harm the whole industry, but when capacity addition at the country level is accounted for, it has a significant impact on profitability and structure

3.23 Geographical Distribution (GD)

Geographical distribution is included as an independent variable to evaluate the importance of geographical advantages of firms in the pulp and paper market. There are many firms that have a geographical advantage over their competitors in particular paper grades and earn above average profits. Similarly, geographical distribution has an important significance for many firms in maintaining timberlands to ensure wood supply. Even if a firm does not have its own timberlands, the firm may manage the wood supply through contractual arrangements in a particular area. In the U.S., most of the packaging paper manufacturing firms are in the South, where plantation wood resources are abundant. Geographical concentration in the pulp and paper business has important significance and needs detailed research.

3.24 Operating Rates (OPRT) (I)

Operating rates are the percentage of capacity utilization. If the demand for pulp and paper is high, operating rates reach up to 98 percent. However, when the demand for pulp and paper is weak, operating rates drop and so does profitability. Normally, it is believed that operating rates also reflect the economic situation in the country. This relationship was valid until the beginning of the 1990, but due to globalization, this relationship does not exist anymore. In the 1990s, the economy was in good shape; industry experts were predicting a good era for the U.S pulp and paper industry. Unfortunately, an influx of paper from Southeast Asia undermined the profits of U.S. paper manufacturing firms.

CHAPTER 4

MATERIALS AND METHODS

The premise in the present study was that the performance and structure of the U.S. pulp and paper industry is determined by the overall structure and performance of the pulp and paper-manufacturing firms. Both structure and profitability at the firm level are influenced by a number of variables related to the firms themselves, the industry and the domestic as well as the global economy. Selection of variables was based on major results of previous theoretical and empirical structure-performance work. Data were obtained from information about U.S. pulp and paper manufacturing firms found in annual reports, Moody's Industrial Manual, Lockwood's Directory, Miller Freeman's publication " Pulp and Paper North American Fact Book", and national and international journals. Cross-sectional data for 60-70 pulp and paper firms, covering the study period from 1960 to 1998, were used to evaluate structural and profitability changes in the U.S. pulp and paper industry.

Data were classified into four decades according to firm performance and conduct, and domestic as well as global economic conditions. The decade 1960 to 1970 was termed the "Growth and Stability Era"; 1971 to 1980 was regarded as the " Rising Cost Era"; 1981-1990 was the "Capital Spending Era"; and 1991-98 was labeled the " Globalization Era". These titles reflect the industrial, technical and economic environments the U.S pulp and paper firms experienced.

The economic models used in this study were formulated according to consistent economic theories and industrial organization principles (Feeny and Rogers, 1999;

Variables	Description	Abbreviation
Net Income	Net Income of Firm	N.INC
United States Advantage	US exports/world exports (P&P)	USADV
Foreign Exchange Rates	$= German Mark	FEXR
K-FACTOR	(Firm Capacity/Ind Cap)*CR4	KF
Exporting Firms	-	EXP.FIR
Price Index	PPI	PRIIND
Average Plant Size/MES	-	AVSP/MES
New Supply/RGDP	(Total Production-exports +imports)/RGDP	NEWSUPP/RGDP
Equity/Sales	-	ES
Assets/Sales	-	AS
Capital Intensity	Capital spending/Sales	CI
Market Share	(Firm's Sales/Industry Sales)*100	MS
Timberlands	Firm's Timberland Holding (million acres)	TL
Firm Size	Firm's Assets	FS
Growth	Firm's Sales Growth	GR

Table 4.1.Variables included in the profitability model for pulp and paper manufacturing firms in the USA. (1960-98)

Ravenscraft, 1982; Shephered, 1972). Three models were designed in order to specify regression equations. The first economic model tested the influence of different variables in terms of the profitability of U.S. pulp and paper-manufacturing firms. Table 4.1. shows the list of the variables included in the Profitability model. Net Income was used as the dependent variable. Market share was regarded as an indicator of market structure. The second economic model used the firm's market share as the dependent variable.

Variables	Description	Abbreviation
Market Share	(Firm's Sales/Industry Sales)*100	MS
Net Income	Net Income of Firm	N.INC
Average Plant Size/ MES	Average plant size of firm/Minimum efficient Scale	AVSP/MES
Capital Intensity	Capital spending/Sales	CI
Four Firm's Concentration Ratio	Market Share of Biggest Four Firms	Cr4
K-FACTOR	(Firm Capacity/Ind Cap)*CR4	KF
Firm Size	Firm's Assets	FS
Growth	Firm's Sales Growth	GR
Timberlands	Firm's Timberland Holding	TL
Product Mix	-No of Products a Firm Manufacture	PR.MIX
Exports	U.S Pulp and Paper Exports	EXP
No of Units	(Number of Facilities a Firm has	NOU
No of Firms	Number of Firms in Industry	NOF
Exporting Firms (Dummy variable)	Firm in Export Business=1 Firm not in Export Business=0	EXP.FIR
Lagged Concentration	Previous Year's Concentration	CR4t-1

Table 4.2. Variables included in the market share model for pulp and paper manufacturing firms in the USA (1960-98).

Variables	Description	Abbreviation
Timberlands	Firm's Timberland Holding (million acres)	TL
Net Income	Net Income of Firm	N.INC
Equity/Sales	-	ES
Mergers (Dummy variable)	Firm Merged =1 Firm not merged =0	MEG
No of Units	(Number of Facilities a Firm has	NOU
Product Mix	-No of Products a Firm Manufacture	PR.MIX
Geographical Distribution	Number of locations Where firm has manufacturing Facilities (States)	GD
Firm Size	Firm's Assets	FS
New Supply/RGDP	(Total Production-exports +imports)/RGDP	NEWSUPP/RGDP
K-FACTOR	(Firm Capacity/Ind Cap)*CR4	KF
Growth	Firm's Sales Growth	GR
Foreign Exchange Rates	$= German Mark	FEXR
Firm Capacity	Firm's installed capacity	FC
Four Firm's Concentration Ratio	Market Share of Biggest Four Firms	Cr4

Table 4.3. Variables included in the timberland model for pulp and paper manufacturing firms in the USA (1960-98).

Independent variables included in the market share model are shown in Table 4. 2. The third economic model was designed to investigate the pulp and paper firm's option to manage and own timberlands during the study period. A firm's timberland holdings were used as the dependent variable. Table 3 indicates the list of the independent variables included in the timberland model. Achen's (1982) technique was used to measure the level of importance of timberlands in the profitability of a firm.

Variables	Mean	SD	CV%
N.INC	12.186	20.646	1.694
USADV	0.105	0.012	0.121
FEXR	0.251	0.0076	0.030
OPRT	0.900	0.031	0.035
KF	0.283	0.456	1.608
EXP.FIR	0.087	0.282	3.230
PRIIND	36.113	1.453	0.040
AVSP/MES	0.467	0.640	1.368
NEWAUPPL	15.127	0.183	0.012
ES	0.830	1.032	1.243
AS	4.223	51.734	12.249
CI	6.586	1.286	0.195
MS	1.417	2.226	4.955
TL	0.637	1.175	1.843
FS	238.880	411.068	1.720
GR	10.853	48.853	4.501
MES	3.08756E+05	1.04320E+05	0.337
CR4	22.988	2.115	0.092
PRMIX	4.082	2.620	0.641
EXP	1768.557	614.767	3.77939E+05
NOU	5.695	5.890	1.034
NOF	465	28	0.05
CR4t-1	22.573	1.99	0.088
MEG	0.340	0.474	1.393
GD	4.966	5.451	1.097
FC	5.88516E+05	9.15581E+05	1.555

Table 4.4. Descriptive statistics 1960-1970

Data Sources: Firm's Annual Reports, Moody's Industrial Manuals, North American Pulp and Paper Factbook, Lockwood's Directory and National and International Publications.

Variables	Mean	SD	CV%
N.INC	50.310	73.797	1.466
USADV	0.121	0.012	0.101
FEXR	0.427	0.084	0.199
OPRT	0.918	0.045	0.049
KF	0.398	0.475	1.196
EXP.FIR	0.126	0.332	2.636
PRIIND	62.737	16.102	0.256
AVSP/MES	0.322	0.425	1.317
NEWAUPPL	14.002	0.817	0.058
ES	0.540	0.309	0.572
AS	0.859	0.385	0.447
CI	7.193	1.183	0.164
MS	2.363	2.826	1.195
TL	0.785	1.400	1.783
FS	802.548	1118.050	1.393
GR	14.572	31.318	2.149
MES	5.35382E+05	2.27593E+04	0.042
CR4	31.182	2.024	0.064
PRMIX	3.854	2.087	0.541
EXP	3449.064	621.282	0.180
NOU	5.238	4.544	0.867
NOF	399	9	0.021
CR4t-1	30.490	2.496	0.081
MEG	0.284	0.451	1.585
GD	4.425	3.699	0.835
FC	7.90734E+05	9. 62337E+05	1.217

Table 4.5. Descriptive statistics 1971-1980

Data Sources: Firm's Annual Reports, Moody's Industrial Manuals, Pulp and Paper North American Factbook, Lockwood's Directory and National and International Publications.

Variables	Mean	SD	CV%
N.INC	93.759	139.132	1.483
USADV	0.116	0.008	0.076
FEXR	0.460	0.089	0.194
OPRT	0.920	0.030	0.032
KF	0.462	0.523	1.133
EXP.FIR	0.125	0.332	2.640
PRIIND	111.620	12.305	0.110
AVSP/MES	0.335	0.391	1.167
NEWAUPPL	13.431	1.041	0.077
ES	0.479	0.268	0.558
AS	0.930	0.430	0.462
CI	7.960	0.942	0.118
MS	2.298	2.872	1.249
TL	0.930	1.592	1.713
FS	1858.168	2555.854	1.375
GR	9.749	22.959	2.354
MES	6.46127E+05	4.98928E+04	0.077
CR4	30.137	2.374	0.078
PRMIX	3.614	2.068	0.572
EXP	4984.829	862.474	0.173
NOU	6.058	6.084	1.004
NOF	395	5	0.013
CR4t-1	30.185	2.329	0.077
MEG	0.244	0.430	1.759
GD	4.728	3.767	0.796
FC	1.21349E+06	1.38487E+06	1.141

Table 4.6. Descriptive statistics 1981-1990

Data Sources: Firm's Annual Reports, Moody's Industrial Manuals, Pulp and Paper North American Factbook, Lockwood's Directory and National and International Publications.

Variables	Mean	SD	CV%
N.INC	82.979	191.466	2.307
USADV	0.145	0.007	0.046
FEXR	0.622	0.042	0.067
OPRT	0.931	0.012	0.013
KF	0.718	0.827	1.151
EXP.FIR	0.907	0.298	0.329
PRIIND	140.245	12.022	0.085
AVSP/MES	0.392	0.288	0.736
NEWAUPPL	12.371	0.325	0.026
ES	0.754	5.641	7.482
AS	15.306	123.719	8.082
CI	5.732	0.741	0.129
MS	1.817	2.391	1.315
TL	1.050	1.591	1.513
FS	3370.773	4673.2	1.386
GR	8.117	34.429	4.241
MES	700,000	0	0
CR4	34.206	1.257	0.036
PRMIX	3.748	2.532	0.675
EXP	1.05517E+04	1662.822	0.157
NOU	7.517	6.370	0.847
NOF	365	4	0.010
CR4t-1	33.912	1.179	0.034
MEG	0.284	0.451	1.590
GD	5.673	4.326	0.762
FC	2.06244E+06	2.37164E+06	1.149

Table 4.7. Descriptive statistics 1990-1998

Data Sources: Firm's Annual Reports, Moody's Industrial Manuals, Pulp and Paper North American Factbook, Lockwood's Directory and National and International Publications.

Level of importance is calculated by multiplying the mean of an independent variable by its coefficient. The product is the net contribution to the level of the dependent variable. Descriptive statistics of variables included in all three models for the four decades were also estimated from data in detail (Tables 4.4, 4.5,4.6,4.7).

All three economic models were converted into econometric models (regression equation) by the introduction of random error terms in the economic model. Data were analyzed using multiple regression techniques with SAS software. Multicollinearity was tested by the variance inflation factor (VIF) technique. A multicollinearity problem was corrected by using the model re-specification technique (Montgomery, Peck, and Vining, 2001). Some of the variables were redefined by developing some new functions (New supply/RGDP, K-Factor and average plant size/MES ratio) etc. These new regressors preserved the information content in the original regressors but reduced the poor conditioning. Negative values were transformed into log values by using Jason (2002) technique, in which a constant is added to move the minimum value of the distribution above zero, preferably to 1.00. Because some firm had negative net income, a constant value of 200 was added to all the net income values and later transformed into log values

Logit regression of timberland ownership (Ohanian, 1993) was performed to identify elements that lead to a firm's decision to manage and own timberlands. The dependent variable was the natural log of p/ (1-p), where p was the probability that a firm owned timberlands. Independent variables in this model included U.S. advantage, time, firm capacity, and foreign exchange rates. In this study, the Berkson (1955) method "minimum chi-square method" cited in Maddla (1996) was used to estimate the probability of timberland ownerships of pulp and paper manufacturing firms. In this regard, a weighted least squares method was applied. In the weighted least squares method, weight was estimated by using the formula, (variance={1/ (n*p(1-p)}, where n is the number of observations and p is the probability of timberland ownership. Estimated weights (sqrt {(1/np(1-p)} were multiplied by the mean value of each variable included in the model. Variable means were estimated on a yearly basis, covering the whole study period (1960-1998).

A dummy variable was used to define the "Exporting Firms". If a firm exported its products, then the value =1 was assigned; value = 0 was assigned for firms that did not export any product. Similarly, dummy variables were used to differentiate between the consumer paper grades (1) and non-consumer paper grades (0).

The Chow test (Chow, 1960, Johnston,1984), which uses the F-test to determine the significance of structural changes, was used to test the following two hypotheses related to the firm's profitability and market share:

Hypothesis No 1. No structural changes took place in the profitability of pulp and paper manufacturing firms from 1960-98 as a result of changes in the firm, industry, and economy-related independent variables shown in Table 4.5.

Hypothesis No 2. No structural changes took place in the market share of the pulp and paper firms from 1960-98 because of the firm, industry and economy-related independent variables shown in Table 4.6

A detailed study was carried out to determine the B-shift for all the variables included in the models by using a special T-Test. Here t = b2-b1/ Sqrt (variance of b2 +variance of b1) for degree of freedom = (ni-k1)+(n2-k2), where n = number of observations and k = number of variables in the regression equations excluding the intercept. A T-test was also applied to identify the profitability difference between firms owning timberlands and those that did not own or manage timberlands during the study period. Finally, a T-test (unequal samples) was used to identify the difference between the profitability of firms manufacturing tissue paper and those manufacturing other grades of paper products. Sampling intensity decreased from 753 observations for the 1960s to 370 observations for the 1990s because of mergers, acquisitions and departure of a large number of firms from the scene during the last forty years.

CHAPTER 5

PROFITABILITY OF FIRMS

This chapter deals with variables that influenced the profitability of pulp and paper manufacturing firms from 1960-98. Results indicate that firm size, market share, and equity/sales ratio are the principal factors contributing to the profitability (net income) of pulp and paper firms in the United States. Timberland ownership, exports, the K-Factor, growth, consumption, and price index also influence the profitability of pulp and paper manufacturing firms.

Firm size and market share are the key elements of market structure and contribute to the overall profitability of a firm through economies of scale, market power and quality management. Similarly, the equity/sales ratio reflects the operational and financial health of a firm. From these results, it may be inferred that a firm's resources, its market power, and its operational and financial health determined the performance of U.S. pulp and paper manufacturing firms from 1960-98

During the 1960s, the pulp and paper industry improved its competitive position by adding new capacity, introducing advanced technology, developing innovative paper products, achieving cost reductions through economies of scale and productivity improvements, and expanding exports. A higher demand for pulp and paper products in the world market helped U.S. producers improve profitability despite a higher U.S. dollar value in the exchange market. In fact, the higher dollar value increased the profitability of U.S. exporters because of the higher demand in the world market. In reality, heavy

	1960-70	1971-80	1981-90	1991-98
Observations	714	654	567	370
Multiple R	0.9096	0.8733	0.7914	0.5312
R-Square	0.8273	0.7626	0.6264	0.2822
Adj R-Sq	0.8236	0.7571	0.6162	0.2518
F-Test	223.065	136.637	61.594	9.281
P-Value	0.000	0.000	0.000	0.000
Dependent variable = ln N.INC				
CONSTANT	+ **	+ **	+ **	
ln USADV		- **		
ln. FEXR	- **	+ *		
ln . OPRT		- **	+ **	
KF	+ **			- **
EXP.FIR	+ **	+ **		
ln PRIIND		+ **	+ *	+ **
AVSP/MES				
NEWSUPP/RGDP		+ **		
ln .ES	+ **	+ **	+ **	+ **
ln .AS			- **	
ln .CI			- **	
ln .MS	+ **	+ **	+ **	+ **
TL	+ **	+ **		
FS	+ **	+ **	+ **	+ **
GR	+ **			

- * = t indicated significant at 0.05% level. * significant at 0.10 % level.
- + = means positive effect, - = means negative effect

Table 5.1. Significant variables contributing to the profitability of U.S pulp and paper manufacturing firms (1960-98).

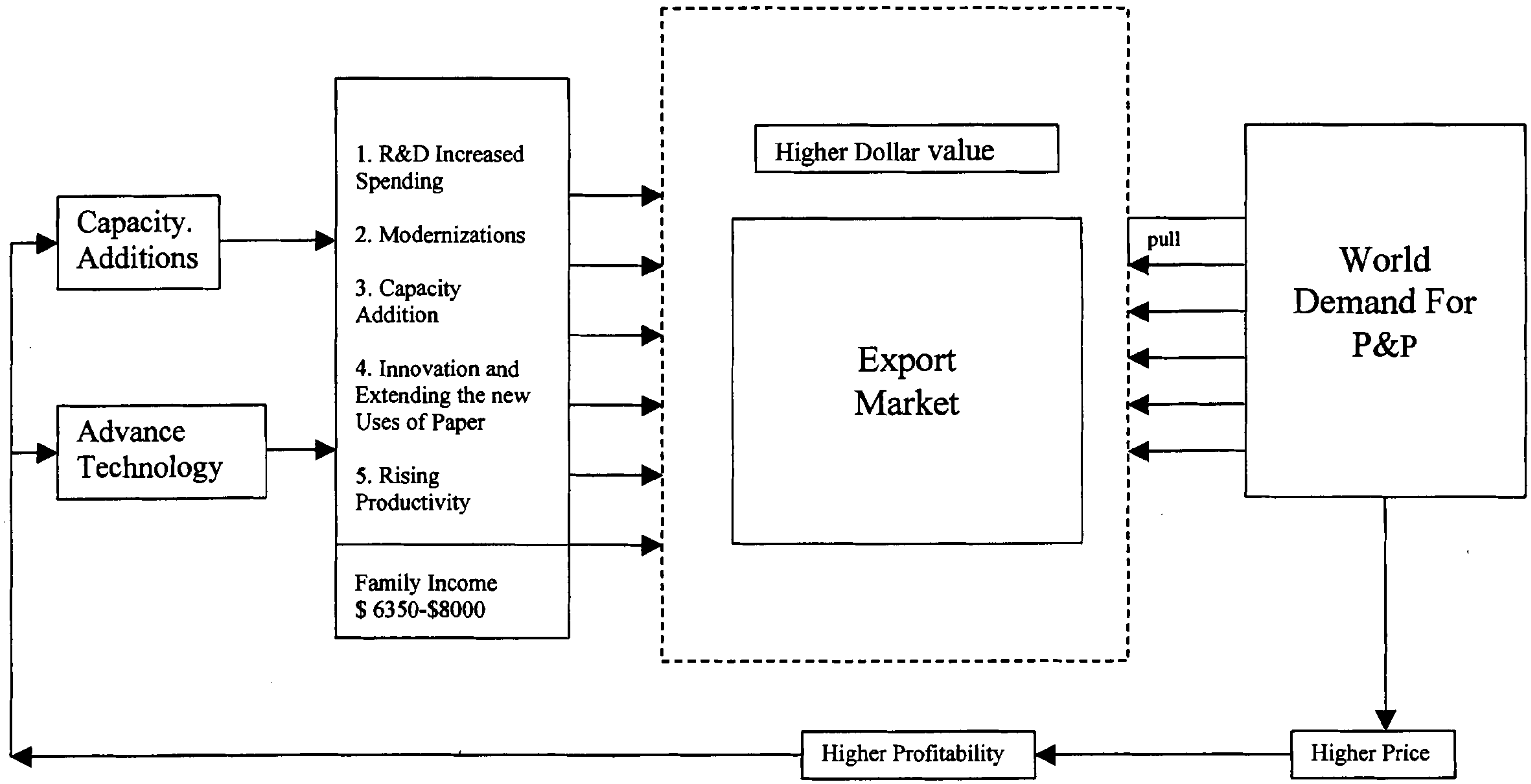

Fig.5.1 Apparent strategy of pulp and paper firms during 1960S

spending on industrial research and development by the pulp and paper industry paid back in the form of increased exports and new uses of innovative paper products. Capital spending increased by 68 percent, from 56 million in 1960 to 94 million in 1967, and probably topped 100 million in 1969. Efficiency improvements in the industry were the direct effect of research and technical development. Kraft paper and paperboard, linerboard, and market pulp were among the major export grades (Fig 5.1).

From 1971-80, the U.S. economy suffered three recessions and an oil embargo. Negative impacts influenced the financial health of the U.S. pulp and paper industry, which had been very stable and growing during the 1960s. Consumption in the domestic market started declining. Costs of energy, pulpwood, and chemicals also increased due to inflation. At that time, the industry had to fight against three challenges: increasing costs, declining demand for pulp and paper, and downward pressure on prices. The industry took advantage of a comparatively weak dollar by appropriately applying its elements of competitive advantages. The U.S. had advanced technology, abundant forest resources, and a skilled labor force. The U.S. pulp and paper industry targeted export markets by boosting production, increasing productivity through automation and enlarged scale of production, and offering innovative paper products in the market. As a result of these aggressive strategies, U.S. pulp and paper manufacturing firms were not only successful in maintaining their world market share in pulp and paper products but also earned record profits (Fig 5.2). By implementing this strategy, firms minimized the impacts of inflation and rising costs on their profitability. No doubt, the investments made to acquire the latest technologies during the 1960s increased the U.S. advantage over its competitors

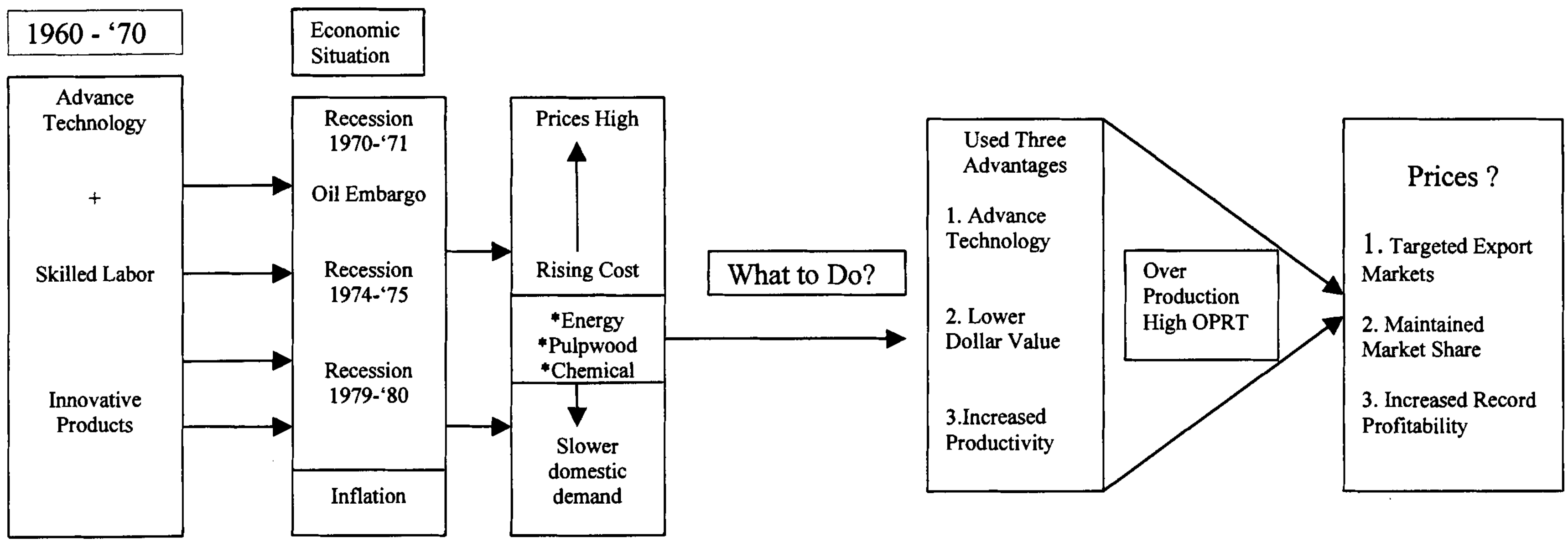

Fig.5.2 Apparent strategy of pulp and paper firms during 1970s

and successfully helped it to face the worst economic challenges of its history (Buongiorono, 1978).

The U.S. pulp and paper industry experienced a number of changes in the value of the dollar during the 1980s. Export markets follow the opposite trend; exports increase when the dollar is low and decline when the dollar is high. Similarly, the U.S. economy, which had a drastic impact on the health of the pulp and paper industry, passed through two recessions, the first in the 1979-82 back-to back recessions and later in 1989, which continued up to 1992 (Fig 5.3). The higher dollar value attracted imports from Europe, and U.S. paper manufacturing firms lost about 12 percent of market share in writing and printing paper to the foreign exporters. Overall, the profitability of the U.S pulp and paper firms remained stable. However, profits declined in 1989. Some experts believe the decline was due to increasing debt financing on new capacity additions. Higher operating rates helped to improve the productivity of the industry. The major pulp and paper companies made record investments during the 1980s. The highest level of restructuring took place in different grades. Concentration (five firms) in Kraft linerboard increased to 45 percent, up from 34 percent in the 1980s. Concentration also increased in the tissue industry, where it was reported that three major producers controlled 80 percent of the industrial tissue market. The index of pulp and paper prices increased more than the increase in the producer's price index in the 1980s. No major shift in the consumption of pulp and paper as a result of change in the real GDP was observed. Market share and equity/sales ratio were significantly associated with the net income of the firms, while capital intensity and asset/sales ratio were negatively associated with net income.

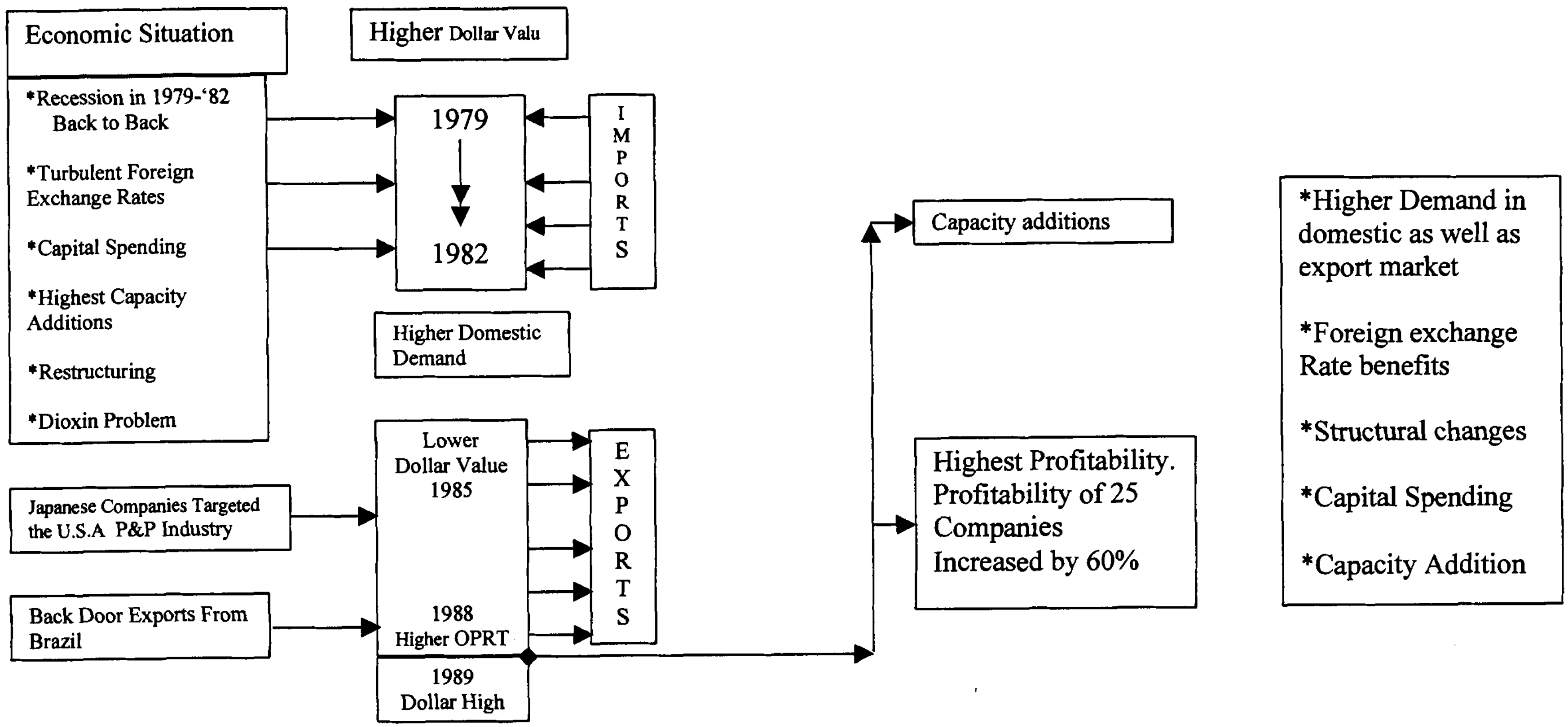

Fig.5.3 Apparent strategy of pulp and paper firms during 1980s

Timberlands also showed a negative association with profitability of the firms. A possible explanation for the negative association may be higher use of recycled paper and oversupply of pulpwood in the open markets. Firm size and growth were also found positively associated with the profitability of the U.S. pulp and paper-manufacturing firms.

The period 1990-98 will be remembered as the most turbulent in the U.S. pulp and paper industry's history. During this period, profitability reached both very high and very low levels. Many experts believe that the turbulent environment was caused by excessive capacity additions, as a result of record capital spending and debt financing. Others believe the poor performance of the industry was the result of globalization and the Asian monetary crisis. Many believe that the higher level of fragmentation in the U.S. industry is one of the major causes of poor performance and further consider that pulp and paper manufacturing firms are not fully utilizing their assets. During 1990-98, the U.S. advantage was badly influenced by the higher dollar value (Fig 5.4) and increased pulp and paper supply in the market as a result of global excessive capacity. The higher dollar attracted imports from cheaper paper supply areas. Industry tried to control the situation by reducing capital spending and postponing capacity additions. Poor prices of pulp and paper ruined profits. Firm size increased as a result of asset influx. The lowest growth rates in sales were recorded during 1990-98. Industry started rethinking the validity of timberland ownership and management. A severe decrease in profitability was due to lower prices, collapse of Asian markets, supply that exceeded expanding demand, and excessive inventory. Firms that performed well were in a niche market or offered a differentiated product (Paun et al, 1999).

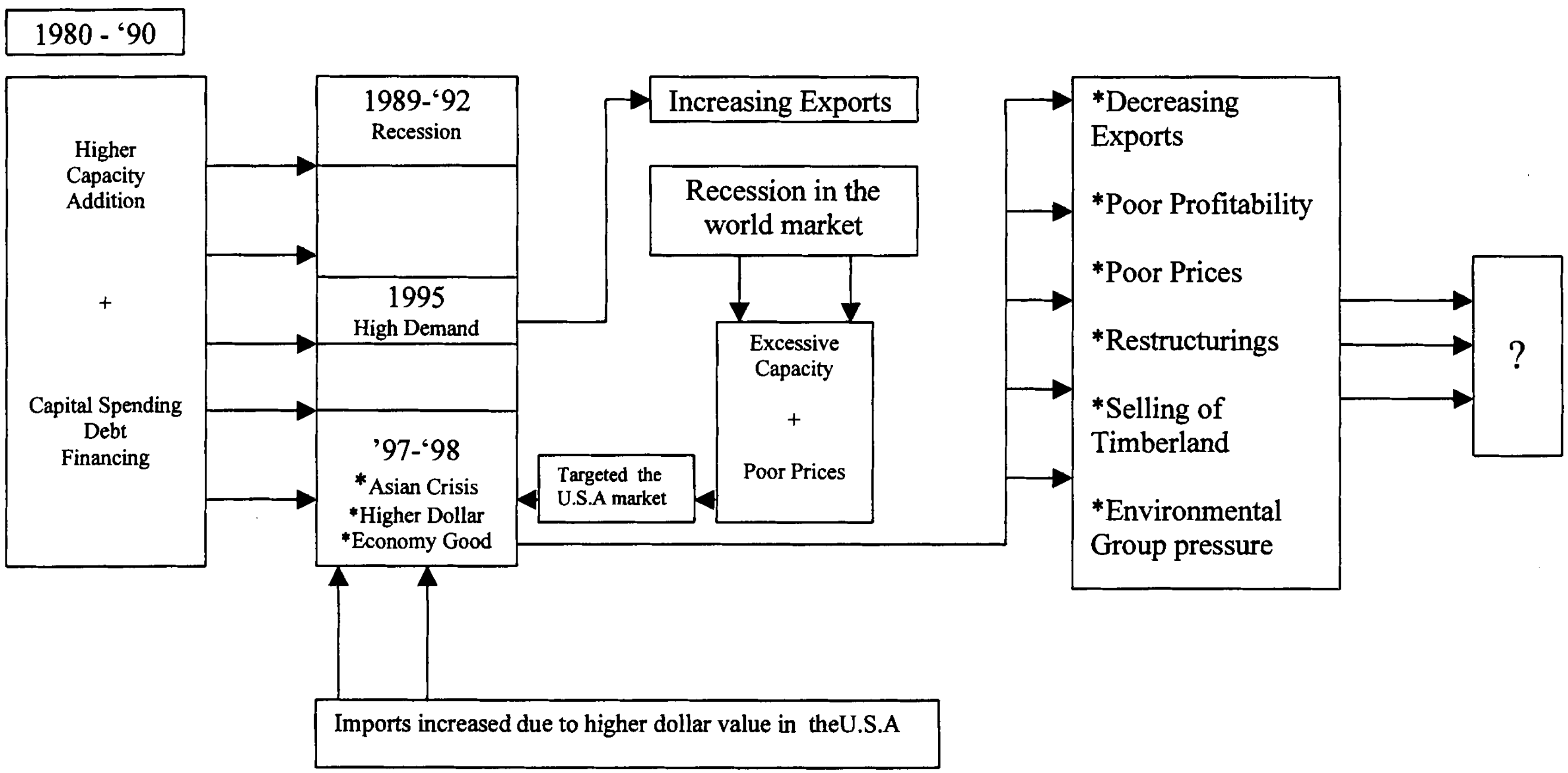

Fig.5.4 Pulp and paper market situation in 1990s

The 1990s were turbulent times for the pulp and paper industry. Global recession and cyclical oversupply at the dawn of the decade plunged the pulp and paper industry into a severe and prolonged market decline. Stagnant demand and depressed prices led many firms to remove marginal production or merge with larger companies (Bjorkman, Dorthy and Jacob-Young, 1997).

5.1. Economic Background (1960-98)

Despite some slowing of the economy during 1969, the 1960s fulfilled the promise of the "Soaring Sixties". The dollar value of the nation's output of goods and services rose 85 percent over the 10-year span, for a real gain of 50 percent. The benefits of growth were widespread. Expansion of the non-farm industries generated nearly 17 million new jobs, while the rising productivity of private industry was reflected in an increase of almost 30 percent in output per man-hour.

Nineteen-seventy started with accelerating inflation, which eroded prosperity. The 1973-74 oil embargo by the members of the Organization of Petroleum Exporting Countries (OPEC) pushed energy prices rapidly higher and created shortages. Even after the oil embargo, energy prices stayed high, adding to inflation and eventually causing rising rates of unemployment. The Federal budget deficit grew, foreign competition intensified, and the stock market sagged. Efforts were made to improve the economy by increasing government spending, but failed. Inflation was successfully checked by deregulation policy, but the most important element in the war against inflation was the Federal Reserve Board, which clamped down hard on the money supply beginning in 1979. Interest rates were increased. As a result, consumer spending and business borrowing slowed abruptly. The economy soon fell into deep recession.

The 1980s started with a so-called "double-dip" recession, which was unusual for several reasons. First, interest rates and real GDP growth were both extremely volatile during this period. Real interest rates ranged from 0.5 percent to 9.5 percent and real GDP growth from -3.1 percent to 4.9 percent per year, with both varying wildly. But, since unemployment rose steadily throughout, this entire period can be viewed as one continuous recession that continued through 1992. This recession followed a two percentage-point increase in real interest rates that began in January 1988 and peaked in February 1989. GDP fell for three quarters, starting in March 1990, representing a lag of six to seven quarters from the peak in real interest rates in February 1989. Sharply rising interest rates often cause recessions.

The 1990s began with a recession that started in 1989 and continued until 1992. This recession was much deeper and longer than expected, and it took much longer to develop than the recession of 1979-82. GDP growth began to decline rapidly in February 1989. Unemployment remained stable for some time and then began to rise in April 1989 (a lag of two quarters). GDP growth reached a low point in April, 1990 and the level of GDP hit a trough in January 1991. Unemployment rose steadily and peaked in March 1992, six to seven quarters after GDP growth and level reached their nadir.

5.2 Profitability of the U.S. Pulp and Paper Firms (1960-98)

The profitability of the pulp-and paper-manufacturing firms in terms of net income for the 1960s, 1970s, 1980s and 1990 was estimated using econometric methods. The results, using cross-sectional data, are reported in Table B.1 (APPENDIX-B), and significant variables are shown in Table 5.1. The profitability model for the 1960s explained about 83.36 percent of the total profitability variance. Coefficients for the variables USADV, OPRT, KF, EXP.FIR, NEWSUPPL, ES, MS, TL, FS, CI and GR show positive signs, in accordance with expectations. However, not all were significant contributors to the profitability of the firms during the decade, titled the "Growth and Stability Era". Non-significant variables included USADV, OPRT and NEWSUPPL. Similarly, some variables (FEXR, PRIIND, AVSP/MES and AS) had negative signs on their coefficients, indicating a negative relationship with the dependent variable. FEXR was the only variable that showed a significant negative association with the net income. The statistical characteristics of the profitability equation showed the fitness of the model. Apparent strategies of pulp and paper firms during the 1960s were shown in Fig 5.1.

The independent variables FEXR, EXPFIRM, PRIIND, AVPS/MES, NEWSUPP/RGDP, ES, MS, TL, FS and GR showed positive signs on their coefficients while the parameters USADV, OPRTT, KF, AS, CI showed a negative association with net income for the " Rising Cost Era" (1971-80). However, only EXPFIR, NEWSUPP/RGDP, ES, MS, TL FS, USADV and KF showed significant associations with net income.

The profitability equation explained 76.26 percent of total profitability variance. Most of the coefficients had the expected signs. Goodness of fit, determined by the coefficient of determination, supported the model in explaining the variance in profitability as a result of change in the independent variables. Apparent strategies of U.S. pulp and paper firms during the 1970s were shown in Fig 5.2.

The profitability model for the 1981-90 period explains 62.64 percent of the total variance in the net income of firms. Most coefficients have the expected sign and magnitude. From the results in Table 5.1, it appears that the parameters like OPRT, PRIIND, ES, MS and FS had significant positive associations with the net income, while AS and CI had significant negative relationships with net income. The apparent strategies of pulp and paper firms during 1981-90 were shown in Fig 5.3.

The profitability model for 1990-98 explains 53.12 percent of the total variance in net income. Results shown in Table 5.1 indicate a significant positive association between PRIIND, ES, MS, and FS, while only KF showed a significant negative association with net income. The apparent pulp and paper market situation during the 1990s was shown in Fig 5.4. Details of the parameters' association in the light of economic, technological and global context that persisted during 1960s 1970s, 1980s and 1990s, are discussed as below:

5.2.1 U.S. Advantage (USADV)

The U.S. Advantage showed a strong negative association with profitability during the 1970s. A one percent change in the U.S. advantage reduced the net income of the pulp and paper firms by 0.147 percent during 1970-80, if we assume that there was no change in the positions of the rest of the variables included in the model. The mean of the USADV was about 0.121 with 0.101 percent coefficient of variation (Table 4.5).

The comparative advantage of a country is embodied in endowment of factor inputs, level of technological development, factor productivity, transfer cost and other variables (Harkness, 1983). Relatively low cost raw material and energy combined with modern facilities make the U.S. paper producers competitive worldwide. During the 1970-80 era, industry experts believed that if timely strategic decisions were not made, the profitability of the pulp and paper firms would be under pressure as a result of rising energy, chemical and pulpwood costs. The US might lose its competitive advantage in the world market. The U.S. advantage was also threatened by the increased supply of pulp and paper in the world market. Realizing the situation, U.S. pulp and paper manufacturing firms fully utilized their technological superiority and boosted production to compete in the world market. Pulp and paper firms fully availed themselves of the opportunities stemming from lower dollar value in the exchange markets. Lower dollar value also increased the cost of inputs, particularly the energy cost. In spite of all the difficulties, U.S. firms were successful in maintaining their world market share by boosting their pulp and paper exports from 2817 thousand short tons in 1970 to 5214 thousand short tons in 1980. The industry met the challenge of increasing cost through productivity gains, producing more tonnage on faster machines with greater efficiency (Michaud, 1970). However, U.S. firms exported products at lower prices compared to the 1960s in terms of constant dollar value.

5.2.2 Foreign Exchange Rates (FEXR)

During the 1960s, the U.S. dollar remained high against the major currencies. The profitability model shown in Table 5.1 indicates a significant negative association between the variable FEXR and the net income of pulp and paper firms for that period. The negative sign of the FEXR coefficient is totally according to expectations. A one percent appreciation of the U.S. dollar may decrease the net income of a firm by 0.19 percent, subject to the condition that there will be no change in the economic or technological environment of the firm.

Estimates of the model for FEXR showed a positive association between profitability and FEXR during the 1970s. A one percent change in the value of the U.S. dollar brought about a 0.2246 percent change in the net income of the pulp and paper firms provided there was no change in the other variables included in the model. However, this association between foreign exchange rates and net income of the firm was just significant at the 95 percent level.

A lower dollar value compared to other hard currencies helped firms to increase their exports and to reduce the impact of increasing input costs. The decline in the monetary exchange rate of the dollar improved the competitive position of U.S. paper products in foreign markets. This improvement was proven true particularly in Japanese markets, where U.S. supplied linerboard and bleached board and shipments to Japan climbed dramatically. The generally favorable foreign market conditions, coupled with added liner and printing paper capacity, provided an opportunity for export expansion.

The U.S. pulp and paper industry is highly vulnerable to fluctuations in the major currencies around the world. When the U.S. dollar appreciates in the market, it hurts the pulp and paper industry by reducing exports and also by increasing imports, leading to loss of market share in the domestic market. This phenomenon was absent during the 1960s. Despite the high dollar value, pulp and paper exports doubled, indicating a higher demand for pulp and paper products in the world markets, particularly in the packaging grades. The higher dollar value further strengthened profitability. From this situation, we may conclude that higher dollar values do not always hurt exports but may actually improve profitability, if the demand for the product is high. Uusivuori and Buongiorono (1990) explained that foreign exchange rates influence price movements but they did not develop a general framework that focuses on determinants of price behavior and associated elasticities.

A strong dollar undermines volume, pricing, and profitability (Berler, 2002). The performance of an industry may be hampered by a failure to maintain international competitiveness, perhaps due in part to fluctuations in exchange rates. Because of impacts of increasing globalization on international trade, firms are expected to respond promptly to keep their competitiveness in the market. Generally, the impacts of foreign exchange rates are evaluated by a commonly used indicator of competitiveness (George, Joll, and Lynk,1991) estimated from {(relative labor cost/relative productivity)* exchange rates)}.

Firms vary tremendously in the impact of currency exchange rate fluctuations on their present and potential profitability. Firms whose assets and liabilities are both dominated in different currencies are normally at greater risk. When the U.S. dollar is strong compared to other currencies, U.S. producers have to reduce prices, at a cost to their profitability , in order to maintain their competitive advantage. Exchange rates can affect the marginal profitability of capital and, more generally, a producer's profit by passing through into home market prices, export prices, and imported input prices (Campa and Goldberg, 1998)

5.2.3 Operating Rates (OPRT)

Operating rates were negatively associated with profitability during the 1970s. The profitability model shows that a one percent increase in the operating rates of the industry decreases the net income of a firm by 1.33 percent. Higher operating rates during the 1970s did not match the slowed domestic consumption. The U.S. pulp and paper firms were trying to achieve three objectives by running the plants at above-demand operating rates: reducing fixed costs, diluting the effects of rising input costs, and maintaining world market share. It appears that firms were successful in implementing this strategy, and the industry chalked up record sales and earnings during the 1970s. Net profits as a percentage of net worth increased from 4.9 percent in 1971 to 12.9 percent in 1979. In 1979, price increases in the raw material and labor inputs outpaced the increase in average paper and board prices. The operating results of some paper companies were adversely affected by slowed demand, but, overall, industry profitability had a positive effect (U.S. Department of Commerce, 1980)

Results shown in Table 5.1 reveal a positive association between industry operating rates and net income of firms during the 1980s. According to the profitability model, a one percent change in the operating rates increased net income by 1.51 percent. The average OPRT from 1980-90 was 0.920 with a 0.032 percent coefficient of variation. Because of higher demand in the domestic markets, operating rates were high. Higher operating rates helped to improve productivity during the recession in 1983. Operating rates during 1980 averaged 92.7 percent, declining to 84.5 percent in 1983. However, capacity utilization rates later improved in 1986 to 91.7 percent. The decrease in operating rates may have been due to increasing imports as a result of lower dollar value. Generally, higher operating rates reflect higher demand in both domestic and foreign markets. Higher operating rates reduce the unit fixed cost and help in improving profitability.

5.2.4 K-FACTOR {(Firm Capacity/Industry Capacity)* Cr4)}

The profitability model indicates a significant positive association between the K-Factor and net income of U.S. pulp and paper manufacturing firms during the 1960s. A one percent increase in the K- Factor increased the net income of a firm by 2.51 percent if other variables remained constant. The K–Factor is an interaction factor. Any change in a firm's capacity, industry capacity, or change in the concentration ratio may change the overall value of the K-Factor. In the profitability model, we are assuming that there will be no change in the economic or technological environment of the firm when we are evaluating the association between net income and the K-Factor. The mean value of the K-Factor for the first decade of the study (1960-70) was estimated at 0.283, with a 1.68 percent coefficient of variation (Table 4.4)

The K- Factor showed significant negative association with the net income of the firms during the 1990s. A one percent increase in the K-Factor corresponded to a 23 percent decrease in net income. The negative association of the K-Factor with net income may be explained on the basis of two factors, an increase in the overall capacity of the industry and a declining relative position of the majority of the firms in the industry. Over-capacity exerted negative pressure on the prices and profitability of most of the firms. No doubt, merger and acquisition activity in terms of increasing concentration is an important determinant of the K–Factor. Higher levels of capacity additions by a small number of firms depressed the impact of the increasing concentration effect on the K-Factor. The change in the overall industry capacity and decrease in the relative position of the majority of the smaller firms resulted in lower net income.

The K-Factor was included in the model to capture the impact of a firm's position in the overall industry, taking into consideration market structure in terms of a four-firm concentration ratio (CR4). From the model estimates it appears that K-Factor is a significant contributor to the profitability of the firm. The K-Factor seems to be successful in capturing change in a firm's position or change in industry capacity and may indicate its positive or negative impacts on the performance of the firm. This factor also captures the impact of structural changes at the firm level or industry level. Feeny and Rogers (1999) suggested the inclusion of a similar interaction factor between market share and concentration to estimate the profitability-market share relationship in the light of oligopolistic coordination (as a result of concentration). Firm capacity/industry capacity is the firm's market share in the industry in terms of capacity. There is an increasing trend to calculate market share by using firm and industry capacity in the absence of sales data (Lazich, 2001). Edward (1949) also emphasized the importance of firm position relative to the total size distribution of firms in attaining profitability. Weiss (1974) included an interaction factor (a product of the concentration and the percentage of industry sales going to the consumer goods market) to estimate profitability by using an econometric model.

5.2.5 Exporting Firm (EXP.FIR)

A dummy variable was included in the econometric model to capture the impact of a firm's participation in exports. Results shown in Table 5.1 indicate that there was a positive and significant relationship between a firm's export strategy and net income during the growth and stability era. From this it may be concluded that exporting firms were more profitable than others during the1960s. As reported earlier, there was a high demand for pulp and paper products from 1960-70, and most of the firms, particularly those that were in the packaging grade business, improved their profitability by taking advantage of the opportunities in the export markets.

Results shown in Table 5.1 clearly indicate a positive, significant association between exporting activities and net income during the 1970s. The importance of the export market strengthened further when domestic consumption slowed because of inflation and recession during the 1970s. Most firms utilized their capabilities to expand their markets abroad and to minimize the negative impacts of increasing costs. During 1970-80, U.S. exports increased from 2,817,000 tons to 5,214,000 tons. In 1980, pulp and paper exports were 8.20 percent of the total pulp and paper production in the country. It is important to note that the gap between imports and exports in 1970 was 4,298,000 tons in favor of imports. This gap dropped to 3,556,000 tons in 1980, which shows an increasing interest of U.S. pulp and paper firms in export markets or decreasing imports.

5.2.6 Price Index (PRIIND)

The price index variable showed the expected positive association with net income during the 1970s. A one percent change in price index corresponds to an increase in the profitability of the firm by 0.348 percent. The producer's price index (1982 =100) increased from 40.4 in 1971 to 91.7 in 1980. The mean price index for the second decade was estimated at 62.737, which was higher than in the 1960s. The increase in the price index was the result of increasing input costs for that period. The highest increase in energy cost was reported because of the 1973 oil embargo. Similarly, increasing cost trends in pulpwood and chemicals can be traced back from the literature. Following a decade of stability, pulp and paper prices changed drastically in 1970 as the result of growing market tightness and sharp escalations in production costs, particularly energy and pulpwood costs from 1973-74 and 1978-80. Unfortunately, most firms were facing the challenges of both increasing costs and slower domestic consumption. During 1970-71, profits of U.S. pulp and paper firms dropped by 56 percent; profits dropped again by 21 percent in the 74-75 recession.

The pulp and paper industry was the fourth-ranking industry in terms of purchased energy and the foremost fuel oil consumer among manufacturing industries during the 1970s. Roughly 90 percent of its demand was for boiler fuel to produce essential- process steam and electricity. The industry had previously shifted away from natural gas and coal for supply and environmental reasons. In 1980, firms were again asked to reduce dependence on fossil fuel oil and purchased energy, which was about 23 percent from the 1972 base period (U.S. Department of Commerce 1980). Eleven percent of the industry's total energy requirement came from wood. Because the pulp and paper industry is a mature industry, it can improve its profitability only by reducing the production costs, particularly energy costs.

The price index showed a positive association with the net income of the firms during the 1980s. According to the profitability estimates, a one percent change in the price index corresponded with a 0.45 percent increase in the net income of firms. However, this relationship was just significant. Generally, pulp and paper prices increase when the economy is strong and decline in recessions. Pulp and paper prices rose sluggishly during the first half of the 1980s as a result of back-to-back recessions early in the decade and the U.S. dollar's strength in 1984 and 1985.The strong dollar attracted more paper imports into the U.S. and made it increasingly difficult for U.S. companies to export pulp and paper products. The dollar's impact on pulp and paperboard prices was as severe as any recession. In 1985, prices for paper rose only 0.2% from the previous year. Wood pulp prices plunged 12.6 percent, and paperboard prices declined by 4.8 percent. The pulp and paper market situation changed in 1986 and, as a result of improvement in the market, the pulp and paper price index shot up 20 percent between 1986 and 1987. Prices further increased by 14.3 percent during 1987 and 1988. All of these changes in the price took place as a result of the decline in the value of the dollar compared to the other currencies, rehabilitating the competitive advantage of U.S. pulp-and paper-manufacturing firms. The index of pulp and paper prices increased more than the increase in the producer's price index in the 1980s. Over the long term, pulp and paper industry prices have kept closer pace with the overall index, rising an average of 6.75 percent since 1970 vs. 6.4 percent/year for industrial commodities as a whole (PPNAFB, 1990).

The price index showed a significant positive association with the net income of the firm during the 1990s. A one percent change in the producer's price index corresponded to a change in net income of pulp and paper firms of 1.57 percent. The price index (1982 =100) increased from 132.9 in 1990 to 144.7 in 1997, with the highest value reported in 1995, when the U.S pulp and paper industry made record profits. The producer's price index captures price movement prior to retail levels and encompasses the input price changes. Prices are inevitably impacted by supply and demand, market volatility, consumption, and general economic and financial conditions, both in the U.S. and international markets. Prices to export markets generally tend to rise faster and higher than U.S. domestic markets, when North American supply/ demand conditions are tight. Similarly, export prices are among the lowest when U.S. domestic markets are weak and producers look to sell off tonnage (PPNAFB, 1999).

Butner (1996) stated that product pricing plays a major role in investment results--the better the pricing the better the results. The pulp and paper sector's PPI has consistently been higher than the majority of the commodity products' price indexes. In fact, over the last 15 years the pulp and paper sector has received some 20 percent more for each unit of product than other commodity products. Obviously, if the pulp and paper sector maintained a comparable cost-of-goods profile to these other sectors, the pulp and paper industry financial return should be double their returns.

5.2.7 New Supply/RGDP (NEW SUPPL/RGDP)

Results shown in Table 5.1 reveal that the only significant positive association between increasing consumption due to a rise in real GDP and net income of pulp and paper firms was observed during the 1970s. A one percent change in new supply/RGDP may increase net income by 11.172 percent.

The growth of the paper and board industry is closely related to changes in the gross domestic product, as measured in real terms, and real disposable income. With the flattened growth for the economy in the 1970s, analysts expected a lower domestic consumption trend and more emphasis on export markets. The drop in consumption was only recorded during 1974 and 1975, but later again consumption returned to its long-term decreasing path. Since 1960, there had been a general trend of decreasing NEWSUPP/RGDP ratio. When the economy was small, the NEWSUPP/ RGDP was at its highest level but, with the passage of time, the economy continued growing at a comparatively higher rate than paper consumption in the country. During 1970, the NEW SUPP/RGDP ratio was 16.473 but it decreased to 14.554 in 1980. The long-term consistency of this ratio indicates the slower growth in the consumption of pulp and paper products in the US and the pulp and paper industry 's movement towards its maturity stage of the product life cycle. Demand for most forest products is directly related to economic activity and correlates to GDP growth (U.S. International Trade Commission, 1999)

5.2.8 Equity/Sales (ES)

The profitability model shows a significant positive coefficient for the equity/sales ratio during the 1960s. A one percent increase in the equity/sales ratio may enhance the net income of a firm by 0.00758 percent, if there is no change in the economic and technological or global situation in the pulp and paper industry.

The equity/sales ratio explains the financial and operational health of a firm. Because of a better economy and a higher demand for pulp and paper products, pulp and paper firms improved their performance by increasing their sales in domestic as well as export markets. The average equity/sales ratio of 0.83 shows a relatively good financial and operational health of the pulp and paper-manufacturing firms. The equity/sales ratio was significantly related to the performance of the pulp and paper firms. From 1960-70, net profit as percentage of net worth ranged between 7.0 and 10.3 percent, and the sales to net fixed asset ratio was in the range of 2.0 to 2.3 (U.S Department of Commerce, 1970). For pulp and paper firms, profits after taxes rose slightly to 4.9 percent of sales in 1969, with $9.3 billion in sales. All of these statistics indicate the good health of the industry, more efficient utilization of industry's plant capacity, and a higher price structure during the 1960s.

The coefficient for the equity/sales ratio showed a significant positive relationship with net income during the 1970s. It is estimated that a one percent increase in the equity/sales ratio increased the profitability of a firm by 0.0427 percent. Increasing sales increased the equity of the firms and also the financial health of a firm. The equity/sales ratio relationship with net income points towards the importance of sales volume for the pulp and paper firms. The mean equity/sales ratio decreased during the 1970s to 0.54 from 0.83 in the 1960s. The reduction in the equity/sales ratio may have been due to the unfavorable economic situation in the country during the 1970s compared to the 1960s. The decline of the dollar against some important foreign currencies contributed to inflation by increasing prices of goods and encouraging price increases on competing domestic products. Finally, the limited productivity gain from 1977 to 1978 contributed to a large rise in unit labor cost, a basic determinant of the rate of inflation. The accelerating rate of inflation in1978, together with Federal Reserve efforts to hold down the growth in money and credit, led to a sharp rise in short-term interest rates. Higher interest rates also impacted the profitability of the pulp and paper firms, particularly the small firms that were already passing through economic hardships because of increasing production costs. It is important to note that these smaller firms were not in a position to reduce the impact of increasing costs through export activities.

The equity/sales ratio showed a significant positive association with net income during the 1980s. According to the model estimates, a one percent change in the equity/sales ratio increased the net income of a firm by 0.170 percent. Since 1980, sales of pulp and paper increased from 56,250 million dollars to 115,523 million dollars in 1990. The ratio of annual net profit to net sales was 4.75 percent from 1980 to 1990. An increase in sales certainly contributes to the equity of the firm; the higher this ratio is the better it is for the firm. A positive association between equity/sales ratio and net income is quite in accordance with expectations. The average equity/sales ratio for 1980-90 was about 0.479, with a 0.558 coefficient of variation.

The equity/sales ratio showed a significant positive association with net income during the 1990s. Model estimates suggest an increase in net income of 0.0844 percent if the equity/sales ratio increases by one percent. This relationship is according to expectations. Higher sales increase a firm's equity. This ratio is an indication of a firm's financial and operational health. Net sales of the pulp and paper industry increased from 115,523 million dollars in 1990 to 166,774 million dollars in 1998. The average equity/sales ratio for the firms included in the study for 1990-98 was about 0.754, with a 7.482 coefficient of variation. The higher level of variation in equity/sales ratio shows the higher level of volatility in the profitability of the pulp and paper firms because of the globalization effect.

5.2.9 Asset/Sales (AS)

The asset/sales ratio for the period 1981-1990 showed a significant negative association with net income. The profitability model indicates that a one percent change in the asset/sales ratio resulted in a 0.177 percent reduction in the net income of the firms.

The negative association with profitability points towards the underutilization of the firms' resources. This is a consistent relationship specific to the pulp and paper industry because of its highly capital-intensive nature. Firms use a high level of capital investment to achieve economies of scale and lower unit costs. Unfortunately, although much research has been done on reducing the unit costs, fewer references are available about the research to reduce the assets levels in the pulp and paper industry. The average asset/sales ratio for 1980-90 was about 0.93, with a 0.462 coefficient of variation.

5. 2.10 Capital Intensity (CI)

Results shown in Table 5.1 reveal a significant negative association between capital intensity and net income during 1980-90. According to the model estimates, a one percent change in capital intensity resulted in a 0.348 percent profitability reduction. U.S. pulp and paper companies devoted an increasing portion of their funds to capital improvement during the 1980s. In absolute terms, spending climbed from $5.24 billion in 1979 to $15.69 billion in 1989, an increase of 200 percent. Capital spending rose from 86 percent of cash flows in 1978 and 93 percent in 1979 to well above 100 percent of cash flows throughout most of the 1980s. To help pay for this increase, companies boosted their long-term debt significantly, from $10.08 billion in 1978 to $27.07 billion in 1988. Capital spending by the paper industry in 1989 reached an estimated $15.1 billion, up 34.6 percent from 1988, the largest gain registered by any U.S. manufacturing industry. Some industry experts believe that capital spending improves the industry's competitiveness, particularly against global competitors. Others consider big capital spending as one of the major causes of poor performance in the pulp and paper sector. They argue that the pulp and paper industry may improve its profitability by cutting spending. Debt financing leaves negative impacts on the pulp and paper industry, which is already mature. The average capital intensity of pulp and paper firms from 1980-90 was estimated at 7.96, with a 0.118 coefficient of variation. (Table 4.3). These statistics are higher than those for the previous decade. Higher capital spending and capacity additions, softer demand, and consumer inventories reductions resulted in lower established prices for many paper grades during the 1980s. Coupled with generally lower operating rates, creeping material costs, and higher fixed costs attendant to new capacity, the softening in prices led to lower profitability gains for most of the establishments in this capital-intensive sector. However, by constantly improving upon its comparative cost advantage and state of technology with increasing capital expenditures, the industry underscores its enduring intent to remain competitive in the home market while capturing a share of foreign market growth. (Butts, 1989).

5.2.11 Market Share (MS)

In this study, the market share coefficient was found to be positive and significantly related to the net income of the firms during each period. In the 1960-70 period, a one percent increase in market share in the pulp and paper market caused an increase in net income of a firm of 0.0097 percent. The positive sign of the market share coefficient is totally according to expectations. These findings fully support the findings of a number of studies carried out in different parts of the world to determine the potential association between profitability and market share of the firms (Feeny and Rogers, 1999; Buzzel and Gale, 1987; Ravenscraft, 1983). The neoclassical expectation is that higher market share yields the firm higher profitability. The average market share of firms during the 1960s was estimated at 1.417, with a coefficient of variation value of

4.95 percent (Table 4.1). Because average market share was so low, reflecting that none of the firms had market power at that time, it may be inferred that the pulp and paper market seemed to be a perfectly competitive market. About one-fourth of the total value of paper and board shipment comes from the largest four companies in the industry, 41 percent from the eight largest, 64 percent from the 20 largest, and 87 percent from the 50 largest companies. (U.S. Department of Commerce, 1970). Nearly 300 mergers (3% of total mergers by all manufacturing concerns) were completed in the pulp and paper industry during the 1960s to stimulate growth in sales and profits. In the 1960s, the industry had only one company whose annual sales exceeded one billion dollars. In 1967, there were five companies of that sales size. Most of the pulp and paper companies were horizontally and vertically integrated. Smaller firms found it profitable to specialize in only a few closely related products, which were produced in limited quantity.

Results shown in Table 5.1 indicate a significant positive association between market share and net income during the 1970s. The profitability model estimates a 0.0287 percent increase in profitability as a result of a one percent change in market share. This relationship clearly points towards the importance of market share in a commodity market. The average market share of firms included in the study, during the 1970s, was about 2.363 percent with a 1.783 percent of coefficient of variation. (Table 4.5). The mean market share in the 1970s was comparatively higher than in the 1960s, when it was about 1.417 percent on average with a 4.955 percent coefficient of variation. The mean net income of firms increased from 12.186 million in the 1960s to 50.310 million in the 1970s. These statistics strongly suggest a relationship between market share and profitability.

Market share had a significant positive association with pulp and paper firm net income during the 1980s. The profitability model estimates indicate that a one percent change in the market share may increase a firm's net income by 0.0923 percent. This relationship is in accordance with expectations. Firms that have a higher market share have bigger plants and enjoy the advantages of economies of scale and, therefore, have lower cost of production. As a result of lower production cost, firms have comparatively higher market power and consequently, higher profitability. Because pulp and paper is a commodity business, market share is an important factor in maintaining growth and improving profitability. The U.S. pulp and paper industry is mature; firms can only increase their profitability by cost cutting and price penetration strategies. Market share contributes to profit leadership in three significant and interdependent ways: economies of scale, market power, and quality of management (Fox& Company, 2000).

Market share was positively and significantly associated with net income during the 1990s. From the results, it appears that if a firm's market share increases by one percent, then the net income of the firm will increase by 0.14 percent. Firms that have a higher market share are supposed to have higher net income. Market share stems from firm size, and size of firm is associated with the assets a firm has. Firms with higher market share may have power in the market. Firms may have cost advantages in terms of economies of scale and may have better access to the market or better technology than competitors in manufacturing the products. Generally, firms that have higher capacity are supposed to have higher market share. Increases in market share imply greater efficiency. The average market share of firms included in the study for 1990-98 was about 1.817, with a 1.315 percent coefficient of variation.

In the pulp and paper industry, those firms that have a high market share are more profitable than those that have a lower market share, because market share is accompanied by economies of scale, higher levels of integration, market power, keeping costs down, maximizing productivity, and spreading of marketing costs. Overall, higher market share and increasing profitability indirectly points towards implementation of a successful strategic plan by the firms to compete in the market.

Shephered (1972) was one of the first to use firm-level data. Using a sample of 231 U.S firms he found a positive impact of market share on profitability and concluded that profits decline beyond some limits of market share (He concluded that market share has an inverted U relationship between market and profitability).

Carlton and Perlof (2000) stated that market shares were imperfect indicators of market power, so additional analysis of economic conditions is necessary before one can reach a conclusion about market power. For example, if entry is easy, then industry pricing is severely constrained regardless of whether an existing firm has a large market share. From the analysis, it appears that in the pulp and paper industry, firms do not have enough power to influence the price; therefore, the pulp and paper market may be regarded as a competitive market.

5.2.12 Timberlands (TL)

Timberlands showed the expected strong positive association with profitability during the 1960s. According to the profitability model, shown in Table 5.1, a one percent increase in timberland holdings may increase the net income of a pulp-and paper-manufacturing firm by 1.2 percent. The mean timberland holding during 1960 was about 0.637 million acres (Table 4.4). Higher profitability due to timberlands may be explained on the basis of the cost reduction hypothesis. Timber and timberland are the strategic resources of forest products firms; therefore, firms strive for greater yield per acre of timberlands through the development of better management and planning strategies (Tedder, La Mont, and Bruner, 1987). In the pulp and paper industry, pulpwood is the primary raw material. The cost of delivered timber, which includes a substantial element of labor input, amounts to 20-25 percent of the manufacturing cost, while labor represents 25-30 percent of the total costs. Firms owning timberlands have better control over pulpwood supply and sometimes help in reducing the transportation costs. Timberlands help in maintaining secure fiber flows and more stable cash flows. Ownership also opens the opportunity for timing timber procurement to save fiber costs. In strong stumpage markets, a firm can harvest more from its fee land rather than just buying from the open market. But when prices of final products are high and a firm can maintain a comfortable profit margin, it may opt to buy more fiber from the open market. On the other hand, if a firm can harvest from its fee lands during downturns, depending on the degree of self-sufficiency during a given period of time, millions of dollars of fiber costs may be saved to relieve the firm from cost pressure and financial distress. In this case, the firm can suffer a lower rate of return from its timberland investment, but still generate sizeable cash flows and earnings. Consequently, the firm may deliver better financial performance, and stockholders will maintain sufficient confidence. Furthermore, timberland ownership can alleviate the effect of unexpected events pertinent to fiber supply. Owning timberland is an important, valuable option for forest products firms to achieve better financial performance (Yin, Harris, and Izlar, 2000; Clephane, 1978).

Timberlands showed a positive association with net income in the 1970s. According to the profitability model, the net income of a firm in the 1970s increased by 3.397 percent if timberlands were increased by one percent. On average, pulp- and paper-manufacturing firms owned about 0.785 million acres of timberland during the 1970s, which was a little bit higher than the statistics for the 1960s (about 0.637 million acres). These findings reveal an increasing interest of firms in timberlands during the 1970s. The attractiveness of timberlands was drastically increased because of increasing pulpwood costs in paper manufacturing. The availability of cheaper pulpwood from fee lands was an important feature in the inflationary environment and to compete in the market. Those firms that owned and managed timberlands were more profitable than those that were buying pulpwood from the open market (Binkley, 1981).

Timberlands provide protection against an inflationary business environment and increasing stumpage prices. The attractiveness of timberlands may be evaluated by observing the increasing woodchip price trend in the export market. Woodchip prices increased from $16.70/ metric ton in1970 to $93.02/metric ton in 1980 (PPNAFB, 1984-85).

5.2.13 Firm Size (FS)

Firm size was positively and significantly associated with net income during the 1960s. A one percent increase in the firm size may increase the net income of a firm by 0.012 percent. Comparatively, a smaller increase in net income compared to the bigger size of the assets requirement also confirms the capital-intensive nature of the pulp and paper industry. Firm size is a key element of market structure and is one main possible source of entry barriers (Bain, 1956; Hall and Weiss, 1967). The pulp and paper industry is highly capital-intensive, so firm size becomes a barrier for the new entrants in the industry and may make exit difficult. Firm size relative to the total size distribution of firms in the industry may increase attainable profitability (Edward, 1949). In the pulp and paper industry, the second aspect suggested by Edward (1949) seems to be more important than the idea given by Bain (1956) and by Hall and Weiss (1967) independently. Firms enter and leave or merge in the pulp and paper industry and no significant effect of entry barriers as a result of firm size may be traced back in the form of increasing concentration (CR4) in the industry. However, larger firms do have bigger shares and higher profitability as a result of economies of scale. Even though bigger firms may not have higher productivity than smaller firms, they certainly do benefit from their size and market power. A lower value of the coefficient of variation for net income also supports the absence of significant entry barriers in the pulp and paper industry during 1960-70. The definition of barriers to entry may differ slightly from industry to industry, but all relate to industry characteristics that place new entrants with smaller assets at a disadvantage compared to the established bigger size incumbent firm in the market (Feeny, 2000).

Firm size showed a strong positive association with net income during the 1970s. The model indicates that a one percent increase in firm size during the 1970s increased profitability by 0.0129 percent. The higher the level of assets a firm has, the more are the chances to earn profits because of economies of scale, the level of integration, market power, and better access to the markets. Firm size is important. In general, the larger a firm, the smaller are the chances for it to be influenced by unfavorable economic situations. Furthermore, bigger firms have more chances to attract investments compared to smaller firms. Average firm size increased drastically to $802.54 million dollars in the 1970s compared to $239 million dollars in the1960s. However, increases in assets not only increased the profitability of most of the firms but also increased their debt/net worth ratios, at the cost of future pulp and paper industry financial performance.

Firm size showed a significant positive association with net income from 1981-1990. The profitability model estimates that a one percent increase in firm size may result in a 0.078 percent increase (in millions) in the net income of the firm. Those firms that have larger assets, are more profitable than smaller firms. Larger firms may have the advantage of economies of scale or power or better access to the market. A larger-scale firm may benefit more from an innovation for cost reduction and may have a better chance to capture a bigger share of the market. Firm size also influences market structure due to chances of higher concentration. From this discussion we may conclude that firm size has an important effect on the profitability of the industry.

The present analysis indicates that firm size and net income had a significant positive association during the 1990. A one percent increase in firm size increased a firm's profitability by 0.004 percent. Firms that have a bigger size in terms of assets are more likely to earn a larger profit because of their advantages over smaller firms. Larger firms may have higher levels of integration, advantage of economies of scale or better access to markets, and advanced technology. Larger firms often spend more on R&D and are more innovative. In the pulp and paper industry, which is a mature industry, cost of production is an important issue. Firms that have lower costs of production are in a better position to compete in the market. Average firm size in terms of assets was about

3371million with a 1.386 percent coefficient of variation, for the firms included for the 1990-98 period (Table 4.7).

5.2.14 Growth (GR)

In this study, growth showed a significant positive association with profitability during the 1960s. A one percent increase in growth resulted in a 0.0069 percent increase in the net income of the pulp and paper manufacturing firm. The average sales growth rate of the pulp and paper firms included in the analysis was about 10.853 percent with a 4.501 percent coefficient of variation. Growth in the pulp and paper sector is more or less tied to the domestic as well as the global economy. A higher demand for pulp and paper in the rest of the world during the 1960s seemed to provide opportunities for the U.S. firms to increase their market share. Growth is the key element for the long-term survival of firms, and it helps firms to use their idle capacity and improve their profitability. However, the growth to profitability relationship is not universal; rather, it depends upon the firm's objective. If a firm is interested in profits it may or may not be implementing a sales growth strategy. But, on the other hand, if a firm is interested in market share it may opt for price penetration or other strategies to achieve the objective of growth. During the 1960s, the U.S. pulp and paper industry had not reached maturity, so growth was an important requirement to remaining in the pulp and paper business. Weiss (1989) also found a significant positive association of net income with growth.

5.3 Differences Between the Mean Income of Firms Producing Tissue Paper and Those Producing Other Grades of Paper

Results shown in Table 5.2 clearly indicate that firms producing tissue paper products from 1960-98 enjoyed higher profitability than firms producing other grades. From 1960-70, tissue paper manufacturers had a mean net income of $24.589 million. Compared to this, the net income of firms manufacturing other grades averaged $9.506 million. This gap widened from 1990-1998, when the average net income of tissue producers was $203.121 million, compared to $66.76 million for other types of paper producers (Fig5.5). The higher profitability of tissue paper manufacturers may be explained in terms of market structure and the profitability approach

The tissue paper industry has the highest four-firm concentration ratio in the paper industry. During 1998, about 68 percent of the market was accounted for by four major producers (PPNAFB, 1999). Historically, the four-firm concentration ratio of the tissue paper industry has been very high, reaching 62 in 1963, the highest among all the grades (Guthrie, 1972). In 1979, five of the industry's top companies accounted for two-thirds of installed capacity with the 10 leading companies accounting for 90 percent (U.S. Department of Commerce, 1980). Virtually all major producers of sanitary products are also large, fully integrated pulp and paper companies that process raw papermaking fibers into pulp and convert it into the final products. A third of all the facilities for tissue paper manufacturing are concentrated in the Northeast (including the Mid-Atlantic and New England regions).

Despite the highest concentration in the pulp and paper industry, the tissue paper industry is intensively competitive and underwent major consolidation in the late 1990s.

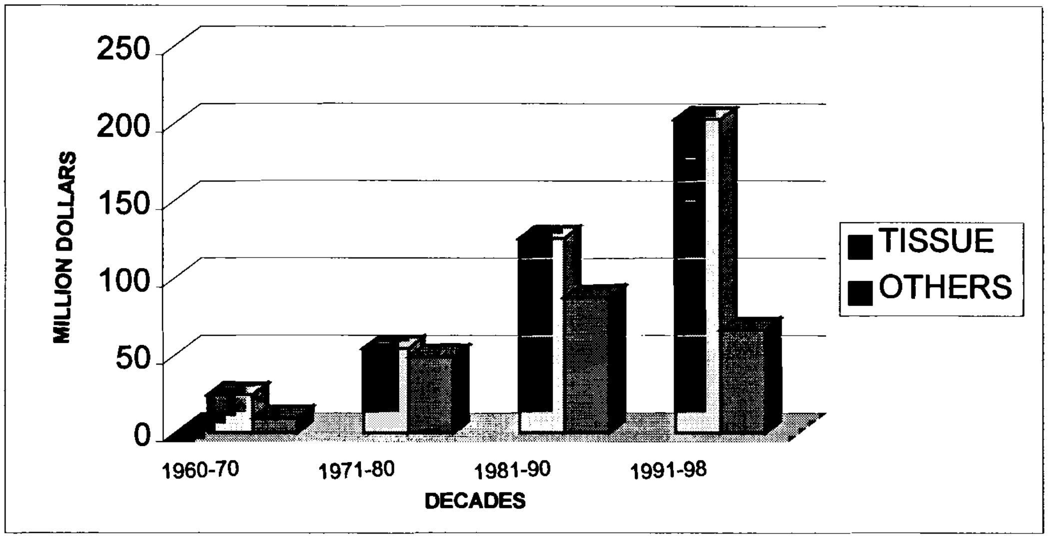

Fig.5.5 Difference among the net incomes of firms producing various grades of paper.

YEAR	TISSUE PAPER		OTHER TYPES OF PAPER GRADES			
	Net Income (million dollars)	CV %	Net Income (million dollars)	CV %	df	t
1960-70	24.589	1.157	9.506	1.834	786	8.76*
1971-80	54.815	1.360	49.506	1.488	665	1.23
1981-90	126.010	1.137	87.925	1.566	579	4.23*
1991-98	203.121	2.112	66.761	2.307	379	3.03*

Table 5.2. Difference between the mean income of firms producing tissue paper and other types of paper grades. * = significant

The question arises, how may an industry at one time have a higher concentration and also be competitive? In fact, although the tissue industry has the highest concentration, none of the four major producers enjoys a market share more than 40 percent of the total market, the concentration level where a producer may use its power to influence the prices. However, individual firms do have significant market power in particular grades. For example, in the facial tissue segment, two firms control more than 84 percent market share; in paper towels three firms have more than 71 percent control; in the bath tissue market, three firms have about 73 percent market share (PPNAFB, 1999). Product market concentration increases a firm's market ability to earn above average profits.

Many other characteristics differentiate the tissue industry from the rest of the pulp and paper industry, including a higher concentration ratio (Fig 5.6), non-cyclic steady growth, highest barriers against foreign entry, inelastic demand, advanced technology, the highest level of product innovation, balanced capacity addition, faster and new machines (Fig 5.7), spending on research and development, and promotional efforts to protect the market share and create an image of an environmentally friendly industry. All these efforts help the tissue producer to earn higher profitability than the other paper products manufacturers. Prices for commercial and consumer tissue paper products are significantly impacted by a number of factors, including raw material costs, industry capacity, operating rates, demand, general economic condition, and product characteristics. Generally, the tissue industry also benefits from the lower prices of pulp

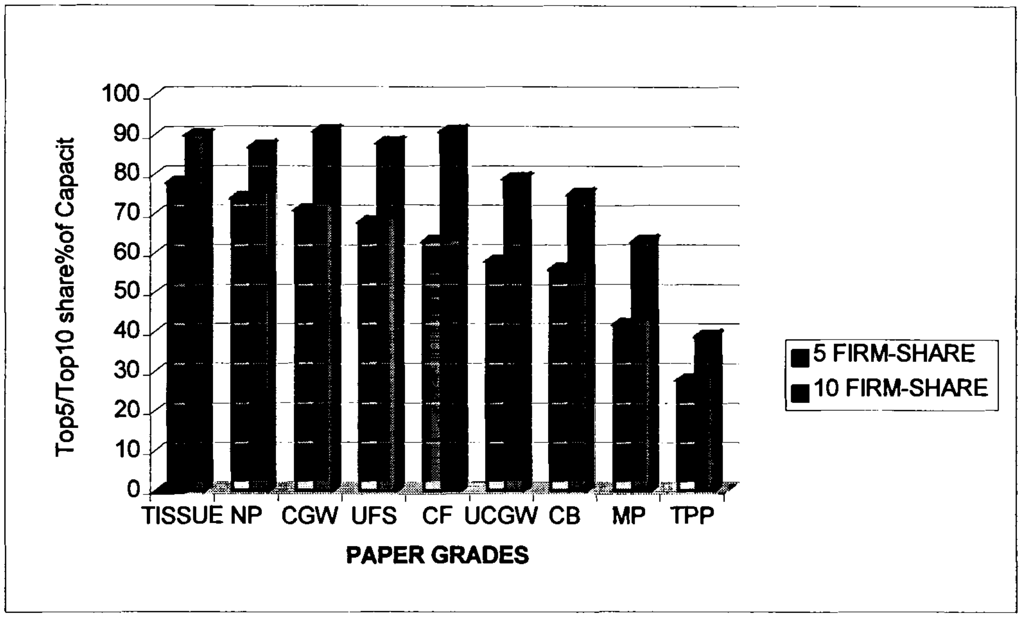

Fig.5.6 Concentration ratios of different grades of paper products in the U.S. pulp and paper industry.

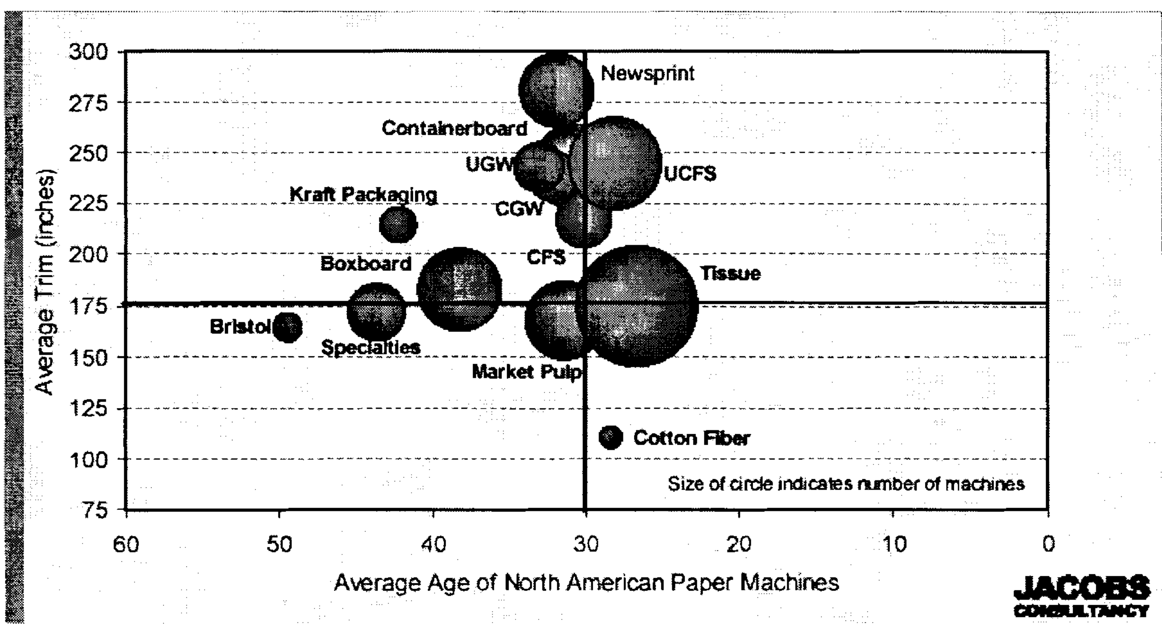

Fig.5.7 Comparison of age of tissue machines with the age of machines manufacturing other grades of paper (Extracted from Jacobs Consultancy)

in the market. In this way, it increases its profitability through cost reduction, paying less for the pulp and charging more for the value-added products.

The manufacturers of tissue and towel products are very interesting from a technology viewpoint. Tissue and towel producers are always striving for new techniques to upgrade quality or reduce cost. This is particularly true in the high-quality grades, where chemical modification, drying, layering and innovative mechanical web modification techniques are employed (PPNAFB, 84-85).

The U.S. tissue industry has been highly active in the export market. In 1979, U.S. exports of all sanitary products exceeded 115,000 tons, valued at $151 million. Major markets included Japan, Saudi Arabia, Mexico, Belgium, West Germany, and Canada. U.S. sanitary paper products exports have been constrained in the past by foreign-based production, especially in the industrial nations of Western Europe and Japan and by the product's generally high bulk, low value shipping characteristic. During 1998, U.S. firms exported sanitary paper products worth $1,069 million. To achieve faster growth, U.S. producers will have to venture into the rapidly growing export market. Developing countries, in particular, may rapidly increase their purchases of sanitary paper products as their increasing wealth and rising sanitary standards drive consumption higher. U.S. producers are well suited to take advantage of the upsurge in demand. Their products are perceived to have the best quality in the world, and the local producers that the U.S. giants will compete with in emerging markets rarely have the product expertise or marketing skill of their new competitors. Demand for tissue paper depends on growth in population, demographic changes, consumer buying and pricing trends, and the specialization of each product to its end use (U.S. Industry and Trade Outlook 1998).

5.4 Factors Responsible for the Survival and Failure of the Pulp and Paper Firms

Table 5.3 indicates the different factors responsible for the survival or failure of the firms during the last forty years. Many firms vanished from the scene because of merger or acquisition activities in the U.S. pulp and paper industry. Those firms that survived during 1960-98 had certain successful strategies that helped them to stay in the business, even in the wake of adverse circumstances and poor financial returns.

All those firms that had negative profitability during 1960-98 showed negative associations with the K-Factor, asset/sales ratio, firm size, growth, market share, capital intensity and operating rates. It is important to note that most of the firms that showed better financial performance had a positive association with firm size, market share and equity/sales ratio. Those firms that were of smaller size, smaller market share, lower equity/sales ratio, poor productivity in terms of operating efficiency and poor relative position compared to their competitors were more vulnerable to the hostile takeovers because of adverse market environment. Although, there were a number of smaller firms

VARIABLES	SUCCESSFUL FIRMS	UNSUCCESSFUL FIRM
Firm Size	Larger	Smaller
Market Share	Appreciable	Not significant
Equity/Sales	Higher	Poor
K-Factor	Higher Side	Lower Side
Growth	Appreciable	Poor
Asset/sales	Lower	Higher
Operating Rates	Higher	Lower
Pulping Process	Chemical (Kraft)	Mechanical, Sulfite
Products	Tissue Paper, Writing and Printing Paper.	Mechanical Paper, Paperb
Research and Development	Appreciable Spending on Product Development	Considered Burden on Firm's Resources
Timberland Holdings	Yes	No
Management Option	Integrated Operation	Absence of Integration in Operation.

Table 5.3. Factors and their possible role in the survival and failure of pulp and paper firms (1960-98)

that were successful in protecting their presence in the market because of their strategic moves, a majority of them could not compete or keep their presence in the market because of a lack of sufficient resources or were unable to implement strategic moves at the right time and became the part of history. From this discussion we may infer that firm size, market share, equity/sales ratio and K-Factor have strong role in the future survival of firms in the pulp and paper business.

CHAPTER 6

MARKET SHARE MODEL (1960-98)

The market share held by a pulp and paper firm from 1960-1998 showed consistent, significant positive association with net income, firm size, and number of units (Table 6.1).The association between net income and market share may be explained on the basis of the structure-conduct-performance (SCP) paradigm (Carlton and Perlof, 2000). Those firms that have higher income have an incentive to achieve economies of scale and integration in operation; both factors also increase the firms' market power and help them to increase their market share. Similarly, firm size helps firms to increase market share because of better chances of access to the market. Those firms that have a higher number of processing units have a higher market share compared to their competitors because of multi-plant economies of scale.

Growth and capital intensity also have a positive association with market share but the association is not statistically significant. Other variables included in the market share do not have consistent relationship, rather their association with market share is influenced by firm, industry and economy- related factors.

The association between market share and profitability is also supported by some earlier studies (Feeny and Rogers, 1999; Ravenscarft, 1983). Size may help a firm to achieve a larger market share if that firm is cost efficient and has economies of scale advantages, better technology, and integrated operations. Similarly, a firm may increase its market share by availing itself of the benefits of multi-plant economies of scale. Market share also raises profit margins on sales increases. Those firms that have higher market

Variables	1960-70	1971-80	1981-99	1991-98
Observations	711	654	567	372
Multiple –R	0.9455	0.8903	0.9767	0.9128
R-Square	0.8940	0.7927	0.9541	0.8333
Adj-R Sq	0.8919	0.7881	0.9529	0.8267
F- test	419.521	174.5755	881.992	127.492
P-Value	0.000	0.000	0.000	0.000
Dep: ln.MS				
Constant	- **		- **	
ln.N.INC	+ **	+ **	+ **	+ **
AVSP/MES		- *		
ln CI				
lnCR4			- **	
ln KF		+ **		+ **
ln FS	+ **	+ **	+ **	+ **
GR			+ **	+ **
TL	- **		- **	+ **
PRI.MIX				+ **
EXP(I)			- **	
NOU	+ **	+ **	+ **	+ **
NOF			+ **	
EXP.FIR	- *	+ **		- **
CR4t-1			- **	

- **= t indicated significant at 5 percent level of significance * = significant at 10 percent level of significance, + = positive effect, - =negative effect.

Table 6.1. Significant variables contributing to the market share of pulp and paper manufacturing firms (1960-98).

share and are leaders in the market, have generally higher capital intensity. (Fox& Company, 2000).

The market share profitability relationship strengthened with the passage of time (Fig 6.1) during the last four decades. This trend clearly shows the increasing competition among the pulp and paper manufacturing firms to improve their profitability.

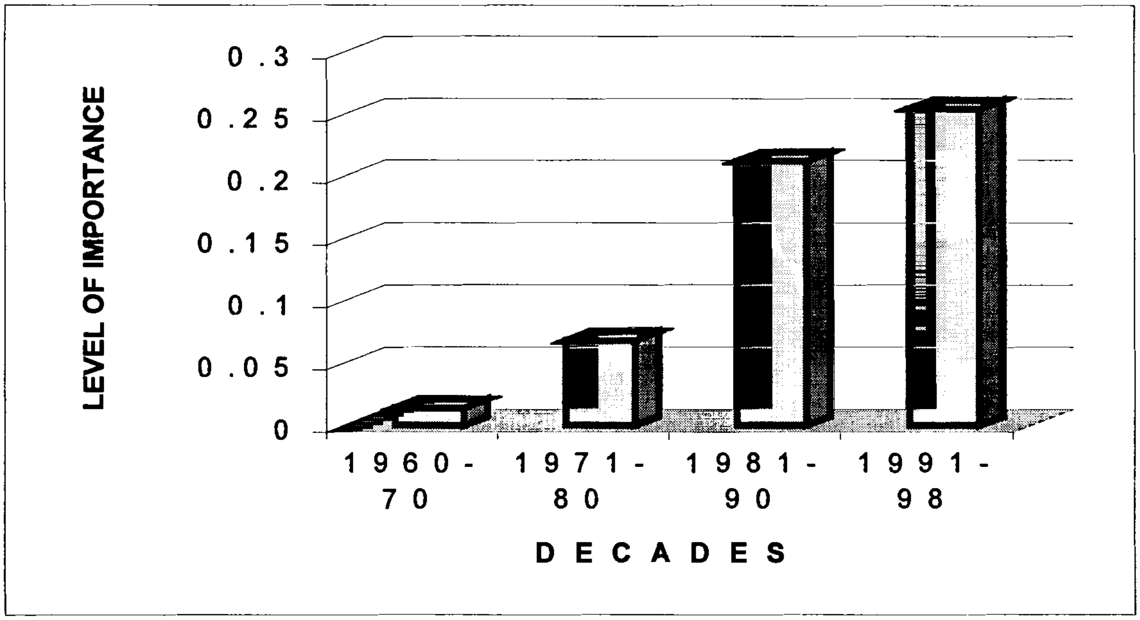

Fig.6.1 Level of importance (Achen, 1982) of market share in the net income of the U.S. pulp and paper firms during 1960-1998.

The market share models for pulp and paper firms from 1960-98 are shown in Table C.1 (APPENDIX-C). The model for the 1960s explains 89.40 percent of the total variation in the market share of the pulp and paper firms included in the study. From the estimates it appears that the variables net income, firm size, and number of units showed significant positive associations with market share while "TL" and "Number of Firms" showed significant negative association.

The market share model for the period 1971-80 explains 79.27 percent of total variation. Net income, the K-Factor, firm size, number of units, and exporting firms showed a significant association with market share, while only the number of firms showed a significant negative association with market share.

The market share model for 1981-90 is shown in Table 6.1. The results indicate that the market share model explains 95.41percent of the total variation in the market share from 1981-90. The variables N.INC, FS, GR, NOU, and NOF showed a significant positive association with market share, while CR4, TL, EXP(I) and CR4t-1 showed significant negative associations.

The market share model for 1991-98 is shown in Table C.1. The model explains 83.33 percent of the total variation in the market share during 1991-98. The model shows a significant positive association between market share and net income, the K-Factor, firm size, growth, timberlands, product mix, and number of units, while it shows a significant negative association only with exporting firms. A detailed discussion about each variable in all the four models in the light of technological, economic, and global context is presented below.

6.1 Net Income (N.INC)

The market share models for all the decades, shown in Table C.1, indicate significant positive associations with net income. However, the quantitative relationship between market share and net income varies from period to period. For example, a one percent increase in net income increased market share of a firm by 0.93, 1.07, 0.168 and 0.144 percent during the 1960s, 1970s, 1980s and 1990s, respectively. Those firms that had a higher income enjoyed a higher market share in the pulp and paper industry. The present findings are in agreement with previous studies in this regard. George, Joll, and Lynk (1991) concluded that there is positive association between profitability and market share. Higher market share as a result of net income may be explained on the basis of the efficiency. Gale and Branch (1982) argued that, while both the four-firm concentration ratio and market share are correlated with a firm's rate of return, the correlation is far stronger for the market share. Actually, efficiency of a firm acts like a link between profitability and market share.

Higher income during the 1960s may have been the result of lower costs of production, achieved by the economies of scale, higher prices, or larger plant size and high market power. Increase in net income during 1971-80 resulted from increased capital intensity, economies of scale, and targeting the exports markets during the 1970s. Increased income impacted conduct and ultimately led to structural changes in the form of market share.

The paper industry chalked up record sales and earnings each year throughout the 1970s. The producer's price index increased by nine percent in 1978 alone, somewhat above the price increase averaged for a sample of representative inputs, excluding fuel costs. In 1979, the price increase in the raw material and labor inputs outpaced the increase in average paper and board prices (U.S. Department of Commerce, 1980).

From 1991-98, average net income and market share of firms decreased compared to net income and market share levels for the 1980s. Simultaneous decreases in net income and market share also provide strong evidence of association between the two variables. During the 1990s, the highest variation in income and market share occurred because of a turbulent economic situation in domestic as well as global economies. A decrease in the market share of pulp-and paper-manufacturing firms was because of increasing imports in the markets due to ahigher dollar value.

Generally, in the commodity market firms try to increase their market share by acquiring new technology, bigger plants, competitive pricing and offering better services to customers. It is hard to define a direct link between net income and market share; rather this link includes economies of scale, input control, and technology and price strategy. Ultimately, all these links increase market share and profitability in the commodity market. One possible explanation may be that the higher income of a firm helps to acquire new technology, bigger plants, input control, and market power and ultimately all these elements increase the market share and profitability of the industry.

The impact of performance (Net Income) on market share may be explained on the basis of the new industrial organization theory, which explains how firm performance impacts conduct and then firm conduct impacts the structure. Those firms that have a higher net income seem to be successful in increasing their market share as a result of their strategies and actions. When firms have higher income, they spend on R&D, try to increase their size through merger, acquisition, or internal growth, and increase their market share by investing in cost reduction technologies and taking advantage of the benefits of economies of scale. Those firms that have lower income are unable to compete in the market. Elements that influence firm performance include price, productivity efficiency, allocative efficiency, equity, product quality, technical progress, and profits. All of these elements, individually or collectively, influence the conduct of the firm in areas such as advertising, research and development, pricing behavior, plant investment, legal tactics, product choice, collusion, and merger and contracts. The conduct of a firm influences the structure of the industry. Major elements of structure are number of buyers and sellers, barrier to entry of new firms, product differentiation, vertical integration, and diversification (Carlton and Perlof, 2000).

6.2 Firm Size (FS)

The market share model indicates a consistent, strong, positive relationship between firm size and market share for all the periods. However, the extent of association between market share and firm size varies from one decade to another. A one percent increase in firm size increased market share by 0.86, 0.45, 0.81, and 0.38 percent during the periods 1960-70, 1971-80, 1981-90, and 1991-98 respectively. Firm size relative to the total size distribution of the firm may increase attainable profitability through increased market share. Normally, larger firms use technology, cost advantage, prices, vertical integration, control on inputs, innovation, and better access to the markets and financial institutions for credit, or any other advantage to increase their market share. A firm may increase its size by expanding through investment, such as building new plants or by means of a merger (Carlton and Perlof, 2000).

Firm size has many effects. These effects include market power through increased market share, efficiency, and economies of scale. Big firms gain market power through increased market share. The larger the size of the firms in terms of assets, the higher is the probability that a firm will try to own larger than MES plants to achieve a lower cost production status in the market and capture the maximum possible market share. Big firms, because of their market power and size, squeeze smaller firms. Contrary to this, smaller firms have limited chances to increase their market share because of lack of market power.

In the pulp and paper industry firm size acts as a barrier to new entrants, as a source of market power in different grades, and as an ever-applied tool to reduce the production costs in paper manufacturing.

6.3 Timberlands (TL)

The market share model showed an inconsistent relationship between market share and timberland ownership. Market share was negatively associated with timberland ownership during the 1960s and 1980s and a positive but insignificant association between market share and timberland ownership occurred during the 1970s. However, there was a strong positive relationship between market share and timberland ownership during the 1990s.

A significant negative association between market share and timberlands may be explained on the basis of this judgment that during 1960-70, pulpwood cost may not be have been a dominating or deciding factor in market share. Other factors like firm size, economies of scale or technology might have played an important role in increasing market share. Market share is related to efficiency of the firm in a particular field of interest. Here, several questions arise regarding the negative association between market share and timberland ownership. First, do the timberland assets of a firm generate an appropriate advantage to capture enough market share? Second, were those firms that owned timberlands fully capable of making financial differences in terms of pulpwood costs (including harvesting and transportation costs) at that time? The level of integration, pulping technology, and health and productivity of the timberlands are also important factors that enhance the firm's capability or advantage to capture increased market share through cost reductions on the basis of timberland ownership. Because most of the firms during the 1960s were of smaller size, they were unable to fully utilize their timberland resources to increase market power. Furthermore, a firm's level of technology is the most important factor in the forest products industry to harvest the benefits of timberland ownership, because a low cost fiber producer and supplier at the mill gate may not be a low- cost pulp and paper producer (Stove and Louis, 1992)

Results shown in Table C.1 indicate that from 1981-90 timberlands had a significant negative association with market share. This negative association may have been due to an increasing use of recycled paper (PPNAFB, 1999; Zhang, Buongiorono and Ince, 1996), an increasing supply of timber due to overharvesting because of high mortality rates (Powel et.al, 1993) and a decline in demand for wood chips in export markets from 1981-90. Recycled fiber became an attractive raw material for paper manufacturing due to increasing environmental moves against pollution and tree harvesting, particularly from natural growth areas.

From 1991-98, the attractiveness of timberland ownership increased because of market wood supply constraints (PPNAFB, 1999). This gave new inspiration to the pulp and paper firms to improve forest management in order to receive maximum return from their investments. The market share model for 1991-98 describes a significant positive association between a firm's market share and timberland ownership. A positive association between market share and timberland ownership may be explained on the basis of the fact that firms holding timberlands have wood cost advantages over competitors that are not managing timberlands for fiber supply. Lower costs of production, which stems from lower wood cost, help the firms increase their market share.

6.4 Number of Units (NOU)

The market share model indicates a consistent strong positive association between the number of units or facilities a firm had and its market share during 1960-98. However, the association between " number of units" and market share was influenced by a number of factors related to the firm itself, the industry, and the domestic and global economy. A one percent increase in the number of units was associated with an increase in a firm's market share by 2.5, 2.19, 2.34 and 2.58 percent during the 1960s, 1970s, 1980s and 1990s respectively. These outcomes are in accordance with expectations. If a firm has more production facilities in different locations, there are chances that the firm may be benefiting from its locations in capturing market share. Firms owning more than one unit may be realizing the multi-plant economies of scale and may use it to increase their market share. Firms that operate multiple plants, have greater flexibility in serving different customer groups than those firms that have only one plant. Flexibility in multiple operations helps firms to acquire higher market share.

In the pulp and paper industry, there are many varieties of paper products, and each product has a distinct product life cycle. Firms try to extend the life cycle by innovation or by finding new markets within the country and abroad. Firms that produce various grades are less vulnerable to the business cycles. Sales of multiple products help firms to increase their market share because of multi-product and multi-plant economies of scale and scope.

George, Joll, and Lynk (1991) argued that high concentration is associated with multi-plant operations, which is difficult to justify by reference to technical economies of scale. According to them, multi-plant operation is particularly important in industries with high firm concentration ratios and is more marked in the U.S.A. than Europe.

6.5 K-FACTOR (KF)

The results shown in Table 6.1 show a significant positive association between the K-Factor and market share, indicating significant changes in the relative capacity of the firms and an increase in e concentration from 1971-1980 and 1991-98. A one percent increase in the K-Factor was associated with 0.2443 and 0.2276 percent increases in a firm's market share during the 1970s and the1990s respectively. Increases in capacity improve a firm's position in the overall industry. Higher capacity helps firms to increase their market share because of economies of scale and increased market power.

The K-Factor is very sensitive to any change in the firm's position in the overall industry or possible structural changes as a result of changes in the concentration ratio. From 1970-80, the K-Factor averaged 0.398, with a 1.196 percent of coefficient of variation, which was higher than the average K-Factor value for the previous decade (Table 4.5). This shift indicates structural changes and changes in the concentration level of the industry. Firms use their position to increase their market share, which is proxy for market power. The K-factor helps to evaluate a firm's position compared to a competitor's strength in terms of market share.

Because there was a small increase in the capacity of U.S. pulp and paper firms, the relative position of most of the firms improved in the overall industry during 1991-98. Furthermore, there was an increase in the four–firm concentration ratio of the U.S. pulp and paper industry during 1991-98 as a result of extensive merger and acquisition activities. Both factors, the relative position of the firm in the industry and the increase in concentration, increased the K-Factor to 0.718. Given these structural changes a positive association between market share and K-Factor is not unexpected.

Market share is more important to businesses when buyers are fragmented rather than concentrated. It is believed that market share leadership that is achieved on the basis of price is less significant than leadership that is achieved by quality, convenience, proprietary technology, exclusivity, nichemanship, or other marketing levers (Fox and Company, 2000).

6. 6 Number of Firms (NOF)

The higher the number of firms, the lower is the market share for any one firm if there is no change in market size. The market share model found a significant negative association between the number of firms and market share from 1970-80. The average number of firms from 1971-80 was estimated as 399 with a 0.021 coefficient of variation. These results are in accordance with expectations. From 1971-80, average market share increased from 1.417 percent to 2.363 percent while the number of firms decreased from 465 to 299. An increase of one firm in the market from 1971-1980 was associated with a reduction in market share of firms by 0.0248 percent.

Generally, the negative association between market share and number of firms in the market is logically valid if the market demand remains constant. But if the demand increases and the market is profitable, then new firms may enter the market, and there is a possibility of increasing market share even if the number of firms in the market increases. The market share model indicates that an increase in the market share resulted from an increasing number of firms from 1981-1990. These extraordinary results find explanation only in the light of an increasing demand hypothesis. These are not expected results.

6.7 Exporting Firms (EX.FIR)

The market share model for 1971-80 indicates a significant positive association between exporting activities and market share. Pulp and paper firms targeted the export market by using the technical superiority achieved during the 1960s. Those firms that exported also enjoyed the benefits of economies of scale in the domestic market. No direct impact can be explained, but there is an indirect impact of export markets on domestic market share. Because the U.S. dollar was high from 1991-98, the U.S. imported cheaper paper from around the world. The market-share model describes this situation by indicating a significant negative association between exporting firms and market share.

6.8 Concentration Ratio (Cr4)

The market share model found a significant negative association between the concentration ratio and market share. A one percent increase in the concentration ratio of the industry was associated with a 0.95 percent decrease in market share from 1981-1990. It appears that larger firms, which have market power, were in a position to impact the market share of smaller firms. The average pulp and paper industry concentration ratio for 1981-90 was estimated as 30.137. Bigger firms have the advantage of economies of scale and lower costs of production and use these elements to increase their market share at the cost of smaller firms, which do not have such advantages.

6.9 Growth (GR)

The market share model shows a significant positive association between sales growth of the firm and market share for the 1980s and 1990s. If the market is expanding and sales are growing, a firm will try to acquire such technologies as may reduce their production costs and help in increasing their market share. Growing markets provide better chances for the firms to increase their market share. The market share model suggests that a one percent increase in the sales growth was associated with 0.12 and 0.20 percent increases in a firm's market share from 1981-90 and 1991-98 respectively. The average growth rate of the firm during 1981-90 was estimated to be 9.749 percent with a 2.354 percent coefficient of variation. The average sales growth declined slightly for 1991-98. It was estimated at 8.117, percent with a 4.241 percent coefficient of variation (Table 4.7)

Higher growth rates create more chances for firms to increase their market share in an expanding market. Only those firms that have any sort of advantage may benefit from the growing market. These advantages may include technology, innovation, and market power. Generally, firms with higher productivity and profitability expand through economies of scale, giving them some level of competitive advantage over less productive/profitable enterprises. Firms must constantly expand and upgrade their capital and production levels so that they can sell enough to keep expanding and upgrading their capital for the sake of production.

6.10 Exports (EXP)

The market share model indicates a significant negative association between exports and market share from 1981-90. The negative association between exports and market share reveals that firms are not benefited in domestic market share as a result of increasing or decreasing volume of exports. Exports impact profitability, but not domestic market share.

6.11 Lagged Concentration (CR4t-1)

There was a significant negative association between lagged concentration and market share from 1981-90. Firms that had a higher market share in terms of concentration influenced the current market share. From these results, it appears that bigger firms in the past also influenced the market share of smaller firms. An increase of one percent concentration in the past was associated with a 1.8 percent reduction of current market share among pulp and paper firms.

6.12 Product Mix (PRMIX)

The market share model indicates a significant positive association between market share and product mix for 1991-98. Manufacturing of multiple-products creates better chances for a firm to serve various market segments and to increase its overall market share. Furthermore, firms have the advantage of multi-product economies of scope. According to the market share model, a one percent increase in product mix was associated with a 4.8 percent increase in a firm's market share from 1991-98.

CHAPTER 7

TIMBERLAND MODEL (1960-98)

This chapter deals with timberland ownership and management decisions of pulp and paper manufacturing firms from 1960-98 (Table7.1). An ordinary least squares model was used to evaluate factors that impact a firm's decision to own and manage timberlands. The dependent variable was timberland holdings of pulp and paper firms. Independent variables included net income, equity/sales ratio, mergers, number of units, product mix, geographical distribution, firm size, new supply/RGDP, K-Factor, growth, foreign exchange rates, firm capacity, and the four-firm concentration ratio. Results indicate that net income, the equity/sales ratio and the K-Factor have consistently significant, positive associations with timberlands. The level of association and sign of other variables change with the firm, industry, and economy-related environment. The attractiveness of timberlands remained high from 1960-80 because of increasing pulpwood costs. However, timberland attractiveness was negatively impacted by the increasing use of recycled paper and increasing wood supply from small private woodlands (Powell et al,1993), as well as poor demand for wood chips in the international market during 1980-90. There were some changes in the ownership of bigger firms during this period. However, the attractiveness of timberlands again increased after 1990 due to pulpwood supply constraints in certain regions. On the basis of these results, it may be concluded that pulp and paper firms will continue taking interest in timberlands because of expected net income from the timberlands and achieving pulpwood cost reduction benefits in order to remain competitive in the pulp and paper business.

Independent variable	1960-70	1971-80	1981-90	1991-98
Observations	753	657	576	370
Multiple R	0.834051	0.896191	0.8849	0.837074
R-Square	0.695642	0.803157	0.783147	0.700693
Adj-R Square	0.69028	0.799178	0.778131	0.6897
F-test	129.9275	201.813	156.124	64.1086
p-value	0.000	0.000	0.000	0.000
Dependent Variable= TL				
Constant	- **		+ * *	
ln.N.INC	+ **	+ * *	+ * *	+ * *
ln.ES	+ * *	+ * *	+ * *	+ * *
MEG	+ * *			
NOU			+ * *	- * *
PRIMIX		+ * *	+ * *	
GD			- * *	
lnFS	+ * *	- * *	+ * *	
NEWSUPPL/RGDP		- * *		
KF	+ * *	+ * *	+ * *	+ * *
GR		+ * *	- * *	+ * *
ln FEXR				
ln.FC	- * *	- * *	- * *	
lnCR4	- * *	- * *	- * *	

- **= t indicated significant at 0.05 percent significant level. + = positive effect, - = negative effect.

Table 7.1. Significant variables in the timberland ownership models (1960-98)

TIMBERLAND MODELS (1960-98)

The Timberland model for 1960-70 is shown in Table 7.1. According to the statistical characteristics, the model is capable of explaining 69.03 percent of the total variation in the timberland holdings owned and managed by pulp and paper firms from 1960-70. The model indicates a significant positive association between timberland holdings and Net Income (N.INC), Equity/Sales ratio (ES), Mergers (MEG), Firm Size (FS), the K-Factor (KF) and a significant negative association with Firm Capacity (FC) and the Four- Firm Concentration Ratio (CR4).

The timberland model for 1970-80 explains 80.31 percent of the total variation in the timberland holdings during 1970-80. The timberland model shows a significant positive association between timberland holdings and net income, equity/sales, product mix, K-Factor and growth and a significant negative association with firm size, New SUPPL/RGDP, firm capacity, and concentration ratio.

The timberland model for 1981-90 has the power to explain 78.31 percent of the total variation in the timberland holdings. The model shows a significant positive association with net income, the equity/sales ratio, number of units, product mix, firm size and the K-Factor, while it shows a significant negative association with geographical distribution, growth, firm capacity, and the concentration ratio.

The timberland model shown in Table 7.1 has the power to explain 70 percent of the total variation in the timberland holdings from 1990-98. The model shows a significant positive association between timberlands and net income, equity/sales ratio, the K-factor, and growth. The number of units showed a negative association with timberland holding during 1990-98. A detailed discussion about each variable follows.

7.1 Net Income (N.INC)

The timberland models shown in Table D.1 (APPENDIX D) indicate a consistent and significant positive association between timberland holdings and Net Income during 1960-98. A one percent increase in net income was associated with 0.031, 0.012, 0.0024 and 0.0026 million acre increases in the timberland ownerships during the 1960s, 1970s, 1980s and 1990s respectively. These results are in accordance with expectations. From these results, it appears that net income is a primary objective of maintaining timberlands (Hungerford, 1969; Zinkhan et.al 1992; Crossely and Jonathan, 1998). The rate of return can be favorable in certain circumstances but, regardless of how favorable, the rate of return alone remains insufficient to explain the patterns of forest holdings (Yin et. al, 1997; Zinkhan, 1988). Explaining about the benefits of holding timberlands, Clephane and Caroll (1982) argued that timber resource ownership is a critical component in the financial success of most companies in the integrated forest products and pulp and paper businesses. Michaelis (2002) suggested that private firms must effectively meet one primary goal--generate a profit. According to him, private firms may increase timber production by 50 percent if lands are managed intensively.

The economic reasoning behind an ownership decision is that wood cost is about 21 percent of the total cost of paper manufacturing. However, the cost of wood may vary from product to product based on yield and pulping processes. McNutt (2002) emphasizes the importance of wood cost in pulp and paper manufacturing. According to him timber is the largest cost, and paper firms have historically devoted enormous amounts of capital to the ownership and management of secure timber resources. Lamberg (2001) refers to John Guthrie's (1972) view about the importance of wood cost.

According to him, low cost of wood gives a predominant advantage in every region. Cheap labor, power, and fuel cannot offset the disadvantage of high pulpwood costs. The importance of raw material reflects on the average cost structure of paper producers during the 20th century: wood, power, and fuel have made up almost 30 percent of total costs.

In addition to this, timberland ownership helps a firm to maintain secure fiber flows and more stable cash flows (Yin, Harris, and Izlar, 2000). Timberlands are a source of strength for the pulp and paper firms when prices of the final products are poor and profit margins decline. Pulpwood supply from fee lands may help firms to successfully absorb business cycle shocks. Furthermore, pulpwood supply from fee land increases a firm's ability to compete in the market on the basis of lower cost of production.

In a mature market, firms have only two options--finding new markets to increase sales or reducing manufacturing costs by using cheaper raw material or other cost reducing strategies. Firms owning timberlands have a cost advantage over those firms that do not. Firms may further reduce costs of production by establishing mills near the forest, using advanced harvesting technologies, and utilizing waste wood and bark as a source of energy. Binkley (1981) emphasized that self-sufficiency in wood resources is an important determinant of after-tax earnings, particularly in an era of rising timber prices. The strategies of companies focusing on forest ownership and management are likely to be driven by geographic diversification, globalization, returns to scale in forest management, consolidation of local timber markets, extraction of the other natural resources on the land, and the relationships with the environmental movement (Sande, 2000).

Gilligan (1973) studied the increased attractiveness of timberlands during the 1970s. According to him, the prices of timberland in many regions increased at rates almost completely unrelated to the economics of growing timber. Land prices had increased faster than timber prices since 1950. Land prices in the North increased primarily because of recreational demand, while land prices in the South increased because of the high concentration of wood-using industries in that area.

The Environmental Defense Fund (1995) stated that forest products companies manage the land to produce sawtimber and pulpwood for mills as a part of a broader objective to minimize total procurement cost. Forest products companies have significant capital investment in processing facilities with high fixed costs. A fiber shortage can be very costly if mills are forced to work at less than full capacity.

7.2 Equity/Sales (ES)

There was a strong positive and consistent relationship between timberland holdings and the equity/sales ratio from 1960-98. A one percent increase in equity/sales ratio was associated with 0.0014, 0.0018, 0.0032 and 0.0014 million acre increases in timberland ownerships during the 1960s, 1970s, 1980s and 1990s respectively. Increases in sales volumes also increase the equity of the firm. The better is the financial health of a firm, the more are the chances that a firm will try to achieve backward integration for a secure supply of raw material for the process. These results confirm that those firms that have better financial health are keeping and managing timberlands. Whenever a firm's financial performance is poor, management often tries to cash in the timberlands in order to escape a bad situation, even though the firm's poor performance is usually due to poor manufacturing or organizational decisions and not because of timberlands. Forest

Systems (2002) explains the reasons behind the selling of the timberlands by pulp and paper firms. According to Forest Systems, most of the companies were facing pressure to boost sagging shareholder returns, while others needed cash to fund new, federally mandated water and air pollution abatement efforts. In short, the timing was right for institutional investors to become timberland owners.

Owning timberland is an important, valuable option for forest products firms to remain competitive in the pulp-and paper-manufacturing business. Although there has been a slight decline in timber assets owned by the major companies, timberland held by the entire forest industry has expanded to over 70 million acres. It also appears that, given the existing industry characteristics, holding timberland as an integral part of the overall operations is an important option for success (Yin et al, 1998).

A significant positive association between the equity/sales ratio and timberland holdings from 1971-1980 may be explained on the basis of an increasing interest of pulp and paper firms in export markets. During this period, the average net income of the firm increased as a result of exports. Those firms that had higher sales also increased their equity. Profitability increases the attractiveness of timberland holdings. There was a drastic increase in wood cost due to inflation. Higher pulpwood costs increased the attractiveness of timberlands. When pulpwood prices are high, pulp and paper firms harvest more from their own timberlands in order to remain competitive.

The timberland models also showed significant positive associations between the equity/sales ratio and timberland holdings during 1981-90 and 1990-98. Better consistent financial performance of the firm was one of the top incentives for a firm to own and manage timberlands. Better performance encourages the firm to further increase its profits by using cheaper inputs to stabilize earnings (O'Laughlin and Ellefson, 1982; Ellefson and Stone, 1984).

7.3 Mergers (MEG)

Mergers have shown a significant positive association with timberland holdings during the 1960s. In the past, larger pulp and paper firms, trying to have maximum control over the wood supply in particular area, have acquired smaller firms that owned and managed timberlands. Often, acquiring firms were more interested in the smaller firm's wood resources than in their manufacturing operations. The present study is consistent with this historical observation. The highest level of merger activity took place in the pulp and paper industry during the 1960s (O'Laughlin and Ellefson, 1979). Many firms also shifted this raw material resource in the form of market pulp to other regions where demand was high enough. Generally, firms merge horizontally to increase their size and merge vertically to control the cost in the same area. But, mergers for timberland may be considered as either strategic or a means to increase firm size and also to cut cost by ensuring a sustained supply of raw material.

7.4 Firm Size (FS)

According to the timberland model, firm size showed a strong positive association with the timberland holdings from 1960-70. This suggests that bigger firms supported their mill operation by securing supplies of pulpwood from fee lands. A one percent increase in the firm size was associated with an increase in timberland ownership by 0.0015 million acres during the 1960s.

The timberland model shows a significant negative association between firm size and timberlands during the 1970s. Because significant technological advancement in wood harvesting and utilization were made during the 1960s, possibly that resulted in a decrease in the pulpwood/ton of final paper products. In this situation, no doubt firm size increased because of an increase in the assets required for modernization, but there was no increase in the derived demand for pulpwood. The negative sign on the coefficient of firm size more or less explained that situation. Pulpwood consumption/ton of paper manufactured dropped from 1.30 cord in 1970 to 1.25 cords in 1980 as a result of technological advancement. These statistics support the model outcome in this regard. A one percent increase in firm size was associated with a decrease in timberland ownership by 0.00036 million acres during 1970s.

There was a significant association between firm size and timberland holdings from 1981-90. Generally, as firm size increases as a result of growth, firms try to have more control over the raw material. Larger pulp and paper firms always try to have more power in the market, which stems from economies of scale, technology, and timberlands. All three factors reduce production costs. A one percent increase in firm size was associated with an increase of 0.00074 million acres in timberland ownership during the 1980s.

7.5 K-Factor (KF)

The K-Factor showed a strong and consistent positive association with the timberland holdings from 1960-98. A one percent increase in the K-Factor was associated with an increase in timberland ownership of 0.0158, 0.0246, 0.0296 and 0.018 million acres during the 1960s, 1970s, 1980s, and 1990s, respectively. It appears that a firm's option to own and manage timberland is strongly associated with the firm's position in the industry and the industry structure. This means that a firm's capacity (Ohanian,

1993) and the structure of the industry are the important factors in making decisions about owning and managing timberlands. The higher a firm's position in terms of capacity in the industry, the greater are the chances that the firm will opt to own and manage timberlands. This means that timberland is a source of power in the market. This power comes from a firm's relative position in the industry, oligopolistic structure, and timberlands. From this discussion we may conclude that owning and management of timberlands is a strategic decision (Tedder, La Mont and Bruner, 1987; Binkley, 1981) for the firm that stems from its strength in the market and industry structure. Timberland ownership helps a firm to achieve sustainable profits and growth through integration and cost reductions (Clephane, 1978; Binkley, 1981).

7.6 Firm Capacity (FC)

The timberland model showed significant negative associations between timberlands and firm capacity for all three decades except for the 1990s, when it was positive but an insignificant association. These are unexpected outcomes. Perhaps the K-Factor, which also uses the firm capacity as an interaction factor, suppressed the role of firm capacity in the model, because both variables compete for the same dependent outcome.

7.7 Concentration Ratio (CR4)

The timberland model shows a significant negative association between timberland holdings and concentration ratio consistently for all the decades except the 1990s. Because the K-factor involves an interaction with the firm's capacity and concentration ratio, both may compete for the same dependent variable. As a result, the concentration shows a negative sign because the interaction factor is stronger than the concentration ratio.

7.8 Product Mix (PRMIX)

Multiple-products showed a significant association with timberland holdings from 1971-80. When prices are low and demand for pulp and paper products is poor in the domestic market, manufacturers of multiple-products always perform better than single product manufacturers. It is not necessary that demand for all paper products be poor at the same time. The timberland model successfully captures the variation in the timberland holding as a result of changes in the product mix.

The timberland model shows a significant positive association between product mix and timberlands for 1981-90. The higher the number of products a pulp and paper firm manufactures, the greater are the chances that the firm will think about backward integration. A firm manufacturing multiple-products may enjoy the benefits of multiple-products economies of scale. A reason behind the positive association of product mix and timberland is that a firm manufacturing more than one product wants to reduce the risk of insufficient raw material supply. Because of the technological advancement in the pulp and paper industry, pulpwood per ton of paper product has declined from over 3 cubic meter/metric ton in the 1960s and 1970s to the current level of 2.3 cubic meters/metric ton. Although pulpwood demand/per ton of paper has decreased, total consumption of fiber raw materials in pulp and paper is projected to increase in the future with a resultant increase in supply and consumption of pulpwood (Ince, 1998).

7.9 New Supply/ RGDP (NEWSUPPL/RGDP)

Because of inflation and the oil embargo, the U.S. economy was not in good shape and this badly influenced paper consumption in the US during the 1970s. The model fully captures the impact of the economic downturn on paper consumption and shows a significant negative association between new supply/RGDP and timberland holdings. When the demand for pulp and paper is poor, those firms that have business in the domestic market find it difficult to own and manage timberlands.

7.10 Growth (GR)

There was significant positive association between growth rate and timberland holdings from 1971-80 and 1990-98. Fast growing pulp and paper firms need more wood so these firms prefer to own and manage the timberlands (Clephane, 1978). Sales growth brings profitability, and profitability helps the firms invest into backward integration. In a commodity business like pulp and paper, sales growth is necessary to remain competitive.

Timberlands had a significant negative association with growth from 1981-90. It is an unexpected result and has limited explanation. However, one reason of this negative association between growth and timberlands may be due to comparatively lower growth in sales in the decade. Lower growth certainly impacts the attractiveness of the timberlands.

7.11 Number of Units (NOU)

Multi-plant operations had significant positive associations with timberlands from 1981-90. Firms owning multi-plant operations are keener about the sustained supply of raw material. Multi-plant operation and availability of cheaper raw material may help firms to improve their profitability. In the simplest multi-plant case, a firm could add one plant after another as it grows. If there are economies of scale in firm-level activities, the successive plants could be added at decreasing average cost. If there is an abundant supply of raw material in one area, a firm could transfer these resources in a processed or semi-processed form to the other regions. A firm can better utilize harvesting skills in other regions. The same harvesting machines may be used in other localities after completing the task in one region. In the light of this discussion, we may conclude that a firm having multi-plant operations can benefit more from timberlands than single plant operations can. If a firm has timberlands in the area, then it may influence pulpwood prices. As a big buyer of pulpwood, a firm or firms may have some power to influence the pulpwood prices in the area. Murray (1995) studied market power in both the pulpwood and sawlog markets in the U.S.A. His results suggested that the U.S. pulpwood market, as a whole, is more oligopsonistic than the sawlog market, although both markets were closer to perfect competition than to monopsony.

It is believed that the higher the number of production units a firm has, the greater are the chances that the firm may be managing and owning timberlands. But, such a relationship did not seem to prevail from 1990-98. Because of poor performance, most of the companies shut down their high cost plants in different regions. Closure and sales of pulp and paper plants left a negative impact on the management of the timberlands attached with those plants. The model successfully captures such a situation and shows significant negative association between timberlands and number of units from 1990-98.

7.12 Geographical Distribution (GD)

The timberland model shows a significant negative association between geographical distribution of firms and timberlands for 1981-90, indicating a specific trend toward owning timberlands in particular areas. The attractiveness of timberland for particular areas may be due to the distribution and density of species, growth rates, harvesting conditions, and the suitability of the species for a firm's products and operation.

7.13 Joint Summary

From the results shown in Table 7.1, it appears that net income, the equity/sales ratio and the K-Factor have shown a consistent significant pattern in explaining the total variance in the timberland ownership and management option of pulp and paper firms. Both net income and the equity/sales ratio reflect the financial and operational health of a firm. From this we may conclude that most of the pulp and paper firms own timberlands to increase their net income through pulpwood cost reduction. The higher the net income or equity/sales ratio, the greater are the chances that a firm will think about purchasing and managing timberlands. The opposite is also true. If the financial health of the firm is poor, it will opt to "demonetize" timberland assets to reduce the pressure. Higher equity, as a result of increasing sales, is another important feature that has a strong impact on a firm's decision to own and manage the timberlands.

The K-Factor, which is an interaction between the relative capacity of the firm in the overall industry and the concentration ratio, also has strong associations with timberland holdings. As a firm's position relative to the industry improves in an oligopolistic industry structure, firms try to own and manage timberlands. Indirectly, a firm's capacity is also an important factor playing a significant role in making decisions about timberland ownership and management. In addition to the above-mentioned factors, mergers, number of units, product mix, firm size, and sales growth are also key elements in firm's decision making regarding timberland ownership and management.

CHAPTER 8

STRUCTURAL CHANGES IN THE PROFITABILITY OF PULP AND PAPER FIRMS

8.1 Analysis

Structural change in the context of regression analysis is indicated by a change in one or more regression coefficients (Broemeling. and Hiroki, 1987). In this study the Chow test (Chow, 1960; Johnston,1984) was used to test the null hypothesis that no structural changes in profitability took place during 1960-70, 1971-80, 1981-98. This method uses restricted and unrestricted residual sums of squares and the F-distribution to test the hypothesis

F={{SSE (Pooled)-(SSE1+SSE2)}/K}/{(SSE1+SSE2)/(T1+T2-K1-K2)},

Where

K= the number of independent variables in each equation, excluding the intercept term,

T1= the number of observations in the profitability model for period 1,

T2= the number of observations in the profitability model for period 2,

K1= the number of independent variables in period 1,

K2= the number of independent variables in period 2.

From the results shown in Table E.1 (APPENDIX E), it may be concluded that significant structural changes in profitability took place during 1960-80, 1971-90 and 1981-98 because of tremendous changes at both firm and industry levels during the last forty years. In addition to the firm and industry-related factors, domestic and global economic trends also left significant impacts on the profitability of U.S. pulp-and paper-manufacturing firms. Closset (1998) concluded that three key forces have been driving changes in the U.S. pulp and paper industry: globalization, capital intensity, and economic performance.

In order to test changes in the regression slope of each variable in the model, the following approach was used.

T= (b1-b2)/{SQRT(variance b1+variance b2)}

T values greater than 2 indicate significance at the 5 percent level. Detailed results about beta shifts are shown in Tables E.2, E.3, E.4, and E.5 (APPENDIX E).

Variables that significantly influenced the profitability of pulp and paper manufacturing firms from 1960-70 were USADV, FEXR, OPRT, PRIIND, NEWSUPPL/RGDP, E/S, MS, TL and FS. Variables that indicated significant structural changes during 1971-90 were USADV, OPRT, NEWSUPPL/RGDP, E/S, AS, MS, TL and FS. From 1981-98, KF, E/S, A/S, and FS showed significant structural changes as a result of changes in firm, industry, and economy-related factors that persisted at that time. From the results it appears that KF, PRIIND, E/S, MS and FS were associated with significant structural changes during 1960-70 and 1990-98.

The capacity addition trends of U.S. pulp-and paper-manufacturing firms indicate that firms tried to increase the size of mills and machines to improve their profitability. However, this move limited the ability of smaller operations to compete. During the whole span of this study, rising energy, fiber, and environmental compliance costs badly impacted the profitability of the pulp-and paper-manufacturing firms. Many of the smaller, non-integrated firms left the industry. In this way, all those efforts that were made to improve the profitability of the firms more or less resulted in structural changes in the pulp and paper industry. U. S. pulp-and paper-manufacturing firms must consider the importance of these factors in designing future global strategies. Detailed information about the role of each variable in impacting the profitability in all of the four decades is shown in tables E.2, E.3, E4 and E5 in APPENDIX E.

Dep: ln.N.INC

Variables	1960s-1970s	1970s-1980s	1980s-1990s	1960s vs1990s
Constant	**	**		
lnUSADV	**	**		
ln FEXR	**			
ln OPRT	**	**		
KF			**	**
EXPFIR				
PRIIND	**			**
AVSP/MES				
NEWSUP/ RGDP	**	**		
lnES	**	**	**	**
lnAS		**	**	
Ln CI				
lnMS	**	**		**
TL	**	**		
FS	**	**	**	**
GR				

•

- **=t indicated significant structural change at 5 percent significance level.

Table 8.1. Structural changes (b-shift) in the profitability of the US pulp and paper firms (1960-98).

8.2 Structural Changes in the Profitability of U.S. Pulp and Paper Firms (1960-98)

Results shown in Table E.2 (APPENDIX E) reveal structural changes in the profitability of pulp and paper firms from 1960-80 and strongly reject the structural stability hypothesis. Significant shifts occurred in the value of coefficients of U.S advantage (USADV), operating rates (OPRT), foreign exchange rates (FEXR), price index (PRIIND), new supply/RGDP (NEWSUPPL/RGDP), equity/sales ratio (E/S), market share (MS), timberlands (TL) and firm size (FS). However, the structural change test failed to reject the null hypothesis of statistical stability of the K-Factor (KF), exporting firms (EXPFIR), average plant size (AVSP/MES), asset sales ratio (AS), capital intensity (CI) and growth (GR) (Table. 8.1).

Results shown in Table E.3 (APPENDIX E) indicate significant structural changes in the profitability of U.S. pulp-and paper-manufacturing firms from 1971 to 1990. Variables that reflected shifts included, U.S. advantage (USADV), operating rates (OPRT), new supply/ real GDP (NEWSUPP/RGDP), equity/sales ratio (ES), assets/sales ratio (AS), market share (MS), timberlands (TL), and firm size (FS). Coefficients of foreign exchange rates (FEXR), the K-Factor (KF), exporting firms (EXPFIR), price index (PRIIND), average plant size (AVPS/MES), capital intensity (CI) and growth GR remained statistically stable during 1971-90.

Results shown in Table E.4 (APPENDIX E) indicate significant structural changes in the profitability of firms as a result of changes in the value of the coefficients of the K-Factor (KF), equity/sales (ES), assets/sales (AS), and firm size (FS). The rest of the variables included in the profitability model showed statistical stability at the 5 percent level of significance during 1981-98.

Results shown in Table E.5 (APPENDIX E) indicate significant structural changes in the K-Factor, price Index, equity/sales ratio, market share, and firm size while other variables show statistical stability during the whole period of study.

A detailed discussion about those variables that underwent structural changes follows.

8.2.1 U.S. Advantage (USADV)

From 1960-80, the U.S. paper industry strengthened its position in the export market. Exports increased from 990,000 tons to 5,148,000 tons. These exports not only helped the U.S. paper industry increase its profitability but also improved its image in the world pulp and paper market as a quality product producer. All this happened because of the lower dollar value in the 1970s and U.S. technological superiority in the world pulp and paper market. In 1980, the dollar reached its lowest level in a multi-year slide against other major currencies and U.S. paper industry exports posted a huge surge in volume (PPNAFB, 84-85).

U.S. advantage increases and decreases with the volume of U.S. exports, supply of pulp and paper for exports in the world market, and rise and fall of foreign exchange rates. When the dollar reached a low relative to other major currencies in 1980, pulp and paper exports--including wastepaper and converted products--hit 11.8 million tons, a large increase of 31.9 percent over 1979. During 1981, the volume of exports started declining. In the following recessionary years, export value plunged 11.9 percent as prices dropped, the dollar strengthened, and volume sank by 7.4 percent. The game of rising dollar and falling dollar continued until relief occurred in 1986, when demand reappeared and the currency began to slide down. This proved a boon to U.S suppliers, shoring up 1986 exports 9.1 percent to 12.9 million tons and increasing their value up by 16.2 percent. Kraft linerboard was on the top of the export list; its exports grew about 21.8 percent. The dollar remained weak during 1987, and exports continued increasing. All the paper grades also did well, with volume growing 19.7 percent over 1987 figures to 1.1 million tons and value jumping to $988 million. Paper exports continued to increase to 5.2 million tons, rising by 10.1 percent with a solid increase in value of 12.8 percent to $3 billion (PPNAFB, 1990). Structural changes in the profitability models for the 1970s and 1980s clearly explain the export situation and profitability of the firm.

8.2.2 Foreign Exchange Rates (FEXR)

Exchange rate fluctuations have also had a growing impact on pulp prices, which are quoted mainly in U.S. dollars (PPNAFB, 84-85). During the 1960s, the dollar was at the highest value compared to the other currencies because of growth and stability in the U.S. economy, but inflation started influencing every section of the economy in the 1970s, the dollar started depreciating against other hard currencies, production costs started increasing, and the demand for paper products slowed down in the domestic market. This situation was successfully captured by the structural change test.

Foreign exchange rates have a tremendous impact on the profitability of the firm as well as the industry. Changes in foreign exchange rates resulted in structural changes in the profitability of U.S. pulp and paper firms during the 1970s and 1980s. The dollar was low during the 1970s, helping pulp and paper firms to increase their share of the world market. The dollar value increase at the start of the 1980s negatively impacted exports. However, the dollar again depreciated and increases in exports continued until the end of 1989, when recession again started.

8.2.3 Operating Rates (OPRT)

There was also significant change in the operating rates of the pulp and paper industry during the 1960s and 1970s. The average operating rate was about 90 percent of the total capacity from 1960-1970. This increased to about 92 percent from 1971-1980. Higher operating rates during the 1970s responded to a higher demand for pulp and paper products. Domestic demand for pulp and paper was poor because of inflation and the oil embargo, but U.S. firms fully utilized their technical advantage, increased the operating rates and targeting the export market. As a result of these measures, the industry not only increased its market share in the export market but also made record profits.

In 1971, operating rates for U.S. pulp and paper firms averaged 91.9 percent; these increased to 93 percent in 1989. Operating rates were even higher for 1973 and 1974, and again in 1986 to 1988. Higher operating rates reflected the higher demand for pulp and paper products in the international market. Actually, US firms increased their market share by utilizing their technology advantage in the world market. Structural changes in the operating rates reflected the overall performance of pulp and paper manufacturing firms during the 1970s and 1980s.

8.2.4 Price Index (PRIIND)

The structural change test also showed significant changes in the price index during the 1960s and 1970s. Price index sharply increased during the 1970s because of inflation and consequent increase in input prices. Major increases in wood, chemical and energy costs badly influenced the pace of growth and stability of the U.S. pulp and paper industry in the first half of the 1970s. However, pulp and paper manufacturing firms later succeeded in diluting the negative impacts of the inflationary environment by their strategic moves in the international pulp and paper market.

There have been significant changes in the value of the price index during the last forty years. The average price index in the 1960s (about 36.113) increased to 140.245 in the 1990s. The price index has a significant relation to the overall profitability of a pulp and paper firm. Representing the input costs, the higher the input costs, the greater will be the price index. Generally, the price indices for paper and paperboard are similar. Commodity paper, paperboard, and converted product prices tend to track the U.S. economy quite closely, declining in recession and rising during recoveries. Fiber and raw material prices tend to be the least volatile. Prices are inevitably impacted by supply and demand; market volatility is shaped by inventories, consumption, and general economic and financial conditions, both in the U.S. and international market (PPNAFB, 1999).

8.2.5 New Supply /Real Gross Domestic Products (NEWSUPPL/RGDP)

Consumption of pulp and paper products is highly tied to real GDP (McGraw-Hill, 1999). The higher growth of GDP expands the economy, and pulp and paper consumption increases, particularly consumption of industrial grades of paper. In contrast, paper consumption drops when the economy is poor. Increasing inflation during the 1970s negatively influenced domestic paper consumption in the USA. The structural change test successfully captured the change in the consumption of paper as a result of the poor economic situation during the 1970s. During 1970s-1990s, the ratio of new supply/RGDP moved downward slowly. The average ratio of new supply/RGDP declined from 14.002 to 13.431 because of decreasing pulp and paper consumption as a result of inflation and recessions.

8.2.6 Equity/Sales (E/S)

The average equity/sales ratio decreased from 0.83 during the 1960s to 0.54 because of a poor economy, followed by a decrease in the consumption of paper during the 1970s. The structural change test captures this by indicating a significant shift in the value of coefficients for equity/sales ratios during the 1960s and 1970s.

A significant shift in the value of coefficients for equity/sales indicates structural changes in the profitability of the pulp and paper firms during the1970s and 1980s. The average equity/sales ratio dropped from 0.54 for the 1970s to 0.479 for the 1980s. The decline in the equity/sales ratio during the 1980s was the result of heavy spending on modernization and expansion projects from 1988-90, and lower growth rates. U.S. papermakers spent nearly 15 billion dollars in 1989 on new production equipment and raised capacity an estimated 2.4 percent to 82.4 million tons, although actual output increased less than 1 percent (PPNAFB, 1990).

The equity/sales ratio increased from 0.479 to 0.754 during 1980-98 due to heavy capital investments in the pulp and paper sector. Possibly, this ratio also increased due to decreasing market share of U.S. firms in the U.S. pulp and paper markets because of import influxes supported by higher dollar values. The increase in the equity/sales ratio played an important role in the structural changes in the profitability of the firms.

Results shown in Table E.5 indicate a significant shift in the equity/sales ratio during 1960-98. It was the highest in the 1960s, about 0.83, and declined in the 1990s to 0.754. These figures clearly point towards the difference between the " growth and stability era" (1960-70) and the "globalization era" (1990-98). The decline in equity can be visualized from the debt/equity ratio of the U.S pulp and paper industry. In 1960, the ratio was 0.233; it increased to 0.980 in 1997. On average, the debt to equity ratio during 1962-72 was 0.411, for 1972-82 it was 0.51, for 1982-92 it was 0.734, and for 1992-97 it was 1.026. All of these statistics clearly indicate the declining performance of the U.S. pulp and paper industry.

8.2.7 Market Share (MS)

The structural change test showed a significant shift in the value of coefficients of market share for the 1960s and 1970s. The average market share of firms increased from 1.1417 to 2.363. A possible explanation for the market increase may be the tremendous merger activities during the last years of the 1960s. Increasing size of the firms helped them in increasing their market share at the cost of those firms that either were acquired or left the market as a result of financial hardships in an inflationary environment.

The average market share of pulp and paper firms decreased from 2.363 percent in the 1970s to 2.298 percent in the 1980s. The decrease in the market share of the firms happened because of increasing imports into the country. Most of the bigger firms targeted the export markets to take advantage of the benefits of the lower dollar value, while smaller firms targeted the domestic markets. Imports rose dramatically as the dollar strengthened from 1983-85 and then kept growing even when the currency retreated.

Market share is one of the key indicators of the profitability of firms. Results shown in Table E.5 show a clear shift in the value of market share from 1960-1998. During the 1960s, the average market share of pulp and paper firms included in the study was 1.417 percent; it increased to 1.817 percent during the 1990s. These statistics clearly point towards the structural changes in the profitability of pulp and paper firms in the U.S. The highest market share for firms was reported during the 1970s. Decline in the market share of U.S. firms was the result of increasing imports because of higher dollar value during the 1990s.

8.2.8 Timberlands (TL)

The attractiveness of timberlands increased during the 1970s because of increasing pulpwood costs. Most major companies in the paper industry owned extensive acreage of forestlands but depended on owned forestlands for only a part of their wood. The forest industries owned 14 percent of the 500 million acres of commercial forestland in the nation (U.S.D.A Forest Service, 1973) and used about 30 percent by volume of the wood taken from the forest per year (U.S.D.A. Forest Service, 1974). The increased attractiveness of timberland during the 1970s was also evident in the fact that timberland prices increased more than pulpwood prices (Gilligan, 1973). The structural change test explains the situation by indicating a shift in the value of the coefficients during the 1960s and 1970s.

Wood pulp continued to be the main fibrous raw material used in the manufacture of paper and paperboard from 1970-1990. As a result of this, the paramount importance of timberlands continued increasing during the 1970s. However, some diminution in the attractiveness of timberland started appearing in the pulp and paper industry during the 1980s. Despite these negative reports, paper and pulp companies still owned about 14 % of the total commercial forestlands of the nation, about the same as a decade before (Yin et. al, 1998). There was no reduction in the industry's commitment to forestry research or to the concept of sustained yield as a goal of forest management (Slatin, 1985).

8.2.9 Firm Size (FS)

There was tremendous increase in the firm size in terms of assets from $238.9 million in 1960s to $3371.8 million in 1990s. The average firm size increased from $238.9 million during the 1960s to $802.55 million during the 1970s. As the technology of pulp and papermaking led to larger and larger machines, the investment in papermaking facilities increased, with the result that company sales and assets increased significantly in size (Slatin, 1975). The structural change test captures the shift in the value of the coefficient for firm size during the 1960s and 1970s.

Average firm size increased greatly from 1970-90, growing from $802.548 million to $1858.168 million for the pulp and paper firms included in the study. Assets increased because of modernization and expansion spending to realize the benefits of economies of scale. Most of these changes in size took place in linerboard, newsprint, and printing and writing paper.

There was a significant shift in average firm size from 1981-98, increasing from $1858.168 million to $3,371.8 million. The increase in firm size was the result of heavy capital spending in capacity expansion. Capital spending by the U.S. pulp and paper firms rose from 1993 to 1996 and dropped more than 14 percent in 1997 to less than 10 billion dollars for the first time since 1994.

The drop in capital spending in the pulp and paper industry was the result of the poor performance of the paper industry during the 1990s. According to Ince (1999), price volatility and sensitivity of profits to the global cycle are related to capital intensity and competitiveness in the pulp and paper sector. Since 1990, the only year when the paper industry's return on assets exceeded the cost of capital was 1995. In 1996 and 1997, returns dropped to the weak levels of the early 1990s and trailed many other manufacturing industries. Real GDP increased by about 2.5 percent, but the sector was unable to keep pace. A number of attempts to increase prices in pulp and paper met with minimal success. It is estimated that the pulp and paper industry has lost $ 22 billion of market value since 1990 (PPNAFB, 1999). Many industry experts believe that the U.S. pulp and paper industry is underutilizing its assets.

Firm size also influences the profitability of firms because of the availability to larger firms of more input resources, better technology to convert these resources into production, and more chances of access to the markets. The average size of the firms included in the study increased from $238.88 million in the 1960s to $3,370.773 million in the 1990s. These statistics indicate a big rise in firm size in terms of assets. Higher assets must generate above average return to investors. Unfortunately, the pulp and paper industry has not shown good performance in terms of return on assets. This supports the perception of many that the pulp and paper industry is underutilizing its resources (McNutt, 2000). More can be done through better management and strategic moves. Davis et al. (1992) concluded that business unit size in the pulp and paper industry has a significant relationship to sales growth.

8.2.10 Asset/Sales (AS)

Pulp and paper industry assets increased from 1971-1990 as a result of debt financing for expansion and modernization. Pulp and paper capacity increased at an average annual rate of 2.0 and 2.5 percent during 1970-79 and 1980-89, respectively. Unfortunately, increases in the actual output of the industry remained even lower than one percent. Decline in output compared to the capacity increase also impacted the profitability of the firms significantly. The structural change test indicates that the situation persisted during 1971-1990 in the U.S. pulp and paper industry as a result of increased debt financing and a resultant increase in the assets of firms in the pulp and paper business.

There was a significant shift in the position of the asset/sales ratio. Firm assets increased during the 1990s because of heavy spending in the modernization and expansion of new capacity, and sales growth declined. Heavy spending and capacity addition impacted the performance of the U.S. pulp and paper firms. Increases in demands for pulp and paper during the 1990s were captured by imports because of higher dollar values. Additions of new capacity continued up to 1996. Later, there was significant reduction in capital spending because of poor profitability.

8.2.11 K-Factor (KF)

The K-Factor is an interaction term. Any significant change in the firm's capacity, industry capacity, or oligopolistic structure will represent a change in the profitability of the firm. From 1981-98, the average K-Factor increased from 0.462 to 0.718, indicating great change in the average firm capacity, industry capacity, and four-firm concentration ratio as a result of merger activities. U.S. pulp and paper capacity increased at an annual rate of 2.6 percent from 1986 to 1995. However, it dropped to a 1.6 percent annual rate from 1996-2000. The highest increase in capacity addition was reported in paperboard, at an annual growth rate of 2.9 percent during the 1990s. A higher demand for paper products was expected during the 1990s because of the strong economy.

The pulp and paper industry was ready to reap the fruits of higher capital spending in the expansion and modernization of the industry, but the opposite happened. Through most of the 1990s, the pulp and paper industry suffered huge losses, except for good financial performance during 1995. What went wrong? Some industry experts believe that higher capacity additions and huge capital spending were the major causes of poor performance of the U.S pulp-and paper-manufacturing firms. Other experts blame globalization as the major factor for the poor performance. The real reason is that the U.S. pulp-and paper industry passed through significant structural changes during the 1990s.

Results shown in Table E.5 indicate the significant relation of the K-Factor to the profitability of the U.S. pulp and paper firms during these 39 years. During 1960, the average K-Factor for pulp and paper firms included in the study was about 0.283. It increased to 0.718 during the 1990s. The increase in the K- Factor clearly shows significant structural changes in the U.S. pulp and paper industry and its profitability. The individual firm's relative position in the pulp and paper industry changed significantly. The four-firm concentration ratio increased significantly. All these estimates certainly show an increase in the market power of U.S pulp and paper firms, but that power is still not up to that level where a firm may have some control over pulp and prices because of the higher level of fragmentation of the industry and increasing impacts of globalization on pulp and paper prices.

8.2.12 Summary

From the outcomes of the structural change tests, it appears that economic, technological, and global factors left a strong impact on U.S. pulp and paper firms from

1960-80. Results shown in Table E.2 provide fairly powerful evidence of structural instability in the net income of firms during 1960-80. These structural changes may help to explain the markets because our understanding is embodied in the set of parameter values included in the profitability models (Carter, 1998). Slatin (1985) called it an "inventory recession," and the subsequent recovery was steep and rapid. U.S. pulp-and paper-producing firms started thinking about alternative sources of energy to reduce the risk of future energy prices. More attention was paid to installing better recovery systems and generating enough electricity internally. In 1972, the energy intensity of the pulp and paper industry was about 38.32 million BTU per short ton of output. Through energy conservation measures such as improvements in existing technology, retirement of less efficient units, and better housekeeping efforts, energy intensity decreased to 29.95 million BTU in 1995 (Ruth et al , 2000). In 1972, the pulp and paper industry used 75 million barrels of fuel oil even though it generated 40 percent of its energy requirements from its internal sources, such as hogged fuel, bark, and spent pulping liquors.

During the 1970s, the pulp and paper industry started paying more attention to export markets. Although export volumes were not large, they had a significant impact on the overall profitability of the firm (Ince, 1999). Pulp and paper firms, for the first time, started realizing the importance of technological superiority in the world pulp and paper market. Rising costs of pulpwood provided incentive for a pulp and paper firm to own and intensively manage its timberlands to remain competitive in the market. Consumption and production of paper and paperboard did rise, but at lower rate, as was clear from downward movement of the NEWSUPPL/RGDP ratio. Slatin (1985) described a shift of mill size and plant ownership during the 1970s. During this period, many of the smaller mills were sold to other paper companies and modernized to fit into their operations. Firm size also increased during the 1970s. In 1971, there were 20 companies with assets over $100 million, compared with 35 in 1981. Their share of assets rose from 89 percent in 1971 to 96 percent in 1981.

Both the 1980s and 1990s were rise-and-fall eras for the U.S. pulp and paper industry. The firm's individual position in the overall industry in terms of capacity, assets, and market share became the most important factor in determining the financial performance of a firm. Paper companies started taking positions on future fiber availability (Repetto and Austin, 2000) in the wake of increasing harvesting bans in some regions (RPA, 2002). Pulp and paper manufacturing firms, for the first time, realized the need for balanced capacity, control on capital spending, and reduction in industry fragmentation through mergers and consolidations to face the challenges of globalization.

From the structural change test results and the above discussion it appears that most of the structural changes that took place during the last forty years were the result of domestic and international economic conditions, and the impact of structural changes was different for different grades. Furthermore, on the basis of present findings it may be inferred that the K-Factor, price index, equity/sales ratio, market share and firm size have been the key determinants of the profitability of pulp and paper firms and that all of these factors must be considered to design the future strategy for the U.S. pulp and paper industry.

CHAPTER 9

STRUCTURAL CHANGES IN THE MARKET SHARE OF PULP AND PAPER MANUFACTURING FIRMS (1960-98)

9.1 Analysis

The structure of the U.S. pulp and paper industry in terms of firm market shares experienced a great shift during the growth and stability era and rising cost era (1960-70 to 1971-80), from the rising cost era to the capital spending era (1971-80 to 1981-90), and from the capital spending era to the globalization era (1981-90 to 1991-98). (Table F.1, APPENDIX F). A number of factors related to firms, the industry, and the economy are supposed to be responsible for causing these structural changes at the firm and industry level. The structural changes influenced the conduct of the firms, which ultimately influenced the performance of the firms. It appears that the financial health of a firm, the firm's assets, the firm's strategic position in the industry, and the number of the firm's production facilities are the major determinants of structural changes in terms of changes in firms' market share. Information about the major determinants of structural changes may help U.S. pulp and paper manufacturing firms to design strategies needed to remain competitive in the domestic as well as in the global market. Table 9.1 shows the structural changes (b-shift) during 1960-98.

Dep: ln.MS	1960s-1970s	1970s-1990s	1980s-1990s	1960 vs1990s
Constant				
ln. N.INC		**		**
AVSP/MES		**		
ln. CI				
ln.CR4		**		
lnKF	**	**	**	**
lnFS	**	**	**	**
GR				**
TL	**		**	**
PRIMIX			**	**
EXP(I)			**	
NOU				
NOF	**	**		
EXP.FIR	**	**	**	
CR4t-1				

**= t indicated significant structural changes (b-shift) at 5 percent level of significance.

Table 9.1. Structural changes (b-shift) in market share during 1960-98

9.2 Structural Changes in the Market Share (1960-98)

Results shown in Table F.2 (APPENDIX F) indicate significant structural changes in market share from 1960-80 indicated by a lack of stability in the coefficients of the K-Factor (KF), firm size (FS), timberlands (TL), number of firms (NOF) and exporting firms (EXPOFIR). The rest of the coefficients for different variables appear to be stable. Average firm market share increased from 1.417 percent in the 1960s to 2.363 percent in the 1970s.

Results shown in Table F.3 (APPENDIX F) indicate significant instability from 1971-90 in the coefficients of net income, concentration ratio (CR4), the K-Factor (KF), firm size (FS), number of firms (NOF) and, exporting firm (EXPFIR). The rest of the variables showed stability during 1971-90. The average market share of firms decreased slightly from 2.363 percent in the 1970s to 2.298 percent during the 1980s.

Results shown in Table F.4 (APPENDIX F) reveal that there was a significant shift in the values of the coefficients of the K-Factor (KF), firm size (FS), timberlands (TL), product mix (PRMIX), exports (EXP), and exporting firms (EXPOFIR) from 1981-98. The rest of the variables showed statistical stability during the period. There was a drastic decrease in the domestic market share of firms during the 1990s because of increasing imports. The average market share of firms decreased from 2.298 percent in the1980s to 1.817 percent in the 1990s.

Results shown in Table F.5 (APPENDIX 5) indicate the significant instability of net income (N.INC), the K-Factor (KF), firm size (FS), growth (GR), timberlands (TL) and product mix (PRIMIX) in the market share models for 1960-1998. The rest of the coefficients of the variables in the market share model showed stability. The market share of the firms slightly increased from 1.417 percent to 1.817 percent during the 1960s and 1990s, respectively. A detailed discussion about each variable follows.

9.2.1 K-Factor (KF)

K-Factor coefficients in the market share models showed a significant shift during 1960-80. A shift in the value of coefficients for the K-Factor indicates the changes in a firm's relative position in the overall pulp and paper industry in terms of capacity and oligopolistic market structure. The four-firm concentration ratio increased from 23 to 31 percent from 1960 to 1980. Similarly, the average capacity of a firm increased from 580,000 tons in the 1960s to 790,000 tons in the 1970s. Both interaction factors caused a net shift in the K- Factor.

The K-factor bears a significant relation to a firm's market share. The capacity of a firm relative to the industry and the oligopolistic market structure interact to determine a firm's market power. The average value of the KF increased from 0.283 in the 1960s to 0.398 in the 1970s. A relatively higher capacity helps a firm to increase its market share through the benefits of economies of scale and other cost reduction factors (Fox and Company 2000). The role of market share in the overall structure of the industry was explained by Kattuman and Barbara (2000). They argued that, in order to understand the market structure, we must estimate firm size and market share as a function of firm level determinants and use the information in these estimates to assess the relative contributions of a firm's characteristics to concentration. In reality, the relative capacity of the firm in K-Factor is its market share in terms of capacity. Concentration is an aspect of the distribution of the market share of firms within the industry.

Results shown in Table F.3 indicate a significant shift in the value of the K-Factor coefficients during 1970-90. The average K-factor increased from 0.398 in the 1970s to 0.462 in the 1980s. Those firms that have higher capacity are generally successful in increasing their market share through cost reduction strategies. Furthermore, bigger firms have better access to the markets. These firms try to increase their power through backward or forward integration. In the pulp and paper industry, a firm's capacity is the basic source of power. Higher capacity may appear in the form of unit production, or a firm may have the capability to manufacture multi-products or a range of products. The average value of the K-Factor increased from 0.462 in the 1980s to 0.718 in the 1990s.

Results shown in Table F.5 indicate significant instability of the K-Factor from 1960-98. The K-Factor increased from an average value of 0.283 in the 1960s to 0.718 in the 1990s. The average firm capacity increased from 588,000 tons in the 1960s to 1,213,000 tons in the 1990s. Similarly, the four-firm concentration ratio of the U.S. pulp and paper industry increased from 22.98 in the 1960s to 34.21 in the 1990. The average market share of the pulp and paper firms increased from 1.417 in the 1960s to 1.817 in the 1990s. These statistics indicate that the market share of a firm increased by 28.22 percent while the concentration ratio increased by 48.79 percent during the 39 years. All these results show a significant shift in the U.S. pulp and paper industry structure. Lower rates of increase in the average market share of a firm was because of increasing imports into the country. From these findings it is confirmed that a firm's relative capacity in the pulp and paper industry and the concentration ratio are the main determinants of the structure of the pulp and paper industry.

9.2.2 Firm Size (FS)

It appears that the coefficient of firm size could not keep its stability during the 1970s and strongly reflected the shift in the market share of the firms. Logically, larger firms enjoy larger market share. The average size of the firm included in the study during the 1960s was about $239 million, increasing to $803 million in the 1970s. Increasing firm size also influenced the market share of the firms. Bigger firms successfully increased their market share by using three tools: economies of scale, market power, and quality of management. Bigger firms may also increase their market share by more integration than is possible for smaller firms (George, Joll and Lynk, 1991).

Firm size showed a significant shift in the value of its coefficient during 1971-90. The average firm size increased from $802 million in the 1970s to $1,858 million during the 1980s. The large increase in the firm size was the result of heavy capital spending in the 1980s. As the size of the firm increases, its control on costs should strengthen if it wants to remain competitive. An increase in size means availability of more resources to convert inputs into product at a lower cost of production. In order to achieve cost reductions, firms may construct bigger plants, use vertical and horizontal integration, innovation, adoption of new technology, etc.

A firm may increase its size in three ways: internal growth, debt financing, or merger and acquisitions. In pulp and paper, the latter two options are often used for growth. Both options change the size and distribution of firms and impact the structure of the industry.

During 1981-98, huge increases in firm size resulted in surplus capacity in the country. Most of the firms used the debt-financing option to increase their size. A number of firms also acquired smaller firms. Generally, increases in firm size should increase the return of the firms but, unfortunately, imports decreased the profits of a number of firms. The structural change test successfully captured the impact of different economic factors on market share by indicating a shift in the value of coefficients. Does an increase in firm size necessarily increase the chances of profitability? Why was there poor performance in the U.S. pulp and paper industry during the 1990s despite the tremendous increase in firm size, increase in concentration, and higher demand in the country?

Firm size appears to be a crucial factor in reshaping the market share of pulp and paper firms. A high level of instability in the value of the coefficients is evident from the results shown in Table F.5. Average firm size increased from $239 million in the 1960s to $3,371.8 million in the1990s. Expansion in the size of a firm seemingly augments the average plant size, technology, and level of integration in the U.S. pulp and paper industry. A large increase in average firm size also impacted the structure of the industry. An increase in firm size resulted in technological changes that ultimately reshaped the structure of the industry. Increases in firm size also impacted the number of firms in the industry. Those smaller firms that could not increase their size vanished. Bigger firms enhanced their market power because of their lower production cost and better chances of access to the markets and financial institutions.

9.2.3 Timberland (TL)

Timberlands became more attractive for pulp and paper firms during the 1970s because of increasing pulpwood costs resulting from inflation. Those firms that owned and managed timberlands were able to increase their competitiveness in the market as lower cost producers. Inflation and rising cost of pulpwood were supposed to be the prime reasons behind the structural changes in the market share model during the 1970s. Increasing pulpwood cost inspired the forest products companies to intensively manage their timberlands. An upsurge in the attractiveness of timberland is evident from the net increases in average timberland holdings from 0.63 million acres in the 1960s to 0.785 million acres in the 1970s.

Results shown in Table F.4 point towards the instability of the timberland coefficients during the 1980s and 1990s. Shifts in the coefficient of timberland clearly indicate the pulp and paper industry's growing interest in timberlands. In fact, growing threats of globalization factors forced U.S. pulp and paper producers to seek more control over input costs. However, during the 1990s, many pulp and paper firms also sold their timberlands due to variety of reasons such as monetary pressure, purchase of new facilities and investors' pressure. Pulpwood costs from company-owned timberlands can be influenced by intensive management that increases their per hectare productivity, by implementing tree improvement programs and by fully utilizing forest waste in energy generation.

Timberland coefficients show significant instability in the market share model for the 1990s. During 1960, the average timberland holding of a firm was about 0.637 million acres while in the 1990s the average timberland holding of a firm had increased to 1.050 million acres. These results totally refute the general impression that attractiveness of timberlands in the U.S. pulp and paper industry dropped during the last 40 years. Rather, the pulp and paper industry strengthened its wood resources during this period. Timberlands have played a significant role in the redistribution of market share of the firms in the pulp and paper business and changing the market structure of the industry.

9.2.4. Number of Firms (NOF)

Results shown in Table F.2 indicate significant instability of the coefficients of the variable "Number of Firms" during the 1960s and 1970s. The average number of firms dropped from 465 to 399 due largely to high merger activities during the 1960s. Increased merger activity in the U.S. pulp and paper industry is also evident from the escalating trend of the concentration ratio at that time. A reduction in the number of firms certainly impacted the market share of the remaining firms. After merger, some firms became larger, and they increased their market share in the pulp and paper market.

The number of firms in an industry plays an important role in the development of that industry's structure. In the pulp and paper industry there were 399 firms in the

1970s. There was a slight reduction in the number of firms during the 1980s. This reduction was not significant. However, the market share model indicates a significant change in the coefficient value. It is hard to define the situation. There is a possibility that those firms that were acquired by the other firms during the 1980s had a significant impact on the market structure.

9.2.5 Exporting Firms (EXPFIR)

Exports do not have a direct impact on a firm's share of the domestic market. But, there is an indirect aspect that may influence firm market share. Those firms that are in the export business always prepare themselves to face international competition. As a result, these firms try to realize the benefits of economies of scale and other cost reduction strategies, which may ultimately augment their advantage in the export markets. All those efforts that increase the firm's advantage in the export market also benefit the firm in the domestic market.

Lower dollar values in the 1970s provided the opportunity for the pulp and paper firms to increase their share of the world market. It also helped the bigger firms to obtain a bigger share in the domestic market. Higher concentration ratios in the 1970s compared to the 1960s is well-documented proof of this situation.

During 1970-90, exporting firms played a significant role in increasing exports and improving their profitability. Exporting firms also impacted the market share in the domestic markets because of their bigger size of mills, more control on inputs, and better access to the markets. It appears that U.S. pulp and paper firms were preparing for the threat of globalization. Mergers and heavy capital spending on capacity and improvement were all important moves towards readiness to face the competition. Europe had earlier completed its restructuring in the pulp and paper business. However, all the efforts that U.S. firms were making to compete in the world market left many sharp downturns in the earnings of major pulp and paper producing firms as a result of the Asian Crisis in 1997 and the comparatively higher dollar value against the major currencies.

9.2.6 Net Income (N.INC)

The average net income of pulp and paper firms increased from $50.31 million in the 1970s to $93.759 million in the 1980s. After lagging the average for all manufacturing for two decades, the paper industry return on net worth exceeded the average of the 1974-75 tight-market period. Return on net worth reached a peak of 16.8 percent in 1974, hovered in the 12 percent to 13 percent range from 1975 to 1978 and then hit 16.0 percent in 1979. Profitability again declined in 1980 and 1981 before plummeting to 5.5 percent in 1982. After then, industry return continued strengthening up to 1988, a record earning year with 18.8 percent returns on net worth.

The U.S. pulp and paper industry continued to enjoy worldwide economic expansion and a favorable U.S. dollar exchange rate in relation to foreign currencies. From 1986-88, the weaker dollar accounted for 70 percent of the improvement in the U.S. paper industry earnings, but in 1989 the dollar's plunge was not enough to offset a poor domestic market. The better performance of the pulp and paper industry encouraged the firms to invest heavily in improvement programs. In absolute terms, spending climbed from $5.24 billion in 1979 to $15.69 billion in 1989, an increase of 200 percent. These spendings certainly impacted the market shares of the firms. Increases in income impacted the conduct of the firms, which ultimately impacted the structure of the industry.

It appears that the coefficient for net income barely showed instability in the market share model for the 1990s. ("Marginal significance" means not significant, but that an appreciable shift can be observed). Net income plays an important role in changing market share. A firm earning above average profits has incentives to invest further to achieve growth. It may increase firm size, acquire new technology, or increase the level of integration. All these elements ultimately impact a firm's market share and industry structure.

During the 39 years, the average net income of firms increased from $12.186 million to $82.979 million. Increased income certainly impacted the industry structure through conduct. Unfortunately, there was a significant increase in the coefficient of variance of profitability. A higher value of the coefficient of variation shows greater volatility in the profitability during 1990s.

9.2.7 Concentration Ratio (CR4)

During 1970-90, there was a slight reduction in the four-firm concentration ratio of the U.S. pulp and paper industry. Decreases in concentration ratios may occur because of increasing market size or decreasing market share of bigger firms. Market growth rates change the concentration. Fast market growth encourages new entry and competitive behavior and means bigger opportunities for smaller firms to expand, while slow growing industries are more likely to become monopolized (George, Joll and Lynk, 1991). There was a slight reduction in the firm's market share during 1970-90. Reduction in market share is also possible because of increased imports when the dollar value is high.

9.2.8 Product Mix (PRMIX)

Market share models for the 1980s and 1990s show instability of coefficients for product mixes. It appears that firms are more interested in manufacturing multi-products than concentrating only on one product or putting all their eggs in one basket. New technologies are helping firms with grade shifting. A firm manufacturing multi-products may enjoy the benefits of economies of scale and scope.

Coefficients for the product mix of a firm appear to be significantly unstable in the market share model for 1960-98, as shown in Table F.5. Although there is no big difference between the mean values of product mix of a firm for the two periods, the test captures the instability in the coefficients of product mix of a firm during 1960 and 1990. This outcome shows a pattern of grade shifting in the U.S. pulp and paper firms during the poor demand periods to at least recover the fixed costs.

9.2.9 Exports (EXP. I)

The structural test points significantly towards the instability of the variable "Exports" in the market share model during the1980s and 1990s. U.S. pulp and paper firms took full advantage of the 1980s for increasing their exports and their profitability, but the 1990s were totally different from the past. U.S. pulp and paper firms only received good returns during 1995. Most of the time in the 1990s, the performance of pulp and paper firms was not satisfactory because of higher dollar values, poor prices in the world market, and increasing paper imports into the country. The structural change test significantly captured the situation of exports and their impact on the market share of firms during 1981-98.

9.2.10 Exporting Firms (EXPFIR)

The structural change test points towards the instability of coefficients for exporting firms in the market share model for the 1980s and 1990s. During the1980s, pulp and paper firms targeted export markets because of higher demands for pulp and paper in the world market. However, the situation was different during the 1990s. Firms were facing increased competition in the domestic markets, and exports declined because of higher dollar values and poor pulp and paper prices in the world market. The test significantly captured the declining role of exporting firms in the overall profitability of the industry and its impact on a firm's market share.

9.2.11 Growth (GR)

Growth appears to have been a significant contributor to market share changes from 1960-98. Sales growth generally increased the profitability of the firms. Higher growth provides incentives to new entrants and reduces the level of concentration of the industry. The pulp and paper industry's growth is limited to the general economy in the country. During the 1990s, the pulp and paper industry experienced slower growth and poor financial performance. As a result, the firms acquired a number of smaller firms and merged with other companies. All these activities resulted in the structural changes in the pulp and paper industry. There were 465 firms in the U.S. pulp and paper industry during the1960s; this number dropped to 365 firms in the 1990s.

CHAPTER 10

STRUCTURAL CHANGES IN THE TIMBERLAND MODELS (1960-98)

10.1 Introduction

Results of the present study have revealed significant structural changes in the timberland holdings of firms from 1960-98 (Table G.1, G.2, G.3, G4). Major factors that played a consistent role in structural changes included net income, the K-Factor, and firm size. In addition to these, mergers, product mix, growth, new supply/RGDP, equity/sales, and number of units were also responsible for the structural changes in a firm's timberland ownership.

From these results, it may be inferred that firms own and manage timberlands to improve the net income of the firm by securing cheaper wood supply from fee lands, to improve their competitiveness in the market, and reduce the risks involved in pulpwood supply. These findings are also supported by Yin, Harris, and Izlar (2000). They concluded that those firms that receive pulpwood from fee lands have clear advantage in production costs over those that purchase pulpwood from the open market. Furthermore, lower wood cost/ton of paper manufactured enhances the price flexibility of a firm receiving pulpwood from owned timberlands and increases the cash flows associated with using fee land timber. Timberlands are also strategic resources. In order to compete in the domestic as well as in the global market, firms must have control over factor inputs, especially, when the input is about 21-30 percent of total paper production costs. Larger firms may think about backward integration to secure the raw material.

Several studies have addressed the question of timberland ownership, used different analytical approaches, and reached different conclusions (Binkley, Raper and Washburn, 1996; Ellefson and Stone, 1984; Hungerford, 1969; O'Laughlin and Ellefson, 1982; Yin et al. 1997; Zinkhan et al. 1992). The role played by different variables in a firm's decision making about the ownership and management of timberlands changed over time. Mergers played a significant role in timberland ownership during the 1960s. Pulpwood cost was the major factor in the increased attractiveness of timberlands during the 1970s. In the 1980s, the emerging use of recycled paper in different pulp furnishes, oversupply of pulpwood in the market due to higher mortality rates (Powell et al.1993), and decreasing demand for wood chips in the export market significantly impacted the timberland-holding decision. Similarly, in the 1990s, there were some constraints in pulpwood supply in different regions as a result of reductions in western public harvest, upward shift in housing activities, and restrictions on the availability of timber from Canada (RPA, 2002) that increased the interest in timberland ownership (PPNAFB, 1999; Repetto and Austin, 2000).

10.2 Structural Changes in the Timberland Model 1960-98

Structural changes in the timberland models help us to understand the timberland ownership issues in the pulp and paper industry, identify the major factors that influence the firm's decision to own and manage the timberlands, and guide the forest products industry planners in designing appropriate strategies about the future wood supply, price projection, and future markets. Structural change manifests itself in the instability of regression coefficients over time (Carter, 1998). Results shown in Table G.1 (APPENDIX G) indicate that the coefficient of the net income (N.INC), mergers (MEG), and product mix (PRMIX), firm size (FS) and the K-Factor (KF) showed significant instability from 1960-80 (Table 10.1), while the rest of the variables included in the timberland model showed stability. The average timberland holding of a firm increased from 0.637 million acres to 0.785 million acres. From this discussion, it appears that timberland ownership and management option of the firm were highly influenced by net income, merger move, multi-products, firm size, and K-Factor.

Results shown in Table G.2 (APPENDIX G) indicate the structural instability of coefficients of net income (N.INC), firm size (FS), New supply/Real Gross Domestic Product, new supply/RGDP, the K-Factor, growth (GR) and firm capacity (FC). The rest of the variables seem to have been stable during 1971-90. The average timberland holding of a firm increased from 0.785 million acres to 0.93 million acres.

Dep: TL	1960-70 1971-80	1971-80 1981-1990	1981-90 1991-98	1960-70 1991-98
Constant	**	**		**
Ln.N.INC	**	**		**
Ln.ES			**	
MEG	**			
NOU			**	
PRIMIX	**			
GD				
lnFS	**	**	**	**
NEWSUPP/ RGDP		**		
KF	**	**	**	
GR		**		
Ln.FEXR			**	
Ln. FC		**	**	**
LnCR4			**	**

**= t indicated significant structural changes in the variables at 5 percent level of significance

Table 10.1. Structural changes (b-shift) in timberland models (1960-98).

Results shown in Table G.3 (APPENDIX G) indicate the instability of coefficients of equity/sales (E/S), number of units (NOU), firm size (FS), the K-Factor (KF), growth (GR), and firm capacity (FC) of the timberland models of the 1980s and 1990s. The rest of the variables showed stability during 1981-98. The average size of timberland holdings increased from 0.930 million acres in the 1980s to 1.050 million acres in the 1990s.

Results shown in Table G.4 (APPENDIX G) point towards a significant shift in the coefficients of net income (N.INC), firm size (FS), and firm capacity (FC) in the timberland model. The rest of the variables had stable coefficients during 1960-98. The average timberland holdings increased from 0.637 million acres in the 1960s to 1.050 million acres during the 1990s.

In all the cases, two hypothesis were tested: (1) there was no shift in the value of a particular coefficient from one decade to another, or (2) we were 95 percent confident that the values of coefficients in the timberland models for the two decades were different, not by chance but because of changes in the business environment as a result of changes in the firm, industry or economy-related factors at a particular time period. Mathematical representations of two hypotheses follow:

Ho= b1=b2

Ha= b1 not equal to b2

A detailed discussion about each variable follows:

10.2.1 Net Income (N.INC)

There was a significant shift in the value of coefficients of net incomes during 1960-80, 1970-90, and 1960-98. Therefore, we reject the null hypothesis and fail to reject the alternate hypothesis that net income of firms responsible for timberland ownership was different during the above-mentioned periods. However, the structural change test failed to reject the null hypothesis for 1980-98. These results indicate the importance of net income in a firm's decision making about timberland ownership. Logically, if the financial position of a firm improves, it tries to acquire the input resource to further strengthen the profitability and alleviate the effects of unexpected events pertinent to raw material supply (Yin, Harris, and Izlar, 2000). Financially sound firms, which are manufacturers of commodity products like pulp and paper products, have many incentives to invest in input resources to achieve price flexibility against their competitors. Furthermore, those firms that own timberlands, are in a better position to integrate their activities and increase their profits. The higher the pulpwood cost, the greater the value of timber assets.

The structural shift from 1960-80 may be explained on the basis of increased interest of firms in timberland ownership because of soaring pulpwood cost during the 1970s caused by inflation in the country. The present study also indicates a slight shift in the use of raw material in the U.S. pulp and paper industry during the 1970s and 1980s. During the 1980s, the pulp and paper industry started using more and more recycled paper. Furthermore, during this period, overharvesting and oversupply of pulpwood influenced the attractiveness of industrial timberlands. The structural change test fully captured the shift in the net income and timberland ownership relationship as a result of the substitution effect and shift in the supply of pulpwood at that time.

The structural change test also indicated a significant shift in the value of the net income coefficient in the 1990s timberland model when compared with the 1960s timberland model. A timberland ownership and management decision of a firm is based upon net income as a result of cheaper pulpwood supply and lower production cost. The higher the pulpwood cost, the greater the value of timber assets. Timberland assets help a firm to compete on the basis of lower production cost, and saving the transaction costs involved in the purchase of pulpwood from the market and may reduce the pulpwood market volatility (Yin et al. 1998; Environment Defense Fund, 1995). Furthermore, changing wood costs, market conditions, and the supply situation are the key elements in the development of pulp and paper manufacturing technologies (Skog et al. 1995). Results from the current study indicate the increased interest in timberlands during the 39 years. Clephane and Carrol (1982) supported the justifications Hungerfold (1969) cited for controlling timberlands and concluded that timber resource ownership is a critical component in the financial success of most companies in the integrated forest products and pulp and paper industries. Gilligan (1973) argued that investment to hedge against inflation and demand for pulpwood and recreational market demand are the major factors that have influenced the attractiveness of timberlands and their prices in different regions.

10.2.2 Mergers (MEG)

The structural change test identified a significant positive shift in the value of the coefficient for mergers. These results clearly point towards the importance of mergers in timberland ownership and management decisions of pulp and paper firms. During the 1960s, merger activity in the U.S. pulp and paper industry was at its peak. Demand for pulp and paper throughout the world market was high. Firms were trying their best to have maximum control over inputs. One way of expanding the access to the wood resources was merger with those firms that owned strategic wood resources. The structural change test successfully captured the situation and explained the role of mergers in increasing timberland ownership. Reference about the role of mergers and acquisitions in timberland ownership title changes in the U.S. pulp and paper industry may be found in the literature (PPNAFB, 94-95; Yin et al. 1998).

In the light of the above discussion we reject the null hypothesis that merger of the firm was not a significant player in timberland ownership decision making, rather we fail to reject the alternate hypothesis that merger was one of the significant factors in a firm's decision-making process about timberland ownership during 1960-80.

10.2.3 Product Mix (PRMIX)

There was a significant shift in the role of product mix in making decisions about the timberland and management options of the firm during 1960-80. During the 1960s, U.S. pulp and paper manufacturing firms introduced new uses for paper products. All this happened because of higher spending on research and technology. New, innovative paper products with extended use increased the importance of timberlands. The structural change test successfully captured the situation by pointing towards the instability of product mix coefficients during 1960-80. On the basis of this discussion, it is concluded that product mix was an important factor in decision making about timberland ownership during 1960-80.

10.2.4 Firm Size (FS)

Firm size has played a consistent role in influencing timberland ownership and management. The structural change test showed significant and consistent instability of firm size coefficients from 1960-80, 1971-90, 1981-98 and 1960-98. With the passage of time, the relationship between firm size and timberland has further strengthened, as indicated by the results shown in Tables G1, G2, G3 and G.4 (APPENDIX G). During the 1960s to 1970s, average firm size increased from $239 million to $802 million because of heavy investments during the late 1960s. Increasing firm size also positively impacted timberland ownership and management. Average timberland holding of firms increased from 0.637 million acres to 0.785 million acres. Similarly, firm size also increased from $802.55 million in 1970s to $1,858.17 million in the 1980s. Timberland ownership also followed the same pattern and increased from 0.785 million acres to 0.930 million acres on average from the 1970s to the 1980s. These results indicate that firms were also making investments in timberlands in addition to the investments they made to expand their production capacities (Fig 10.1). Average firm size increased to $ 3,371 million during the 1990s and average timberland ownerships of firms increased to 1.050 million acres. All these statistics show that as the firm size increases, pulp -and paper-manufacturing firms also increase their timberland ownerships due to a number of reasons. These include: cost control, secured wood supply, and tax rebates (Yin, Harris and Izlar, 2000). When there is high demand, bigger firms try to own and manage timberlands to increase their profitability through cost reduction, but when demand is poor, bigger firms are under more pressure than smaller firms because of higher fixed costs.

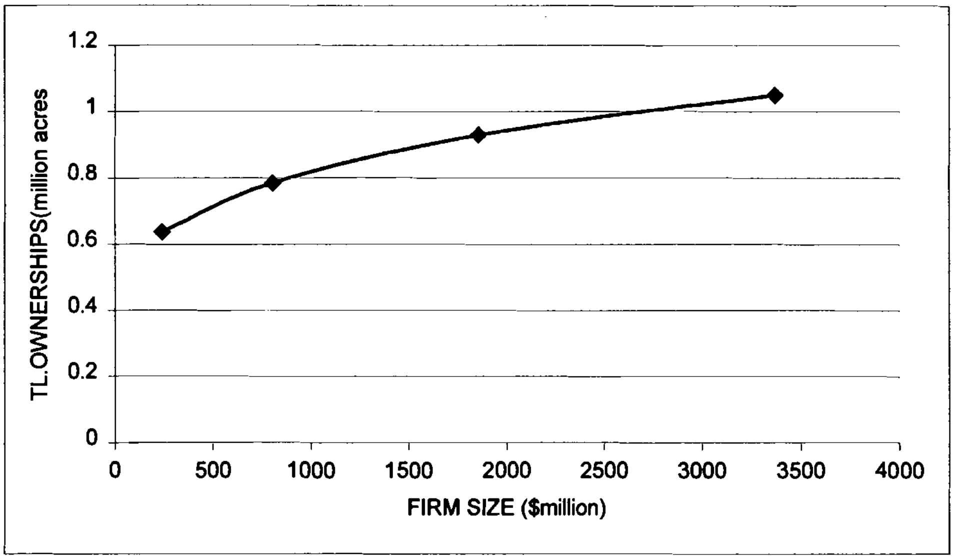

Fig.10.1 Timberland ownership and firm size relationship in the U.S. pulp and paper industry from 1960-98.

Results shown in Table G.4 (APPENDIX G) strongly suggest the importance of firm size in making a decision about the management and ownership of timberlands. From the 1960s to 1998, the relationship between firm size and timberland ownership strengthened. This fact is further confirmed by the structural change test, which indicates a significant positive shift in the value of the coefficient of firm size. The larger the firm, the greater the chance that a firm will own and manage timberlands. Powell et al (1993) argued about the expansion of industrial timberlands over time. According to them, industrial timberlands grew from 59 million acres in 1952 to over 70 million acres in 1991; over two-third of this gain occurred prior to 1977. The share of industrial timberland appears to have stabilized at about 14.5 percent of the U.S. total timberland since 1987 (Yin et al, 1998).

This study fully supports the importance of firm size in the firm's decision about timberland ownership and therefore, rejects the null hypothesis that firm size did not make any difference during 1960-98 in a firm's option to own or manage the timberlands for future pulpwood supply .In the light of the above discussion we also reject the hypothesis of stability of the coefficients of the firm size during 1960-98.

10.2.5 K-Factor (KF)

The K-Factor, which reflects an interaction between a firm's relative capacity and industry concentration was closely related to timberland ownership and management of pulp and paper firms. Coefficients of the K-Factor seem to have been unstable during the 1970s. The instability of the K-Factor may be explained on the basis of increased firm capacity and industry concentration during the1960s and 1970s. A higher K-Factor means more capacity at the firm level, and higher capacity needs more wood.

Coefficients of the K-Factor in the timberland model showed instability during 1970-90. Both the decades had one thing common, that exports of paper continued increasing. High capital spending during the 1980s increased the size of the plants. As a result of these changes K-Factor increased from 0.398 in the 1970s to 0.462 in the 1980s. The average firm capacity increased from 790,000 tons in the 1970s to 1213,000 tons in the 1980s. Increases in firm capacity also increased the demand for timberlands. The instability of the coefficients of K-Factor in timberland models during 1971-90 is successfully captured by the structural change test for individual variables (Table G.2)

The results shown in Table G.3 indicate a significant shift in the coefficient value of the K-Factor in the timberland models for the1980s and 1990s. Pulp and paper firms spent huge capital in capacity expansion during the 1980s and in the early 1990s. As a result of the big increase in pulp and paper capacity and increasing concentration in the industry because of merger activities, the K-Factor significantly increased. This entire situation is explained by the structural change test, which indicated the biggest shift in the value of the K-Factor in the timberland model.

The K-factor remained one of the important contributors to timberland ownership and management in the period 1981-98. The importance of the K-Factor has further strengthened with the passage of time. The higher a firm's relative position in the industry, the greater are the chances of its owning and managing timberlands. Firms make the decision about timberland ownership and management on the basis of their relative position in the industry or the strategic position in the market. This study supports the idea that timberland resources are the strategic resources of a firm, which enhance the competitive position of the firm in the market.

These results fully support the concept that the K-Factor reflected a firm's decision making about timberland ownerships during 1960-80,1971-90 and 1981-98 and significant shifts in the values of the K-Factor coefficients was noted. However, the structural change test failed to identify any significant shift in the coefficient values of the K-Factor during 1960-98.

10.2.6 New Supply/ RGDP (NEWSUPPL/RGDP)

Consumption of paper is tied to the economy of the country. When the economy is good, paper consumption rises, and when the economy is in bad shape, paper consumption declines. The higher the consumption of paper, the higher will be the derived demand for wood. The coefficient of new supply/ RGDP showed the instability in the timberland model because of poor demand for paper during the 1970s in the domestic market due to inflation and oil embargo impacts on the economy and their impacts on timberland ownership. The structural change test shows a significant shift in the new supply /RGDP; therefore, we fail to reject the hypothesis that changes in the consumption of pulp and paper as a result of changes in the RGDP impacted the firm's decision about timberland ownership during 1971-90.

10.2.7 Growth (GR)

The coefficient of growth in the timberland model showed instability during 1971-90. The highest growth in sales was observed in the 1970s (14.572 percent for the firms included in the study), and it declined to 9.749 percent in the1980s. Increase in sales growth was the result of targeting the exports markets. Decline in growth during the 1980s was the result of a higher dollar value in 1980-84 and in 1989-90. As a result, pulp and paper imports increased. Higher growth increases timberland attractiveness. During the 1970s, the attractiveness of timberland was at its peak because of increasing wood costs. The structural change test explains the situation, indicating instability of the coefficient of growth during the 1980s.

The 1980s showed a negative association between growth and timberlands because of increasing use of recycled paper as a result of technological progress, evolution of markets and fiber substitution (Ince, 1998), over harvesting, and oversupply of timber from private lands due to a high mortality rate of trees during 1986-1990 (Powell, et al.1993). However, during the 1990s, the relationship between timberland and growth became positive because of the increasing importance of timberlands as a result of a ban on harvesting in certain regions and higher demand for wood in the housing industry and some restrictions on the wood supply from Canada (RPA, 2002). This shift in the situation is well shown by the structural change test. Therefore, we reject the hypothesis that sales growth did not make any difference in pulp and paper manufacturing firms' decision about the ownership and management of timberlands. Rather, there is enough statistical support to believe that sales growth played a significant role in a firms' decision about timberland ownerships during the 1970s, 1980s and 1990s.

10.2.8 Firm Capacity (FC)

Firm capacity has a strong relationship with timberland ownership. The higher a firm's capacity, the greater the chances that the firm will own and manage timberlands because of risks involved in the supply of raw materials (Yin, Harris, and Izlar, 2000). If a firm with high capacity decides to own timberlands, it may benefit from lower costs of production and an ensured supply of wood, and it may also benefit from integration. The structural change test fully captured the situation by showing the significant instability of firm capacity during the 1970s and 1980s. The average firm capacity increased from 790,734 tons in the1970s to 1,213,480 tons in the1980s.

The relationship between firm capacity and timberlands weakened slightly during the 1980s because of increasing use of recycled paper in the manufacture of different grades of paper. Because of poor performance of the pulp and paper industry, capacity growth slowed down in the late 1990s, and the relationship between timberlands and firm capacity further strengthened. Higher addition of capacity and its relationship with timberland is picked up by the structural change test in the form of a shift in the value of coefficients for firm capacity.

During the 1960s, there was significant negative association between timberland ownership and firm capacity. However, this relationship changed somewhat in the 1990s. In the 1990s, the timberland model indicated a positive association between a firm's capacity and timberland holdings. Other variables statistically remained stable during the

1960s and 1990s. From the above discussion, it may be inferred that firm capacity is one of the important factors in making a decision about timberland ownership. However, the level of importance of timberland ownership with respect to firm capacity may vary from product to product (Ohanian, 1993), because some paper grades need virgin pulp due to strength and quality requirements. A study conducted by Turner, Buongiorono, and Zhu (2000) used capacity as a predictor variable in a mathematical model, "Global Forest Products Model (GFPM)" to predict global demand for different forest products. Their study supports the idea of including capacity as a predictor variable in the present study.

10.2.9 Equity/Sales (E/S)

The equity/sales ratio increased from 0.479 in the 1980s to 0.754 in the1990s. Results shown in Table G.3 indicate the structural changes in terms of instability of the coefficient of equity/sales ratio. The 1980s was a decade of profitability for the U.S. pulp and paper industry, except for a few years of recession. However, the situation was different in the 1990s. The firms were unable to take advantage of export markets due to poor prices and a higher dollar value. Increasing paper imports badly impacted the profitability of U.S. firms. The structural test picks up the situation and shows a significant shift in the value of the coefficient of equity/sales. In light of the above discussion, we reject the null hypothesis and fail to reject the hypothesis that the equity/sales ratio passed through significant changes during the 1980s and 1990s, and it played a significant role in pulp and paper manufacturing firms' decision about timberland ownership.

10.2.10 Number of Units (NOU)

Results shown in Table G.3 (APPENDIX G) also point towards the instability of the coefficient of "Number of Units" in the timberland models. During the 1980s, the relationship between the number of units and timberland ownership was positive. However, it turned negative because of the poor profitability of the firms and decreasing pulp and paper prices in the world market. Generally, the profitability of the pulp and paper industry is high when there is high demand in the world market. During the1990s, because of poor performance of the pulp and paper industry, a number of units were shut down to avoid further losses. The structural change test successfully explains the changes. There is enough statistical support to believe in the hypothesis that the number of units or production facilities were significant factors in the firm's timberland ownership decision during 1981-98 and significant changes took place in the value of coefficients of " Number of Units " as a result of changes in the economic, industrial, and global factors.

CHAPTER 11

FACTS AND ISSUES RELATED TO TIMBERLAND OWNERSHIPS AND MANNAGEMENT IN THE U.S. PULP AND PAPER INDUSTRY

11.1 Introduction

This chapter discusses the results of hypothesis tests regarding the role of timberland ownership in the overall profitability of pulp and paper the firms. In this regard, the following hypothesis was formulated:

Ho = Net income of firms that own timberlands is equal to that of firms that do not own timberlands.

Ha = Net income of firms that own timberlands is not equal to that of firm that do not own timberlands.

A t-test was used to estimate any statistical difference between two means. It was found that there was a significant difference between the profitability of pulp-and paper-manufacturing firms holding timberlands and those that do not. The net income of firms increases with an increase in timberland holdings. The relation between net income and increasing timberland holding may be explained by the influence of timberland holdings on the costs of production. Pulpwood is one of the major costs involved in paper manufacturing. Timberland ownership increases the competitiveness of a firm in the pulp and paper market.

Timberlands are forest lands capable of producing 20 cu. ft. of industrial wood per acre per year, and not withdrawn from timber production (Backwith et al. 1998).

Pulp and paper firms overall still own the same acreage of timberlands as they did 40 years ago. It is important to note that overall, total acreage in timberland in the U.S. declined slightly since 1952 and is projected by the USDA Forest Service to continue on a gradual decline through 2040 (Department of Agriculture, 1994). This decline is primarily due to reduction in the holdings of non-industrial private owners (lost to other uses) and to a lesser extent, reduction in publicly-owned timberland. Acres owned by the forest products industry has risen significantly (by 11.5 million acres, almost 20 percent) since 1952, but is projected to remain stable through 2040 (Environmental Defense Fund, 1995).

Achen's (1982) approach was used to estimate the level of importance of timberland ownerships in the profitability of pulp-and paper-manufacturing firms by multiplying the coefficient value of timberland in the profitability model by the mean value of timberland ownerships of a firm (Fig 11.1). It appears that timberland ownerships were at the lowest level of their importance during 1981-90 because of substitution of pulpwood with recycled fiber, increased wood supply in the market, and decline in the demand for wood chips in the export market.

A Logit model analysis indicates a positive association between probability of timberland ownership of a firm and United States advantage (U.S. Pulp and Paper Export/World Pulp and Paper Export) and firm capacity. Time and foreign exchange rates have a negative association with the probability of owning and managing timberlands. From these findings, it may be concluded that if U. S. pulp and paper firms want to remain competitive in the global market, then these firms must continue their interest in owning and managing timberlands. Firm capacity may also play some role in decision making about timberland management and ownership.

11.2 Difference Between the Profitability of Firms Holding Timberlands and Firms Without Timberland Holdings

Results Shown in Table 11.1 indicate a significant difference between the profitability of firms that own and manage timberland and those that do not. The average net income of firms included in the study that hold timberlands is estimated to be about $58.75 million, while the average income of those firms that do not own or manage timberlands is about $26.76 million, with a standard deviation difference of 150.64. The data for these estimates cover the period from 1960 to 1998.

Firms Holding Timberlands Mean Net Income (million dollars)	58.750277
Firms Without Timberland Holdings Mean Net Income (million dollars)	26.760066
Mean Difference	31.990211
95% CI	22.784316-41.196106
SD Difference	150.638664
T	6.818832
df	1030
Prob	0.0000

Table11.1. Difference between the profitability of firms holding timberlands and firms without timberland holdings (1960-1998).

The difference in profitability between the two groups may be explained on the basis of the hypothesis that those firms that own timberlands have a cost advantage over their competitors. Wood accounts for about 21 percent of the cost of manufacturing. In addition, a firm holding timberland may have the benefits of integration, lower transportation costs, and some influence on the pulpwood prices in the area. Firms owning timberlands have a lower risk involved in the wood supply. Yin et al. (2000) state that holding timberlands can enhance the ability of companies to make the decisions that can result in financial success in the long term and conclude that timberland ownership is an important option to the success of forest products companies.

The importance of timberlands as a source of pulpwood further increases in the wake of possible changes in future timberland area in the Unites States. According to Smith et al. (2001), out of 747 million acres (33 percent of the country's area), nearly 504 million acres are classified as commercial timberland. According to Haynes (1990), the trend for the past 40 years indicates a decline in timberland area as a whole. This trend is expected to continue, and it is projected that by 2040 there will be a net loss of 21 million acres of timberland. If these projections are correct then the attractiveness of timberland is expected to increase further in the future.

Gilligan (1973) concluded that timberland prices would continue to rise, with probably a faster rate of increase for northern hardwood lands than for southern pinelands. It appeared that land prices would continue to rise at a considerably faster rate than stumpage in the northern hardwood region, and at a slightly faster rate of increase in the southern pine region. Gilligan's forecast may be explained on the basis of current trends of decreasing supply of good quality hardwood logs from conventional hardwood producing regions, higher demand for quality hardwood logs in the world market and increasing use of hardwoods in pulp and paper manufacturing. All these factors increase the apparent attractiveness of timberlands in the northern regions, particularly in the northeast.

There are many other factors that will further increase the importance of timberlands in the future. First, if private institutions continue increasing their timberland investment, there is a possibility that a number of forest products firms will be at the mercy of private institutional timberland owners. Second, if the supply of wood declines from the public lands, as has happened in the past in some regions, then pulpwood prices are expected to rise and will negatively impact the profitability of those firms that are net buyers of wood for pulp making. Gorate (1998) expressed a similar view about the negative impact of a harvesting ban on public lands. According to him, declines in federal harvests have led to concern about impacts on forest health and on the economy. The national impacts appear to be relatively modest, but local and regional effects could be substantial.

Slatin (1985) argued that forests continue to be of paramount importance to the pulp and paper industry. While it is true that in recent years there has been some diminution in the attraction of investments in forests, paper and wood products companies still own about 13 percent of the total commercial forestland of the nation, slightly less than the 14 percent of decade ago. There has been no reduction in the industry's commitment to forestry research or to the concept of sustained yield as a goal of forestry management.

Yin et al. (1998) stated that in contrast to the slight decline in timber assets owned by the major companies, timberland held by the entire forest products industry had expanded to over 70 million acres. It also appears that, given the existing industry characteristics, holding timberland as an integral part of the overall operations is an important factor in business success. The Pulp and Paper North American Fact Book (1999) states that renewed concern in the 1990s about timber availability has led major forest products companies to reassess the value of owning and managing timberlands.

11.3 Level of Importance of Timberlands in Pulp and Paper Manufacturing Firms' Profitability (1960-98)

The level of importance of timberland ownership in the profitability of pulp and paper manufacturing firms from 1960-98 was estimated using Achen's (1982) approach by multiplying the mean of independent variables with their corresponding coefficients. The product is the net contribution to the level of the

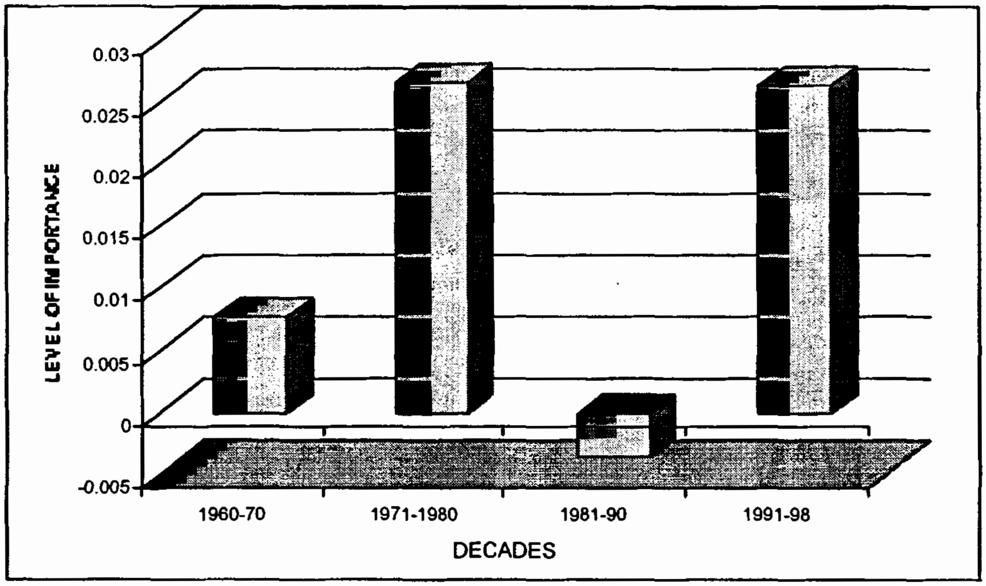

Fig.11.1 Level of importance of timberlands in pulp and paper manufacturing firms' profitability.

dependent variable. This measure has the attractive property that when all the contributions are added, including that of the intercept, the result is precisely the mean of the dependent variable.

From Fig.11.1, it is evident that timberlands were at the lowest level of their importance during the 1980s, and the highest level of timberland ownership importance was recorded during the 1970s. These findings also confirm that, since 1990, timberland ownership has regained its importance in the overall profitability of the firms. Fig. 11.1 also indicates that, in the 1970s, increasing pulpwood prices increased the importance of timberlands to the pulp and paper business. The lower level importance of timberland ownership during the1980s may be explained on the basis of the substitution effect of recycled fiber as a result of new technology and new markets and oversupply of timber in the market. Increasing importance of timberland ownership during the1990s was the result of a ban on harvesting in some regions, increasing demand of wood from housing markets, and some restriction on wood imports from Canada (RPA, 2002).

11.4 Timberlands and Mean Income of Pulp and Paper Manufacturing Firms During 1960-98

Table 11.2 indicates the distribution of timberland ownership among the pulp and paper-manufacturing firms and their respective mean incomes during 1960-98. The results clearly indicate a positive relationship between net income and timberland holdings. There is slight variation in the net income among the firms owning between two and three million acres of timberland. However, there is a significant difference between the income of firms holding timberland between less than two million acres and those owning four million acres and above. A possible explanation for the insignificant difference in the net income of the firms holding timberlands in the range of 2-3 million acres may be the similarity in their mill size. Firms belonging to the groups G4 to G6

Group	Timberlands (Million acres)	Mean Net Income (Millions of dollars)	Coefficient of Variation %
Zero	Nil	26.943	5.08
G1	<0.5	43.546	2.246
G2	<1.0	46.274	2.246
G3	<1.5	52.042	1.697
G4	<2.0	61.088	1.775
G5	<2.5	60.549	1.771
G6	<3.0	62.680	1.733
G7	4 million and above	227.686	1.009

Table 11.2. Timberlands and mean income of pulp and paper manufacturing firms during 1960-1998.

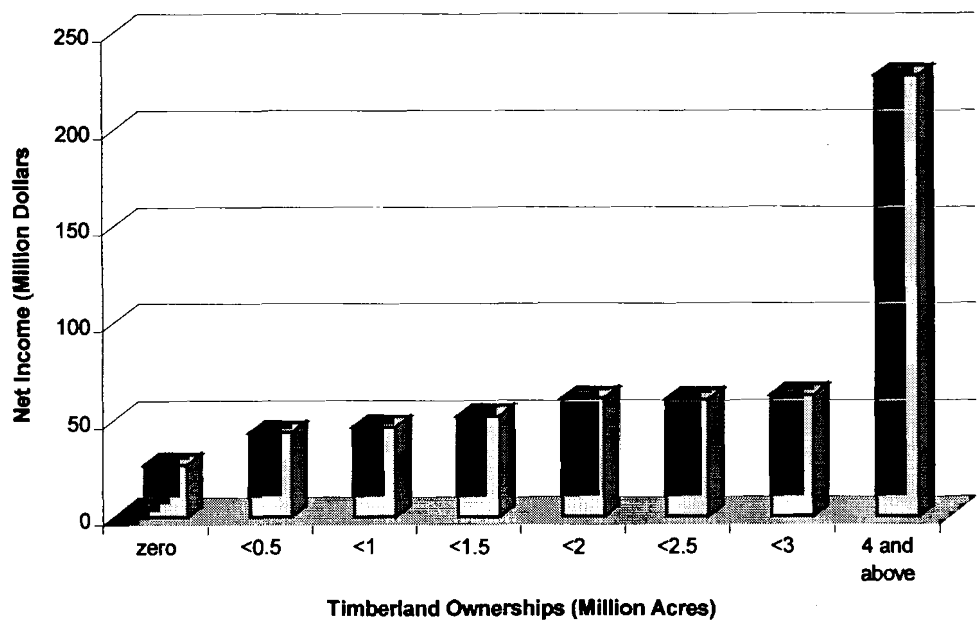

Fig.11.2 Increasing income of pulp and paper firms with their timberland holdings.

may have mill sizes near the minimum efficient scale (MES). Those firms that own timberlands of more than four million acres are of larger size and enjoy the benefits of economies of scale and integration. As a result of these characteristics, these firms fully utilize their timber resources to increase their profitability. However, this topic needs more research in the future.

Timberlands also stabilize the net income. Variation in net income decreases with increasing timberland holdings. Timberland ownership helps firms to reduce the impacts of price volatility of pulp and paper products. These findings are also supported by the earlier work in this regard. Yin, Harris, and Izlar (2000) argued that holding timberlands can enhance the ability of companies to make the decisions that can result in financial successes in the long term, and concluded that timberland ownership was an important factor in the success of forest products producers. Furthermore, timberlands reduce the risk of raw material supply; help in the reduction of transportation costs, and increase a firm's ability to integrate the process. Timberlands increase a firm's credibility for loans, help in building the confidence of new investors in the firm's business, indirectly impact pulpwood prices in the area and act as a barrier to new entry.

Ohanion (1993) thought that large integrated firms that produce standardized grades such as newsprint or kraft papers are typical of firms with timberland assets. According to her, the choice to own timberland may have been motivated by transaction-cost economies, to avoid the necessity of negotiating pulpwood prices and other contractual issues with an outside supplier, and to assure a supply of pulpwood. Gullichsen and Hannu (1998) argued that, depending on the paper grade produced, the availability and price of wood raw material was a primary success factor in the pulp and paper business.

11.5 Consistency of Timberlands Owned by the Pulp and Paper Manufacturing Firms Based on Firm Size Criteria (1960-98)

Results shown in Table 11.3 indicate that from 1960-70, only 23.65 percent of the firms below the median of the firm size ($80.33 million) owned and managed timberland. From 1990-98, 40.95 percent of the firms below the median firm size ($1,508 million) owned and managed timberlands. In contrast, in 1960-70, 88.08 percent of the firms above the median firm size owned timberlands, as did 92.02 percent of the firms above median size from 1990-98.

These results reveal a number of patterns in timberland ownership during 1960-98. First, there was a gradual increase in firm size from $80.33 million in 1960-70 to $1,508 million in 1998. Second, there was a significant increase in the number of firms below the median firm size that owned and managed timberlands during 1960-98. It appears that smaller firms have become more interested in controlling their wood supply. These results do not show a big change in timberland ownership in the group above the median firm size. There was a slight decline in the timberland ownership of bigger firms during the 1970s-80s; however, later in the 1990s, ownership seems to have approached previous levels, being even slightly above the 1960-70 figures.

Year	Median	Lower	Higher	No of Firms	%of Firms HTL	% of Firms WTLH
1960-70	80.33	X	-	394	23.65	76.14
1960-70	80.33	-	X	394	88.08	11.92
1971-80	293.545	X	-	333	34.83	65.17
1971-80	293.545	-	X	333	76.51	23.51
1981-90	937.459	X	-	290	33.10	66.90
1981-90	937.459	-	X	290	80.00	20.00
1990-98	1508	X	-	188	40.95	59.05
1990-98	1508	-	X	188	92.02	7.99

HTL= Holding timberlands WTLH= Without timberland holdings

Table 11.3. Consistency of timberlands owned by pulp-and paper-manufacturing firms based on firm size criteria (1960-98).

From the results given in Table 11.3 it may be inferred that there are no signs of decreasing attractiveness in timberlands among the pulp and paper firms. These results support the findings of Yin et al. (1998) that, in contrast to the slight decline in timber assets owned by major companies, timberland held by the entire forest products industry has expanded to cover 67 million acres. It also appears that, given the existing industry characteristics, holding timberlands as an integral part of the overall operations is an important option for business success. Sande (2002) also supports the present findings that the trend of declining timberland ownership identified by Yin et al. (1998) has continued since 1994. The total amount of timberland in the U.S. owned by the companies that were classified as Major Companies in 1994 has decreased further, from 27.23 million acres to 13.25 million acres in 2001 (excludes International Paper Company). Land owned or controlled by the same companies has increased slightly. Looking at the major and other companies, it is evident that several of them have reacquired timberlands. Therefore, some of the acquirers have increased their timberland ownership substantially through mergers and acquisitions.

Current findings are also supported by Slatin's research (1985) on the subject. He concluded that forestland continues to be of paramount importance to the pulp and paper industry and that there had been no reduction in the pulp and paper industry's commitment to forestry research or to the concept of sustained yield as a goal of forestry management.

McNutt (2002) describes the importance of wood resources to the pulp and paper companies. He states that the pulp and paper industry constitutes nearly 5 percent of the U.S. manufacturing sector's contribution to GDP, and because the timber cost is their largest single production cost, paper firms historically have devoted an enormous amount of their capital to the ownership and management of secure timber resources.

11.6. Logit Regression of Timberland Ownership of Pulp and Paper Firms (1960-98)

Results of a logit regression of timberland ownership of pulp and paper firms are shown in Table H.1 (APPENDIX H). The minimum Chi-squares method was applied in order to reduce the impact of the heteroscedasticity problem. Weights were estimated by taking the square root of {(1/ (n p (1-p)} and the mean value of each variable for all the years was divided by the corresponding estimated weights. The dependent variable was the natural log of (p/1- p), where p is the probability that a firm owns timberland and n is the number of observations. After transformation, a weighted least squares regression was carried out. The logit model has a standard error of estimate of 0.160891 and F-value of 3.027. The logit model shows a positive association between the probability of timberland ownership and U.S. advantage (USADV) and firm capacity, while time and foreign exchange rates (FEXR) show a negative association with the probability of timberland ownership. In the logit model, a change in the probability of owning and managing timberland by a pulp and paper manufacturing firm as a result of a change in the value of an independent variable was calculated by using a probability density function (PDF) as mentioned by Griffth, Hills and Judy, 1993. In order to calculate the marginal effect, coefficients of the variables were multiplied by variable means (in log) to calculate the XB, ($XB=B_1+B_2\ln X1+ B_3\ln X_3$.....) and then the PDF function value { $(e^{XB}) /(1+e^{XB})^2$ } was estimated. The estimated PDF function value was multiplied by the corresponding coefficients of the variables to estimate the percentage point change in the probability as a result of a one percent change in the independent variables. Variables contributing to the probability of timberland ownership decisions of pulp and paper manufacturing firms are shown in Table H.1 (APPENDIX H) and discussed in detail below.

11.6.1 U.S. Advantage (USADV)

The U.S. advantage is a ratio of U.S. pulp and paper export/world pulp and paper export (in volumes). The logit model shows a positive relationship between the probability of timberland ownership and U.S. advantage. When export markets are good, firms try to reduce the production cost to the level where they can compete in the international market. One way of cutting production cost may be to receive the wood supply from fee lands. Most of the pulp and paper firms in

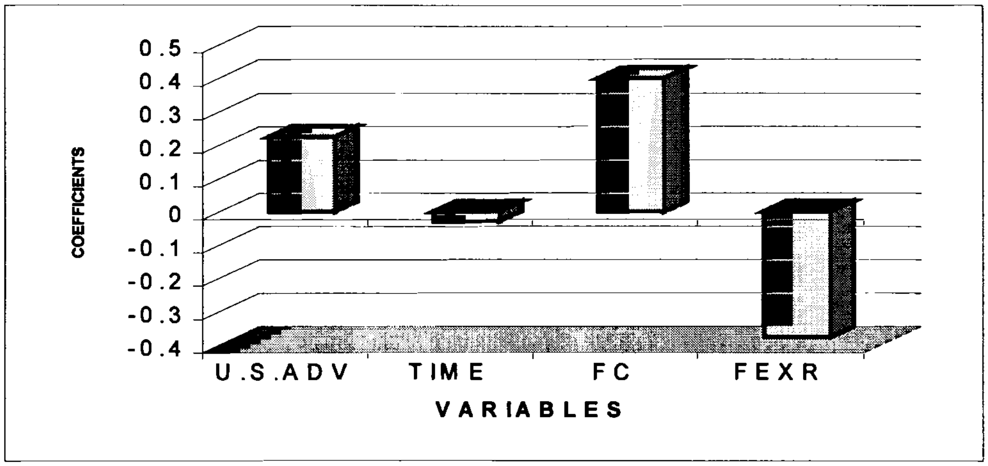

Fig.11.3 Factors affecting the timberland ownership and management probability of pulp and paper manufacturing firms

the export business are of larger size and these firms strive to reduce their production cost by owning and managing timberlands. These results are quite in accordance with the expectations (Fig 11.3). According to the logit model estimates a one percent increase in USADV will increase the probability of owning and managing timberlands by 2.92 percentage point, if other variables remain constant.

11.6.2 Firm Capacity (FC)

The Logit model shows a positive association between probability of timberland ownerships and firm capacity. Firm capacity may or may not be a deciding factor in making decision about owning and managing timberlands. If recycled fiber is easily available in the area and pulpwood is available from the open market, then timberland ownership may not be a practical option for a firm. However, if, neither the recycled fiber nor the pulpwood availability from the open market is possible, then the firm have limited option and may think to own and manage the timberlands. Ohanian (1993) argued that firms manage the timberlands to ensure raw material supplies. The higher the firm's capacity, the more are the chances that firm will own or manage timberlands. A one percent increase in the capacity increased the probability of timberland ownership by 5.19 percent point.

11.6.3 Foreign Exchange Rates (FEXR)

Foreign exchange rates have a significant effect on the forest products business. The higher dollar value negatively impacts exports and decreases the attractiveness of timberland ownership. Higher demand in the export market increases the raw material demand and also the demand for timberlands. A higher dollar also has an impact on the interest rate in the country and impacts the lumber and housing industries that have a direct influence on wood chip prices (PPNAFB, 1984-85). A one percent increase in the foreign exchange rate may decrease the probability of timberland ownership by 4.88 percentage point.

11.6.4. TIME

Time as an independent variable was included in the logit model to examine the trend of timberland ownership. The logit model shows that, generally, there has been a decreasing trend of owning and managing timberlands among the firms, but the negative trend may have been primarily among the bigger firms, which sold their timberlands in order to reduce their financial pressures. However, most of the pulp and paper firms are keeping their timberlands. There was some decline in the timberland area of the larger firms during the 1980s, but later they strengthened their timberland position through mergers and acquisitions. It is estimated that there is a probability of declining timberland ownerships by 0.004 percentage point with the passage of time.

CHAPTER 12

CONCLUSIONS

12.1 Background (Industrial and Economic Environment (1960-98)

Pulp and paper manufacturing firms have experienced dramatic changes in profitability and structure. A number of factors related to the firm, industry and economy have contributed to reshaping the structure of the U.S. pulp and paper industry during the last four decades. The 1960s provided the best opportunities for industry because of expanding economies throughout the world. Research and development increased the U.S pulp and paper industry's advantage over its competitors. The 1970s were difficult years for the industry because of recessions and the oil embargo in 1973. However, the industry managed to defend its world market share. The 1980s varied, but generally it was a good decade for the pulp and paper industry. Record investments were made to add new capacity. However, the 1990s was overall not a good decade for the paper industry, Globalization badly influenced the U.S. pulp and paper industry. A higher dollar value undermined the volume, pricing and profitability of the U.S pulp and paper firms. The U.S pulp and paper industry tried to change the situation through merger and acquisitions, control on capital spending, and reduction in capacity additions. Debt/ Assets ratios peaked. In order to reduce monetary pressure, big firms started selling their productive resources such as timberlands. The validity of timberland ownership was questioned for the first time. A general perception that the U.S pulp and paper industry is under-utilizing its resources became popular. Pulp and paper firms were under tremendous pressure from the investors. Institutional investors took advantage of the opportunities to buy pulp and paper industry timberland assets. In this way, institutional investors were successful in increasing their power in the wood market. A detailed discussion about the profitability, structure and timberland situation follows.

12.2 Profitability

Firm size, market share and equity / sales ratio seem to be consistent factors contributing to profitability in terms of net income of the firms. In addition to these variables, timberlands ownership, exporting firms, the K–Factor, growth, new supply/ RGDP and the price index also impact profitability but not consistently.

Larger firms, with higher market share and higher equity/sales ratios also have higher net income. Larger assets increase the chances for a firm to convert inputs to products profitably. Similarly, a firm having higher market share is expected to earn higher profit in the pulp and paper industry. Companies have generally attempted to gain market share at the expense of low pricing achieved through high volume production. This movement, which was at its height during the late 1980s, placed many firms in a highly sensitive financial position with regard to small change in market demand. This became fully confirmed during the recession years 1991-94 when some market pulp prices, in particular, fell by over 50 percent (Higham, 1995). Equity/ sales ratio is supposed to indicate the financial and operational health of a firm. Higher sales increase the equity of a firm and, consequently the profitability of the firms.

These results strongly describe the market share profitability relationship in the U.S pulp and paper industry during 1960-98. Furthermore, bigger firms also take advantage of benefits of their size to have more access to the markets than smaller firms.

However, bigger firms are not in a position to influence prices, which are determined on the basis of supply and demand in the market.

There have been significant structural changes in the profitability of U.S pulp and paper firms. From 1960-80, U.S. advantage, foreign exchange rates, price index, consumption of pulp and paper with increasing real GDP, equity/sales ratio, market share, timberland and firm size played significant roles in changing the net income of pulp and paper firms. From 1971-90, U.S advantage, foreign exchange rates, operating rates, consumption, equity/sales ratio, market share, timberlands and firm size played a significant role in changing the profitability of the U.S. pulp and paper firms. From 1981-98, the K-Factor, equity/ sales ratio, assets/ sales ratio and firm size played a significant role in changing the net income of the firms. In general firm size, market share and equity/sales ratio are the variables that consistently impact the net income of the firms. Timberland, the K-Factor, US advantage, price index, and consumption also impact net income, but not consistently.

The present study also indicates that tissue-manufacturing firms have higher profitability than firms manufacturing other grades of paper. Higher concentration, advanced technology, innovation and faster machines are the major elements that have increased the profitability of the tissue industry in the U.S.A.

Results of this study clearly explain the fact that demand is of paramount importance in the overall financial health of U.S pulp and paper firms. Achieving higher market shares through bigger assets seems to be the prime strategy of U.S pulp and paper manufacturing firms. Larger size of firms in terms of assets and a strategy of higher market share work successfully when demand is high enough for the pulp and paper products. Unfortunately, bigger assets and higher market share strategy do not provide enough help during the economic down cycles. It appears that the U.S. pulp and paper industry lacks flexibility in reacting against the poor demand cycles because of a high level of fragmentation, higher energy costs, and tough environmental regulations. No doubt, the U.S. pulp and paper industry has made remarkable progress during the last forty years in operational efficiency through technological developments, but enough attention was not paid towards achieving cost reductions in factor production. The U.S. pulp and paper industry must consider off-house cost reduction strategies in order to remain competitive in the wake of increasing intensity of economic cycles and to tackle the globalization challenges successfully. The industry has already started seriously to build economies of scale in distribution similar to those it has achieved in production , although this trend is less obvious (Higham, 1995). Firms must also pay attention towards achieving economies of scale in factor production because these provide solid opportunities to compete in the market.

12.3 Market Share

Firm size and net income of firms consistently impact the market share of the firms. In addition to these, the number of units, The K-factor, exporting firms, lagged concentration, number of firms, growth, timberland and consumption and product mix also influence market share but not consistently.

The market share model confirms the association between market share and net income during 1960-98. Firm size also has a strong relationship with market share. High income firms impact market structure through their conduct. Statistical tests confirmed a significant change in the market share of the firms studied during 1960-80, 1971-90 and

1981-98. Changes in market share also indicate the structural changes in the U.S. pulp and paper industry.

From 1960-80, the K-Factor, firm size, timberlands, number of firms and exporting played an important role in market share change. Similarly, from 1971-90, net income, the 4-firm concentration ratio, the K-Factor, the number of firms and exporting firms played a significant role in shifting market share of the firm in the U.S pulp and paper industry. From 1981-98, the K-Factor, firm size, timberlands, product mix, exports and exporting made a significant contribution to change market share. Market share was significantly changed as a result of changes in the K-factor, firm size, sales growth, timberland and product mix during 1960-98. If we observe carefully, it appears that KF, firm size, timberlands and exporting have played a dominant role in changing the market share of the pulp and paper firms. This means that a firm's relative capacity, and a firm's assets are major players in changing the market share of pulp and paper firms.

The present study confirms a strong relationship between market share and profitability of firms during the last forty years. This means that there is great opportunity to improve profitability by bringing changes to industry structure through conduct such as mergers and consolidations, research and development, and capacity and investment controls.

12.4 Timberlands

During the 1960s, timberland ownership and management was strongly linked to net income of the firm, the equity/sales ratio, mergers, firm size, and the K-Factor. From these findings it appears that net income, relative firm capacity in an oligopolistic market structure, and firms size were the major factors influencing decisions about timberland ownership. However, this situation shifted during the next decade to some extent. Timberland attractiveness increased because of increasing wood costs. Those variables that were related to timberland ownership were net income, equity/sales ratio, product mix and consumption of paper, K-Factor and growth. The attractiveness of timberland decreased slightly in 1981-90, in part because of the increasing use of recycled paper, increased wood supply from private farms and decline in wood chips demand in the export market. Timberland management and ownership were related to net income, equity/sales, and number of units, geographical distribution, firm size, KF and growth. The attractiveness of timberland again increased in 1990-98 because of concerns about the supply of raw material for paper manufacture. During the 1990s, net income, equity/sale ratio, and number of units, the KF and sales growth impacted timberland ownership of pulp and paper firms.

From the above findings, it appears that net income, equity/sales ratio and KF have had the most consistent relation with a pulp and paper firm's decision to own and manage timberlands.

There was a significant shift in timberland ownership from 1960-80. Net income, merger, product mix, firm size and KF were related to structural changes in timberland ownership and management. During 1971-90, net income, firm size, consumption of paper, KF, growth, and firm capacity were the most important factors, while from 1981-98, equity/sales ratio, number of units, firm size, and KF, growth and capacity were significant. During 1960-98, net income, equity sales ratio, number of units, KF and growth in sales were closely related to structural changes in timberland ownership. From the above-mentioned findings, it appears that net income, equity/sales ratio, KF were the major elements related to structural change in timberland ownership and management.

The present study also indicates that those firms that own timberlands have higher incomes than those firms that do not own timberlands. Generally, net income increases with an increase in timberland ownership. The present study also indicated that there was no net decrease in the timberland ownership of pulp and paper firms during 1960-98. Timberlands had the same level of attractiveness in 1998 as in 1960. A logit model indicated that US advantage and firm capacity were positively related to probability of timberland ownership, while FEXR and Time were negatively related to the timberland ownership probability.

The present study fully supports the idea of those that consider the timberlands as important assets for the financial health of pulp and paper manufacturing firms. The attractiveness of timberland is expected to increase further in the wake of environmental regulations, increased interest of institutional investors in timberlands and gradual increase in their market power in wood business, and increasing demand for more and more recycled paper in the overseas pulp and paper markets. The strategic importance of timberland ownership is going to attract more investments in the future for intensive and extensive management of industrial timberlands.

CHAPTER 13

FUTURE RESEARCH

The present study has raised many questions about the associations between profitability, market share, and timberland ownerships of the U.S. pulp-and paper-manufacturing firms. These questions can be answered through future studies in the field of forestry economics. The proposed studies will further increase our ability to understanding the important issues related to the U.S. pulp and paper industry and the importance of the timber assets in the overall competitiveness of the industry. The following studies are suggested in this regard:

1. The present study confirms a strong relationship between market share and profitability. Strong association between market share and profitability raises a question about how much market share a firm must have in order to at least remain profitable in the pulp and paper business. At present there are a number of smaller firms in the paper industry. Obviously, their market share is very small in the overall market. How did these smaller firms manage to survive in the competitive environment and what strategies must smaller firms adopt in the wake of the increasing globalization threat in the pulp and paper business?

2. Unfortunately, the current study missed the opportunity to explore the influence of debt/assets ratio and interest rate on the financial health of the U.S. pulp and paper firms. Future research on the

subject may uncover the negative impacts of these two factors and help in designing future strategies.

3. The present study confirms the positive role of exports on the overall financial health of a firm. A research study can further investigate the relationship between exports and profitability at the firm level. More emphasis may be placed on the identification of the paper grades and target markets. In this regard a survey may be conducted at the national level to answer these questions.

4. Future competitiveness in the pulp and paper business will be determined by wood costs. A study may be planned to identify the impacts of plantation wood grown overseas on the competitiveness of the U.S. pulp and paper industry in the future.

5. The present study confirms the positive role of timberlands in the overall profitability of the firm. This finding raises the following questions on the subject.

   i. How much timberland is sufficient to guarantee the profitability of a firm? At present, the wood self-sufficiency rate is about 32 percent. A survey may be conducted to investigate the pulpwood self-sufficiency rate at the firm level in the U.S. pulp and paper industry. This survey will highlight the importance of timberland ownership and its relation with the net income of a firm.

   ii. In the past, firms acquired other firms because of the attractiveness of their timberland assets. The question arises as to whether the acquiring firm continued managing the acquired timberlands or whether these assets were disposed of. Such a study will answer many questions regarding the attractiveness of timberland assets for the acquiring firms.

iii. Institutional investors will play an important role in the wood market of the future. It is expected that if the paper industry continues selling its timberlands to institutional investors, certainly institutional investors' market power is going to influence the wood prices in the open market. In this regard a study may be planned to investigate the conduct of institutional investors and their impact on wood prices, especially in regional markets. Such a study may help the pulp and paper firms in making future decisions about timberland ownerships and management.

iv. A study may be planned to investigate the impact of fiber substitution, shift in pulpwood supply, and impact of regulations on the overall attractiveness of timberland ownerships in the U.S. pulp and paper industry. Unfortunately, the current study missed the opportunity of selecting "recycling" as an independent variable in the timberland model.

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APPENDIX A

STRATEGIES FOR THE U.S. PULP AND PAPER FIRMS AND INDUSTRY

INTRODUCTION

The pulp and paper industry is one of the most important sectors of the U.S. economy and plays a critical role in the local economies of virtually all regions of the country. Unfortunately, since the start of the 1990s, the industry has been facing economic and financial problems. As a result of these hardships, a number of pulp and paper manufacturing units have stopped their production and laid off their employees. These shutdowns have had significant negative impacts on a number of communities in the U.S. The findings of the current study suggest strategies to address issues of the pulp and paper industry.

Exports have become a crucial segment of the U.S. pulp and paper markets during the last forty years. Pulp-and paper-manufacturing firms will have to design their strategies in the wake of globalization and increasing competition in the pulp and paper business. In order to face the globalization issue, firms must think about consolidation and cost reduction, particularly by improving the productivity of timberland through intensive management techniques. The U.S. pulp and paper industry will be facing tough competition from those regions that have higher timberland productivity. Using cost reduction, the industry can also successfully address issues related to price volatility due to foreign exchange fluctuations. Profitability can be improved by creating virtual quality and cost barriers. Research is needed into how assets can be better utilized or can be reduced without impairing quality and profitability. Unfortunately, the pulp and paper industry is not fully utilizing its assets. Firms will have to reduce their energy costs in order to remain competitive in the global market. The United States has an advantage on the processing side because of the bigger size of its mills. Now the industry must avail itself of opportunities in backward integration, increasing spending on research and development and increasing the productivity of its timberlands.

Background

The pulp and paper industry is a major branch of U.S. manufacturing that plays a critical role in the local economies of virtually all regions of the United States. Yet during the last decade and a half, the industry has been faced with economic, financial, and organizational dislocations that firms have found difficult to address. Among the chronic problems facing the industry are over-capacity, weak prices, poor profit outlooks, and deteriorating shareholder value. These have directly or indirectly affected the pulp and paper industry during the last forty years (CPBIS, 2002). The industry is being buffeted with winds of global, social, economic, and political changes that have altered permanently the historical paradigm that once drove a very successful industry (McNutt, 2002).

Historically, pulp and paper firms have tried to solve problems through technical solutions in the wake of growing competition both within the US and in the international markets. Firms have tried to achieve economies of scale by constructing bigger and bigger plants and making major capital investments. Many companies believe that being a low cost producer means having low variable cost (Lamberg, 2001). Followers of this approach ignore the fixed costs that they incur to obtain low variable costs. They seemingly forget that they need to earn a return on their capital (Kirk, 1997). Unfortunately, this approach has further increased the pulp and paper industry's problems in the form of overcapacity and weak pricing. Despite the limitations of the approach, almost all players have tried to improve their operational effectiveness by investing in new technology, especially from 1980-1990s (Richard, Ormbsy and Ruthstorm, 1990). But, it is not possible to achieve permanent competitive advantage with better technology alone.

U.S. pulp-and paper-manufacturing firms tried to address the issues generated by economies of scale by merger and consolidation. The merger and consolidation approach is basically a disciplined approach in formulating corporate strategies. It seems however, that merger and consolidation are unable to address the root causes of the pulp and paper industry's real issues. It is hard for an individual firm to fix the problem. Before we address the major issues of the U.S. pulp and paper industry, we must be aware of the special characteristics of the industry.

Berler (2002) argues that the U.S. is no longer participating in or benefiting from global paper industry growth, and the "playing field" has shifted dramatically. As a result, the U.S. paper deficit has tripled since 1997. An "excessively" strong dollar is partially to blame. The strong dollar has undermined volumes, pricing, and profitability over the past five years.

Lowry (2002) states that dramatic changes are affecting the stability of the pulp and paper industry, forcing consolidation and closures in attempts to eliminate inefficient capacity. In addition, the market is changing as the result of advancing printing technologies as well as shifts to a direct-marketing paradigm. Two strategies are emerging to help the industry face the future-- reduce costs and increase customer focus. Companies must balance the competing interests of innovative technology against operating efficiencies and value pricing to satisfy today's increasingly demanding marketplace. All factors contributing to product cost must be analyzed for overall impact and necessity. Companies find that more must be done with less to survive during this era of downsizing.

The U.S. pulp and paper industry is highly capital intensive, highly fragmented and highly vulnerable to domestic as well as global economic cycles. The industry is faced with firm, industry, and economy-related issues, which may be addressed only through an integrated approach based on a combination of technological, managerial and contextual knowledge. Understanding the problems of the U.S. pulp and paper industry may help it to rediscover its path to success. Lamberg (2001) concluded that both competitive and institutional elements affect organization strategy processes.

In the light of current research the following strategies are being suggested to address the issues related to globalization, enterprise effectiveness, innovation, assets management, and utilization.

Globalization: "Understand globalization or you will be acquired by someone tomorrow"

The U.S. pulp and paper sector exhibits fairly steady production and growth trends, but its economic fortunes have become intertwined with the "global cycle " of supply and demand. Exposure to the global cycle has increased for the U.S. industry in recent decades, with increased levels of U.S. exports (Ince, 1999). Globalization changes the position of a company by increasing the number of potential competitors and thickening the market (McLaren, 2000). One effect of globalization on the pulp and paper industry is increased price volatility associated with trade related adjustments in export demand and capacity utilization. Pulp and paper price volatility and sensitivity of profits to the global cycle are related to capital intensity and competitiveness in the pulp and paper sector (Ince, 1999).

The following strategies are suggested for the U.S. pulp and paper industry in the wake of increasing global competition.

1. Reduce the fragmentation in the industry through mergers and acquisitions. In a capital-intensive industry, which is rapidly becoming global, the cost of fragmentation is very high.
2. Generate invisible barriers through quality improvement and cost reduction, particularly reduction in factor costs.
3. Promote products as quality products in the exports market. Sometimes, quality acts as a barrier for new entrants.
4. Reduce the negative impacts of Foreign Exchange Rates in the world market through cost reduction and anticipations.
5. Be aware of five "Fs"
    a. Foreign Forest Resources. U.S. pulp and paper firms must realize that in the global market, a number of new competitors have wood cost advantages over U.S. firms because of the higher productivity of their forests. U.S. firms holding timberland must also seek the benefits of

intensively managing their timberlands and improving profitability.

b. Foreign Capacity. U.S. pulp-and paper-manufacturing firms must keep aware of the capacity additions overseas, particularly capacity of those grades for which the firm is in the export business. Excessive foreign capacity and supply reduces U.S advantages in terms of reduction in exports.

c. Foreign Exchange Rates. Foreign exchange rates undermine the volumes, pricing, and profitability of paper products. It is necessary to monitor the exchange rates and their impacts on the firm. A firm must design short-term strategies to tackle the exchange problem. Cost reduction strategies are best to face the challenges of foreign exchange rates.

d. Foreign Prices. Globalization has increased volatility in pulp and paper prices. Price stability is good for the supplier as well as for customers. Firms may minimize the impacts of price volatility through managing capacity utilization and cost reduction approaches.

e. Foreign Demand. Exports play an important role in the profitability of the firms. If U.S. companies want to improve their profitability, they must design their business strategies in the light of growing global competition.

Enterprise Effectiveness

The main theme of enterprise effectiveness is to reduce production costs by the effective utilization of all the available resources to improve the profitability of a firm. In order to achieve this goal, a firm must consider all the factors that may impact enterprise effectiveness, directly or indirectly. Economic, social, technological, and organizational relationships are the salient factors that affect enterprise effectiveness in terms of operations, performance, and competitiveness of a firm (CPBIS, 2002). Here are some of the important strategies that may help the firms to improve their enterprise effectiveness in order to remain competitive in the pulp and paper business:

1. Intensively manage timberlands to increase the productivity of harvestable wood, decrease the wood cost at the mill gate, and increase competitiveness in the domestic as well as in the global market. Low wood cost gives a predominant advantage in every region. Cheap labor, power and fuel cannot offset the disadvantage of high pulpwood cost (Lamberg, 2001). Harkness (1983) noted that comparative advantage embodies a region's endowment of factor productivity, transfer cost, and other factors. Prestemon and Buongiorono (1997) concluded that forest products exports were positively related to forest resources.

2. Effectively utilize assets. Firm should regularly compare their position with firms of equal size. Labor productivity improves as more capital is invested, but the invested capital may not be managed efficiently. With the paper industry being the most capital intensive of all basic industries, this lagging economic success in terms of capital efficiency is creating a major value destruction problem (McNutt, 2002)
3. Reduce the number of breakdown hours. Most of the machines in the U.S. pulp and paper industry are old and slow and have higher breakdown hours. Breakdown increases the cost of production and ultimately impacts the overall competitiveness of the firms.
4. Be innovative through research and development. The U.S. pulp and paper industry was highly innovative during the 1960s. Research and development paid back in terms of higher profitability. Pulp and paper firms introduced new uses of pulp and paper products and extended their markets abroad. Unfortunately, the U.S. paper industry is now not paying much attention to research. Research and development has been left to the equipment and chemical companies. As a result of this, U.S firms are lagging behind their competitors in product development and quality improvement research.
5. Compare operating rates with industry operating rates and evaluate performance regularly to develop short-term strategies to remain competitive.
6. Avoid debt financing. Debt financing creates trouble for a firm when the pulp and paper market is poor. Increased debt compared to assets compels the firms to sell their productive assets and retain assets that are not as productive,

making the financial situation more difficult. Generally, firms sell their timberlands to get out of debt situations but this may negatively affect their competitiveness in the long term.

7. Avoid capacity addition for the sake of capacity additions. It is one of the major causes of the poor performance of the pulp and paper firms in the U.S. Add capacity only in product area that are growing.
8. Keep customers and your employees informed about products and plans.
9. Think how energy can be saved and utilized effectively. The U.S. pulp and paper industry is one of the major users of energy in the country. Firms may improve their competitiveness in the market by reducing their energy costs. In this regard, installation of better recovery systems can help to minimize the overall production costs.

Research and Development

Prior to 1990, the U.S. pulp and paper industry was the technological leader for the global industry. However, due to a variety of business reasons, the U.S. paper industry has lost its leadership position. This is due in part to the industry's desire to chase short-term profits to satisfy Wall Street, to the cutting of research and development (R&D) funding and the loss of research and development facilities (Kinstrey, 2002). As a result of the decrease in R&D, technology development in the pulp and paper industry has shifted from the US to Europe (Table. A.1), and the use of modern technology in pulp and paper manufacturing has significantly increased in Asia.

TECHNOLOGY	PAST	CURRENT
Continuous Pulping	US	EUROPE
ChemicalRecovery System	NA	EUROPE
Headbox, hydraulic	US	EUROPE/ASIA
Forming Fabrics, plastic	US	US/EUROPE
Pressing, Shoe press	US	EUROPE
Drying, single tier	US	EUROPE
Coating, short dwell	US	EUROPE
Calendaring, hot/soft	US	EUROPE
Calendaring, in line super	US	EUROPE
Tissue	US	US/EUROPE
Papermaking, alkaline	EUROPE	EUROPE
Disc refining, stock &TMP	US	EUROPE

Table A.1. Shift in technology development in the pulp and paper industry (Kinstrey, 2002)

In order to regain its leadership position, the U.S. pulp and paper industry will have to strengthen the role of technology in the competitiveness equation to improve the profitability of the firms. These objectives may be achieved by joint efforts of the firms. Here are some approaches that may be implemented to remain competitive in the pulp and paper world markets:

1. Spend more on research and development, especially on new product development, product quality improvement, and the productivity of timberlands.
2. Increase research on bio-chemical pulping, development of low-energy-demanding and high-yield pulping techniques and new uses of paper and paper products.
3. Research the reduction of assets without impairing the productivity and profitability of a firm.

Workplace Transformation

Workplace transformations relate to the organizational structures, management direction, and policies that collectively establish the work environment for those engaged in the development, manufacture, and delivery of products. In fact, workplace transformations are more related to management structure, which has a significant impact on the level of quality and productivity of the firm in order to excel in the world market. The following strategies are suggested to improve the overall competitiveness of the firm:

1. Provide cost effective information to the employees from top to bottom. Provide training opportunities to employees to implement cost reduction programs.
2. Promote innovative strategies and provide a research atmosphere to develop new products according to the needs of customers.
3. Promote coordination between the marketing department and the production department through occasional meetings and seminars.

4. Promote advanced forest management strategies that may help integrate the market and business activities.

APPENDIX B

ORDINARY LEAST SQUARES ESTIMATES OF PROFITABILITY MODEL

Dep: ln.N.INC

Independent variables	1960-70	t	1971-80	t	1981-90	t	1991-98	t
Constant	5.128019	15.259	2.5997	3.076	5.31909	6.669	-2.7894	-0.535
ln USADV	0.036168	1.40738	-0.147332	-2.016	0.37187	1.746	-0.6816	-0.919
ln FEXR	-0.190664	-2.531	0.224672	1.917	-0.14870	-0.881	0.817581	1.211
ln OPRT	0.058354	0.776	-1.337065	-2.796	1.51540	2.900	3.77119	0.894
KF	0.025241	4.668	-0.013853	-0.629	0.00493	0.118	-0.2356	-3.242
EXP.FIR	0.048438	8.367	0.036023	2.038	-0.02722.	-0.805	-0.0771	-0.926
ln PRIIND	-0.037873	-0.563	0.348417	2.753	0.44912	1.977	1.573386	2.361
AVSP/MES	-0.003908	-1.648	0.01875	1.478	0.008836	0.315	-0.127977	-1.305
NEWSUPP/RGDP	0.009202	0.964	0.11172	3.173	-0.02469	-1.444	-0.015113	-0.100
ln ,ES	0.007586	2.620	0.042688	3.379	0.16952	7.518	0.084462	2.876
ln .AS	-0.003387	-1.356	-0.03315	-1.575	-0.176997	-5.371	-0.026757	-0.968
ln .CI	0.006966	0.614	-0.222822	-1.083	-0.34844	-2.659	0.174905	0.367
ln .MS	0.009740	6.46976	0.028748	5.541	0.09231	8.399	0.140043	4.684
TL	0.012058	5.833	0.033974	4.338	-0.00387	-0.293	0.025107	0.947
FS	0.000102	18.555	0.000129	18.003	0.00078	12.464	0.00004	3.934
GR	0.00006915	2.382	0.000110	0.687	0.000368	0.817	0.000388	0.543
Multiple R	0.9096		0.8733		0.7914		0.5312	
R-Square	0.8273		0.7626		0.6264		0.2822	
Adj R-Sq	0.8236		0.7571		0.6162		0..2518	
F -test	223.065		136.673		61.594		9.281	
Observations	714		654		567		370	

Table B.1. OLS estimates of profitability models (1960-98).

APPENDIX C

OLS ESTIMATES OF MARKET SHARE MODEL (1960-98)

Dependent Variable	ln.MS							
Independent Variables	1960-70	t	1971-80	t	1981-90	t	1990-98	t
Constant	-6.9865	-2.3748	0.4322	0.1138	-7.8888	3.2802	-3.461069	0.858
ln.N.INC	0.932144	2.3660	1.071526	6.2712	0.168474	3.4309	0.144646	2.417920
AVSP/MES	-0.052308	-1.5437	-0.145259	-1.92487	0.023875	0.5778	-0.119919	-0.802576
ln CI	0.012282	0.0791	0.681290	0.9670	0.114710	0.6612	0.078667	0.19378
lnCR4	-0.487744	-0.6060	0.053370	0.1217	-0.953319	-4.91967	-0.028114	-0.013860
ln KF	-0.032964	-1.3060	0.244329	8.1269	-0.027127	-1.59734	0.227650	5.5900
ln FS	0.860959	35.4449	0.454230	22.4254	0.814395	59.84961	0.383209	15.47536
GR	0.000248	0.64860	0.000164	0.1858	0.001228	2.05934	0.002067	2.5304
TL	-0.064666	-2.6846	0.016727	0.51479	-0.042652	-3.408	0.127549	5.1229
PRI.MIX	0.011404	1.2853	0.002551	0.1552	-0.004714	-0.58362	0.048652	3.0597
EXP(I)	-0.000160	-1.2831	-0.000128	-1.266	-0.00016	-4.7491	-0.000054	-1.62376
NOU	0.025030	5.7615	0.02194	2.3332	0.023470	7.2392	0.025835	3.50391
NOF	-0.000456	-0.38285	-0.024893	-2.1574	0.014736	2.4725	0.003018	0.1434
EXP.FIR	-0.047143	-1.90024	0.441708	4.4111	0.053096	1.16587	-0.236860	-2.3233
CR4t-1	-0.024845	-0.7800	0.009883	0.6716	-0.018067	-2.46538	-0.024447	-0.7001
Multiple –R	0.9455		0.8903		0.9767		0.9128	
R-Square	0.8940		0.7927		0.9541		0.8333	
Adj-R Sq	0.8919		0.7881		0.9529		0.8267	
F- test	419.521		174.5755		881.992		127.492	
Observations	711		654		567		372	

Table C.1. OLS estimates of market share models (1960-98).

APPENDIX D

OLS ESTIMATES OF TIMBERLAND MODELS (1960-98)

Dependent Variable	TL							
Ind.Variables	1960-70	t	1971-80	t	1981-90	t	1991-98	t
Constant	-13.34759	-3.37029	-1.423023	-0.844333	5.562550	3.46250	3.171012	0.59724
ln.N.INC	3.136436	6.18427	1.237893	8.28925	0.240412	2.06657	0.262662	2.66856
ln.ES	0.142637	3.41041	0.177969	3.62351	0.325794	5.19907	0.145892	2.56942
MEG	0.194724	3.59097	-0.020091	0.34651	0.009501	0.122890	-0.02300	-0.18899
NOU	0.001684	0.09788	0.015028	0.75222	0.041406	2.60316	-0.045770	-2.45521
PRIMIX	0.011337	0.95101	0.056140	3.78174	0.047604	2.42927	-0.002357	-0.08552
GD	-0.007232	-0.38488	-0.005650	-0.24481	-0.061381	-2.366720	0.007067	0.27909
lnFS	0.149832	4.38297	-0.036830	-1.99382	0.074008	2.28236	-0.056031	-1.34238
NEWSUPPL	0.078214	0.55999	-0.011807	-2.83324	0.064729	1.80686	-0.154955	-1.04691
KF	1.586053	15.41039	2.457042	26.63114	2.962797	25.63483	1.805734	16.19171
GR	0.000367	0.70306	0.001638	2.01476	-0.004796	-3.36089	0.003269	2.37227
ln FEXR	0.710054	0.71498	-0.071780	-0.402507	0.181266	0.92166	-0.423619	-0.55764
ln.FC	-0.145820	-4.09355	-0.205165	-7.39253	-0.322727	-7.28947	0.046924	0.73898
lnCR4	-0.7423	-2.16126	-0.811958	-2.08113	-1.205614	-3.05597	-0.832370	-0.62536
Multiple R	0.834051		0.896191		0.8849		0.837074	
R-Square	0.695642		0.803157		0.783147		0.700693	
Adj-R Square	0.69028		0.799178		0.778131		0.6897	
F-test	129.9275		201.813		156.124		64.1086	
Number of Observations	753		657		576		370	

Table D.1. OLS estimates of timberland models (1960-98).

APPENDIX E

STRUCTURAL CHANGES IN PROFITABILITY OF PULP AND PAPER FIRMS (1960-98)

YEAR	F= {(SSE (Pooled)-(SSE1+SSE2)}/K]/{(SSE1+SSE2)/(T1+T2-K1-K2)}	F-Test
1960s to 1970s	F = {(11.5674- 10.5581)/15}/{(10.5581/1368-30)}	8.5271*
1970s- to 1980s	F = {(43.15456- 39.34077)/15}/{(39.34077/1221-30)}	7.6972*
1980s to 1990s	F = {(113.8261- 101.68147)/15}/{(101.68147/936-30)}	7.2140*

* = significant at 5 percent level.

Table E1. Structural changes in profitability of U.S.pulp and paper firms (1960-98)

APPENDIX E Cont'd

Variables	Coefficients B1 1960-70	Variance V1	Coefficients B2 1971-80	Variance V2	T
Constant	5.128019	0.11303044	2.599763	0.713916844	2.780239
ln.U.S.ADV	0.0361668	0.00066049	-0.147332	0.005338056	2.369246
ln.FEXR	-0.190664	0.005673856	0.224672	0.013728575	-2.981751
ln.OPRT	0.058354	0.005643014	-1.337065	0.228556662	2.8834437
K-FACTOR	0.025241	2.92356E-05	-0.013853	0.000483648	1.7262379
EXPFIR	0.048438	3.35125E-05	0.036023	0.000312406	0.6675134
l.n.PRIIND	-0.037873	0.004522428	0.348417	0.016016674	-2.695396
AVSP/MES	-0.0033908	5.62214E-06	0.018875	0.000163047	-1.754257
NEWSUP/RGDP	0.009202	9.10688E-05	0.111172	0.0012227521	-2.808131
ln.E/S	0.007686	8.38103E-06	0.042688	0.000159517	-2.709001
ln.A/S	-0.003387	6.23501E-06	-0.033153	0.000443018	1.404348
ln.CI.	0.006966	0.000128596	-0.222822	0.042325656	1.115235
lnMS	0.00974	2.26503E-06	0.028748	2.69153E-05	-3.51877
TL	0.012058	4.27249E-06	0.033974	6.13402E-05	-2.705623
FS	0.000102	2.5E-11	0.000129	4.9E-11	-3.138686
GR	0.00006915	8.44484E-10	0.00011	2.56E-08	- 0.2512028

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant.

Table E. 2. Structural changes in profitability of U.S. pulp and paper firms (1960s to 1980s)

APPENDIX E Cont'd

Variables	Coefficient B1 1970-80	Variance V1	Coefficients B2 1981-90	Variance V2	T
Constant	2.599763	0.844936	5.319095	0.636073242	-2.3404
ln.U.S.ADV	-0.147332	0.073062	0.371874	0.045353239	-2.3060
ln.FEXR	0.224672	0.117169	-0.1487	0.028433042	1.8183
ln.OPRT	-1.337065	0.478076	1.515405	0.273013565	-4.0276
K-FACTOR	-0.013853	0.021992	0.00493	0.001718103	-0.4002
EXPFIR	0.036023	0.017675	-0.027222	0.001142034	1.6583
l.n.PRIIND	0.348417	0.12657	0.449116	0.051583949	-0.3873
AVSP/MES	0.018875	0.012769	0.008836	0.000786634	0.3257
NEWSUP/RGDP	0.111172	0.035036	0.024688	0.000291897	3.4854
ln.E/S	0.042688	0.01263	0.16952	0.000508322	-4.9078
ln.A/S	-0.033153	0.021048	-0.176997	0.0010859	3.6787
ln.CI.	-0.222822	0.205732	-0.348448	0.017165192	0.5150
lnMS	0.028748	0.005188	0.092313	0.00012078	-5.2303
TL	0.033974	0.007832	-0.00387	0.000174134	2.4661
FS	0.000129	0.000007	0.000078	3.6E-11	5.5317
GR	0.00011	0.00016	0.000368	2.03401E-07	-0.5391

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table E.3.Structural changes in profitability of U.S. pulp and paper firms (1970s to 980s)

APPENDIX E Cont'd

Variables	Coefficients b1 1981-90	Variance V1	Coefficients b2 1991-98	Variance V2	T
Constant	5.319095	0.636073	-2.789405	27.11061	1.5393
ln.U.S.ADV	0.371874	0.045353	-0.68167	0.549460	1.3660
ln.FEXR	-0.1487	0.028433	0.817581	0.455519	-1.3894
ln.OPRT	1.515405	0.273013	3.77119	17.77393	-0.5310
K-FACTOR	0.00493	0.001718	-0.2356	0.005278	2.8755
EXPFIR	-0.027222	0.001142	0.077102	0.006918	0.5555
l.n.PRIIND	0.449116	0.051583	1.573386	0.443913	-1.5971
AVSP/MES	0.008836	0.000786	-0.127977	0.009616	1.3413
NEWSUP/RGDP	-0.024688	0.000291	-0.015113	0.022635	-0.0632
ln.E/S	0.16952	0.000508	0.084462	0.000862	2.2977
ln.A/S	-0.176997	0.001085	-0.026757	0.000763	-3.4932
ln.CI.	-0.348448	0.017165	0.174905	0.226143	-1.0610
lnMS	0.092313	0.000120	0.140043	0.000893	-1.4984
TL	-0.00387	0.000174	0.025107	0.000702	-0.9788
FS	0.000078	3.6E-11	0.00004	1E-10	3.2584
GR	0.000368	2.03401E-07	0.000388	5.11225E-07	-0.0236

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table E.4. Structural changes in profitability of U.S. pulp and paper firms (1980s-to-1990s

APPENDIX E Cont'd

Variables	Coefficients b1 1960-70	Variance V1	Coefficients b2 1990-98	Variance V2	T
Constant	5.128019	0.11303044	-2.789405	27.11061	1.5174
ln.U.S.ADV	0.0361668	0.00066049	-0.68167	0.549460	0.9678
ln.FEXR	-0.190664	0.005673856	0.817581	0.455519	-1.4851
ln.OPRT	0.058354	0.005643014	3.77119	17.77393	-0.8805
K-FACTOR	0.025241	2.92356E-05	-0.2356	0.005278	3.5802
EXPFIR	0.048438	3.35125E-05	0.077102	0.006918	1.5057
ln.PRIIND	-0.037873	0.004522428	1.573386	0.443913	-2.4061
AVSP/MES	-0.0033908	5.62214E-06	-0.127977	0.009616	1.2648
NEWSUP/RGDP	0.009202	9.10688E-05	-0.015113	0.022635	0.1613
ln.E/S	0.007686	8.38103E-06	0.084462	0.000862	-2.6057
ln.A/S	-0.003387	6.23501E-06	-0.026757	0.000763	0.8421
ln.CI.	0.006966	0.000128596	0.174905	0.226143	-0.3530
lnMS	0.00974	2.26503E-06	0.140043	0.000893	-4.3530
TL	0.012058	4.27249E-06	0.025107	0.000702	-0.4909
FS	0.000102	2.5E-11	0.00004	1E-10	5.5454
GR	0.00006915	8.44484E-10	0.000388	5.11225E-07	-0.4455

Table E.5. Structural changes in profitability of U.S. pulp and paper firms (1960s vs 1990s)

APPENDIX F

STRUCTURAL CHANGES IN MARKET SHARE OF U.S.PULP AND PAPER MANUFACTURING FIRMS (1960-98)

YEARS	F = [{(SSE (Pooled)-(SSE1+SSE2)}/K]/{(SSE1+SSE2)/(T1+T2-K1-K2)}	F-TEST
1960s to 1970s	F = {(549.0678-473.71713)/14}/{(473.71713)/(1409-28)}	15.6904*
1970s to 1980s	F = { (445.48191-361.861)/14}/{(361.862)/(1029-28)}	16.5226*
1980s to 1990s	F = {(203.87981-156.60297)/14}/{(156.60297)/744-28)}	18.80*

* = Significant at 5 percent level

Table F.1. Structural changes in market share of U.S.pulp and paper manufacturing firms (1960-98)

APPENDIX F Cont'd

Variable	COEFFICIENT B1 1960-70	VARIANCE V1	COEFFICIENT B2 1971-80	VARIANCE V2	T
CONSTANT	-6.9865	8.6543	0.4322	14.4130	-1.5446
ln.N.INC	0.9321	0.1552	1.0715	0.0291	-0.3245
AVSP/MES	-0.0523	0.0011	-0.1452	0.0056	1.1236
ln.CI	0.0122	0.0240	0.6813	0.4963	-0.9273
ln.CR4	-0.4877	0.6477	0.0533	0.1921	-0.5904
ln.KF	-0.0329	0.0006	0.2443	0.0008	-7.1096
ln.FS	0.8609	0.0006	0.4542	0.0004	12.8601
GR	0.0002	1.4592E-07	0.0001	7.77924E-07	0.0874
TL	-0.0646	0.0005	0.0167	0.00105	-2.0123
PRMIX	0.0114	7.8730	0.0025	0.00026	0.4746
EX	-0.0001	1.5625E-08	0.0001	1.0201E-08	-0.1991
NOU	0.0250	1.88703E-05	0.0201	7.4909E-05	0.4993
NOF	-0.0004	1.41848E-06	-0.0248	0.00013	2.1067
EXPFIR	-0.1471	0.0059	0.4417	0.01002	-4.6519
CR4t-1	-0.0248	0.0010	0.0098	0.00021	0.9898

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table F2. Structural changes in market share of U.S. pulp and paper firms (1960s to1980s).

APPENDIX F Cont'd

Variable	COEFFICIENT B1 1971-80	VARIANCE V1	COIEFFICIENT B2 1981-90	VARIANCE V2	T
CONSTANT	0.4322	14.4130	-7.8888	5.7840	1.8515
ln.N.INC	1.0715	0.0291	0.1684	0.0024	5.0796
AVSP/MES	-0.1452	0.0056	0.0238	0.0017	-1.9658
ln.CI	0.6813	0.4963	0.1147	0.0300	0.7808
ln.CR4	0.0533	0.1921	-0.9533	0.0375	2.1004
ln.KF	0.2443	0.0008	-0.0277	0.0002	7.9254
ln.FS	0.4542	0.0004	0.8143	0.0002	-14.7601
GR	0.0001	7.77924E-07	0.0012	3.55216e-07	-0.9995
TL	0.0167	0.00105	-0.0426	0.000156	1. 7053
PRMIX	0.0025	0.00026	-0.0047	6.5237	0.3972
EX	0.0001	1.0201E-08	-0.0001	1.156E-09	0.3002
NOU	0.0201	7.4909E-05	0.02347	1.05106E-05	-0.3544
NOF	-0.0248	0.00013	0.01473	3.55216E-05	-3.0515
EXPFIR	0.4417	0.01002	0.05309	0.00207	3.5326
CR4t-1	0.0098	0.00021	-0.01806	5.3699E-05	1.7002

T=(B1-B2)/SQRT(V1+V2) All the values more than 2 are significant

Table F3. Structural changes in market share of U.S. pulp and paper firms (1970-to-1980s).

APPENDIX F Cont'd

Variable	COEFFICIENT B1 1981-90	VARIANCE V1	COIEFFICIENT B2 1990-98	VARIANCE V2	T
CONSTANT	-7.8888	5.7840	-3.4610	16.2462	-0.7064
ln.N.INC	0.1684	0.0024	0.1446	0.0035	1.9762
AVSP/MES	0.0238	0.0017	-0.1199	0.0223	0.4412
ln.CI	0.1147	0.0300	0.0786	0.1648	-0.1527
ln.CR4	-0.9533	0.0375	-0.0281	4.1139	-0.2106
ln.KF	-0.0277	0.0002	0.2276	0.0016	-5.4394
ln.FS	0.8143	0.0002	0.3832	0.0006	13.773
GR	0.0012	3.55216e-07	0.0020	6.67489E-07	-2.0168
TL	-0.0426	0.000156	0.1275	0.00062	-5.5485
PRMIX	-0.0047	6.5237	0.0486	0.00025	-2.0455
EX	-0.0001	1.156E-09	-0.000054	1.089E-09	-0.8199
NOU	0.02347	1.05106E-05	0.025835	5.43611E-05	-0.0940
NOF	0.01473	3.55216E-05	0.0030	0.00044	-0.1648
EXPFIR	0.05309	0.00207	-0.23686	0.01039	0.7008
CR4t-1	-0.01806	5.3699E-05	-0.0244	0.001219	-0.0084

T=(B1-B2)/SQRT(V1+V2) All the values more than 2 are significant

Table F4. Structural changes in market share of U.S. pulp and paper firms (1980-to-1990s).

APPENDIX F Cont'd

Variable	COEFFICIENT B1 1960-70	VARIANCE V1	COIEFFICIENT B2 1990-98	VARIANCE V2	T
CONSTANT	-6.9865	8.6543	-3.4610	16.2462	-0.7064
ln.N.INC	0.9321	0.1552	0.1446	0.0035	1.9762
AVSP/MES	-0.0523	0.0011	-0.1199	0.0223	0.4412
ln.CI	0.0122	0.0240	0.0786	0.1648	-0.1527
ln.CR4	-0.4877	0.6477	-0.0281	4.1139	-0.2106
ln.KF	-0.0329	0.0006	0.2276	0.0016	-5.4394
ln.FS	0.8609	0.0006	0.3832	0.0006	13.7730
GR	0.0002	1.4592E-07	0.0020	6.67489E-07	-2.0168
TL	-0.0646	0.0005	0.1275	0.00062	-5.5485
PRMIX	0.0114	7.8730	0.0486	0.00025	-2.0455
EX	-0.0001	1.5625E-08	-0.000054	1.089E-09	-0.8199
NOU	0.0250	1.88703E-05	0.025835	5.43611E-05	-0.0940
NOF	-0.0004	1.41848E-06	0.0030	0.00044	-0.1648
EXPFIR	-0.1471	0.0059	-0.23686	0.01039	0.7008
CR4t-1	-0.0248	0.0010	-0.0244	0.001219	-0.0084

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table F.5. Structural changes in market share of U.S. pulp and paper firms (1960s vs-1990s).

APPENDIX G

STRUCTURAL CHANGES IN TIMBERLAND OWNERSHIP IN U.S. PULP AND PAPER FIRMS (1960-98)

Variable	COEFFICIENT B1 1960-70	VARIANCE V1	COEFFICIENT B2 1971-80	VARIANCE V2	T
Constant	-13.3475	15.6845	-1.4230	2.8404	2.7705
ln.N.INC	3.1364	0.2572	1.2378	0.0223	3.5910
ln.ES	0.1426	0.0017	0.1779	0.0024	-0.5476
MEG	0.1947	0.0029	-0.0200	0.0033	2.7059
NOU	0.0016	0..0002	0.0150	0.0004	-0.5061
PRIMIX	0.0113	0.0001	0.0561	0.0002	-2.3532
GD	-0.0072	0.0003	-0.0056	0.0005	-0.0531
ln.FS	0.1498	0.0011	-0.0368	0.0003	4.8038
NEWSUP /RGDP	0.0782	0.0195	-0.1180	0.0017	1.3466
KF	1.5860	0.0105	2.4570	0.0085	-6.3014
GR	0.0003	2.7248	0.0016	6.60969E-07	-1.3155
lnFEXR	0.7100	0.9862	-0.0717	0.0318	0.7748
ln.FC	-0.1458	0.0012	-0.2051	0.0007	1.3137
ln.CR4	-0.7423	0.1179	-0.8119	0.1522	0.1340

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table G.1. Structural change in timberland ownership in U.S.pulp and paper firms(1960s-1970s)

APPENDIXG Cont'd

Variable	Coefficient B1 1971-80	Variable V1	Coefficient B2 1981-90	Variable V2	T
Constant	-1.4230	2.8404	5.5625	2.5808	-3.0001
ln.N.INC	1.2378	0.0223	0.2404	0.0135	5.2692
ln.ES	0.1779	0.0024	0.3257	0.0039	-1.8566
MEG	-0.0200	0.0033	0.0095	0.0059	-0.3062
NOU	0.0150	0.0004	0.0414	0.0002	-1.0329
PRIMIX	0.0561	0.0002	0.0476	0.0003	0.3472
GD	-0.0056	0.0005	0.0613	0.0006	1.6052
ln.FS	-0.0368	0.0003	0.0740	0.0010	-2.9700
NEWSUP /RGDP	-0.1180	0.0017	0.0647	0.0012	-3.3263
KF	2.4570	0.0085	2.9627	0.0133	-3.4198
GR	0.0016	6.60969E-07	-0.0047	2.0363	3.9175
lnFEXR	-0.0717	0.0318	0.1812	0.0386	-0.9531
ln.FC	-0.2051	0.0007	-0.3227	0.0019	2.2498
ln.CR4	-0.8119	0.1522	-1.2056	0.1556	0.7094

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table G.2. Structural change in timberland ownership in U.S.pulp and paper firms(1970s-1980s)

APPENDIX G Cont'd

Variable	Coefficient B1 1981-90	Variable V1	Coefficient B2 1990-98	Variable V2	T
Constant	5.5625	2.5808	3.1710	28.1900	0.4311
ln.N.INC	0.2404	0.0135	0.2626	0.0096	-0.1460
ln.ES	0.3257	0.0039	0.1458	0.0032	2.1274
MEG	0.0095	0.0059	-0.023	0.0148	0.2254
NOU	0.0414	0.0002	-0.0457	0.003	3.5573
PRIMIX	0.0476	0.0003	-0.0023	0.0007	1.4774
GD	0.0613	0.0006	0.0070	0.0006	-1.8884
ln.FS	0.0740	0.0010	-0.0560	0.0017	2.4602
NEWSUP /RGDP	0.0647	0.0012	0.1549	0.0219	1.4425
KF	2.9627	0.0133	0.1115	0.8483	3.0715
GR	-0.0047	2.0363	0.0013	0.0051	-0.0863
lnFEXR	0.1812	0.0386	0.7596	0.0003	-2.9289
ln.FC	-0.3227	0.0019	0.0634	0.0015	-6.5464
ln.CR4	-1.2056	0.1556	1.3310	0.0003	-6.4221

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table G.3. Structural change in timberland ownership in U.S. pulp and paper firms (1980s-1990s)

APPENDIX G4 Cont'd

Variable	COEFFICIENT B1 1960-70	VARIANCE V1	Coefficient B2 1990-98	Variable V2	T
Constant	-13.3475	15.6845	3.1710	28.1900	-2.4938
ln.N.INC	3.1364	0.2572	0.2626	0.0096	5.5625
ln.ES	0.1426	0.0017	0.1458	0.0032	-0.0461
MEG	0.1947	0.0029	-0.023	0.0148	1.6341
NOU	0.0016	0..0002	-0.0457	0.003	1.8706
PRIMIX	0.0113	0.0001	-0.0023	0.0007	0.4560
GD	-0.0072	0.0003	0.0070	0.0006	-0.4534
ln.FS	0.1498	0.0011	-0.0560	0.0017	3.8156
NEWSUP /RGDP	0.0782	0.0195	0.1549	0.0219	1.1457
KF	1.5860	0.0105	0.1115	0.8483	1.5910
GR	0.0003	2.7248	0.0013	0.0051	-0.01413
lnFEXR	0.7100	0.9862	0.7596	0.0003	-0.0499
ln.FC	-0.1458	0.0012	0.0634	0.0015	-3.9621
ln.CR4	-0.7423	0.1179	1.3310	0.0003	-6.0271

T=(B1-B2)/SQRT(V1+V2)   All the values more than 2 are significant

Table G.4. Structural change in timberland ownership in U.S.pulp and paper firms(1960s vs 1990s)

APPENDIX H

VARIABLES CONTRIBUTING TO THE PROBABILITY OF HOLDING TIMBERLANDS BY THE PULP AND PAPER FIRMS (1960-98)

Dependent variable Log (p/1-p)

Variables	Coefficients	Standard Error	Variable Mean (in log)	Unit Change In probability % point
Constant	-3.902992	1.942326		
Ln. USADV	0.224903	0.280966	-0.79263	2..92
Ln.FC	0.400036	0.144931	15.15717	5.19
Ln.FEXR	-0.370696	0.150335	0.41748	-4.88
Ln.Time	-0.028590	0.072046	4.066773	-0.003

Model: log (pi/1-pi)= B1+ln B2 X1i+lnB3X2……+ei
Pi = Proportion of firms owning timberlands.
X1= Average of USADV for year (i= 1960-1998)
X2= Average of Firm Capacity for the year i.
X3= Average of FEXR for the year i.
X4=Time period.
Weight= SQRT (1/np (1-p)),
Method: Minimum chi- squares.

Table H.1. Variables contributing to the probability of timberland ownership and management decision by the US pulp and paper manufacturing firms during 1960-98.

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Kanwar Muhammad Suleman was born on June 1st, 1949 in Chak No 24.S.B, District Sargodha, 100 miles from Lahore, the second largest city of Pakistan. After completing his high school education from the The Government High School, Bhagtanwala, he received his B.Sc degree from The Government College Sargodha, affiliated with The Punjab University Lahore in 1970. Later he received his M.Sc (Chemistry) degree from The University of Agriculture, Faisalabad (Pakistan) in 1975.

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