Final Report

Assessment of Pricemaking Forces in the US Softwood Lumber Markets

PART ONE: INDUSTRY CHARACTERIZATION AND ECONOMIC PERFORMANCE, 1946-92

PART TWO: SHORTRUN MARKET DYNAMICS, 1976-1993

Report to
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PREFACE

This Assessment depicts the changing economic conditions and structural traits of the North American softwood lumber industry during the postwar period. It then assesses the industry's economic performance according to basic economic criteria. Its purpose is to present the strategic pricemaking forces at work in the industry over this period. Finally, it provides an analysis of shortrun pricemaking forces in the industry through a detailed description using monthly data. It closes with case studies of the various "bubbles" that occurred in the lumber market from 1978-93.

Mexican softwood production and trade are small relative to the US and Canada, and Mexico's softwood trade with the US has been small until recently. So we omit Mexico from this analysis though it is usually considered part of North America.

We would like to acknowledge the assistance of many people in industry, government, and trade associations who provided us with data and information.

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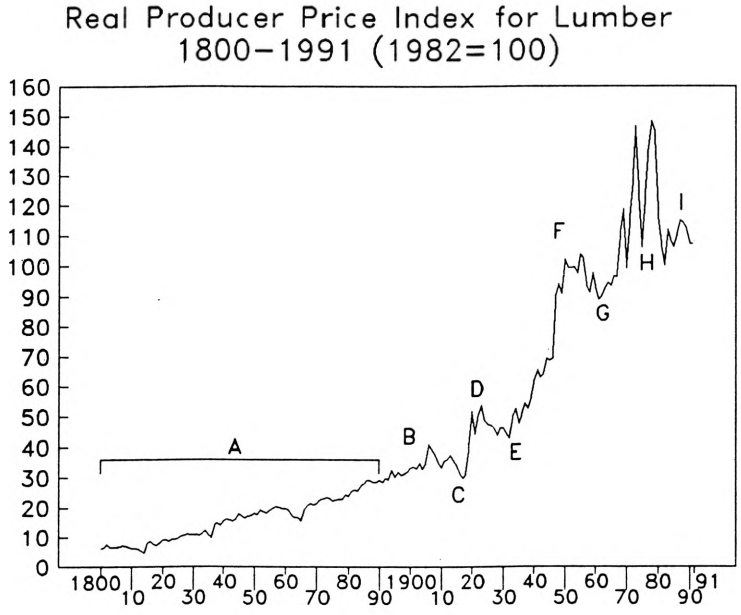
1 INDUSTRY CHARACTERIZATION AND ECONOMIC PERFORMANCE, 1946-92

1.1 CHANGING BASIS FOR CONCERN OVER LUMBER PRICES

The price of softwood lumber has been an issue for public policy makers, foresters, and the forest industry for many years. The basis for the concern has changed over time. Early in the century, availability and impacts on consumers were emphasized, during temporary shortages. But at the same time, many foresters argued that low prices of lumber were in fact a major barrier to private forest conservation and management. Later, episodes of rising lumber prices raised concerns for their impacts on inflation, especially in the cost of housing. By the late 1980's, the nation's international trade performance and competitiveness became an issue, and a Materials Policy paradigm developed that helped analysts examine a variety of issues. Finally, policy choices like Spotted Owl preservation have highlighted anew the importance of the industry's local economic impacts.

A widely used index of long-term lumber price trends (Fig. 1) provides a framework for this discussion. While the most prominent feature is clearly the secular uptrend, an examination of the differing forces at work during subperiods conveys a richer picture of causes at work (Table 1).

Figure 1



Source: USDA Forest Service.
Codes for periods: see Table 1.

Table 1
Periods in Lumber Price Development, 1800-1991

Letter	Years	Period
A	1800-1890	Liquidation of eastern timber; farmland clearing; lower freight costs
B	1890-1909	Consumption peak for lumber; farm prosperity and expansion; urbanization
C	1910-18	Declining demand; wartime housing slump Panama Canal opened
D	1919-26	Postwar inflation; housing boom peaks
E	1927-45	Depression and war reduce consumption; collapse of world trade
F	1946-51	Postwar inflation European reconstruction Historic housing boom
G	1950's early 1960's	Moderate inflation Modest housing production Plywood annexes lumber markets
H	1970-84	Housing boom; Vietnam War inflation and economic boom Mid eighties recession Exports reduced by high dollar Log exports become prominent
I	1985-91	Late 1980's housing boom Reagan boom peaks Resurgence of exports Recession Old growth supply conflicts

1.1.1 The Conservation/Progressive Era to World War One

During the 1890's, eastern states were feeling the consequences of the exhaustion of nearby wood supplies. At this time, the use of wood for fuel, in construction, and for industrial and transportation stood at an all time peak. As wood products were hauled greater distances from the South and West to the nation's cities and farms, costs rose. Also at this time, a prolonged period of declining real transportation costs came to an end and ton mile costs began to rise.

Given the huge consumption of lumber products at that time, analysts and policymakers were naturally concerned with the impacts of sheer availability as well as price. To some observers, it appeared certain that continued consumption at recent rates would progressively exhaust supplies, burdening many areas of industry as well as consumers. At the same time, however, some observers believed that an underlying cause of forest liquidation was that lumber prices were too low to support long-term management. Early forester Gifford Pinchot was one of these. These observers argued that tariffs on lumber imports might help maintain prices at levels that would reduce the need to liquidate and would provide incentives for long-term private forest management.

1.1.2 Roaring Twenties and Depression

The economic boom following 1918 boosted markets for many commodities. Lumber prices rose sharply, prompting widespread concern. Senator Capper of Oklahoma requested an analysis from the Forest Service, which led to the well-known report (1920), which is now often known by the Senator's name.

Lumber was not by any means the only commodity raising such concerns. The farm economy, boosted by strong exports and strong domestic demand, had several banner years of high prices and prosperity in the years just before World War One. Price levels reached at this time were later used as the base for "parity pricing" in farm support programs. During the spring and summer of 1920, a severe gasoline shortage afflicted California (Olmstead and Rhode 1985).

The Capper report assessed the condition of the nation's forests, the trends experienced in lumber prices, and their social consequences. The report examined forces

including resource depletion, exports, and concentrated ownership of timberland as potential causes for the increases in prices. The situation as the report was prepared was indeed worrisome:

> *"In March 1920, average mill prices in the South and West had increased 300 percent and more over the prices received in 1914, and average retail prices in the Midwest showed increases ranging from 150 to 200 percent.*
>
> *The timber market has been more unstable than ever before in our history. Many industries have been unable to secure their supplies of timber at any price. The output of entire industries has been reduced by 50 percent. ...The ramifications of lumber shortages and high prices are limitless and have affected seriously practically our entire population. ...That prices have been too high is recognized by the best thought in the industry..." (p. 4).*

While this portrait of ill effects seems overdrawn today, we should remember that it was written at the very peak of the price inflation that followed the Great War. It depicts a much more materials-intensive economy than we have today, and one in which wood played a far more pervasive role as an industrial raw material.

The housing boom of the twenties broke late in the decade, several years ahead of Black Friday and the beginning of the Great Depression. The social concerns over lumber supply and prices changed. Problems of overproduction, timber liquidation, catastrophic levels of unemployment, forest destruction, and soil erosion dominated the agenda. As difficult as conditions were for surviving lumber producers, imports of lumber from Russia and Canada threatened to further depress markets.

1.1.3 Postwar Shortages Once Again

After 1945, the recovery of the US economy, followed by those of Europe and Japan, brought worldwide increases in demands for all raw materials. In 1946, the Forest Service titled its Reappraisal of the forest situation "Forests and National Prosperity" to emphasize the connection. On best information then available, the nation was still reducing forest growing stock.

The materials shortages were brought to a head by the Korean War. Their wide influence in the economy prompted the Paley Commission, which reported its findings and recommendations concerning resource supplies in 1953. Prices of wood products

were again a concern. In a later congressionally mandated report (1957), the Forest Service reviewed developments in stumpage, log, and lumber markets since the 1940's. It found increases in current dollar prices as follows:

	Percentage Increase, 1940-55
Douglas-fir stumpage	1,157
Southern pine sawlog stumpage	611
Douglas-fir sawlogs	237
Douglas-fir lumber	264
All lumber	202
All commodities (wholesale)	117

Source: US Congress, House 1957, p. 45.

Once again, under pressure of rapid increases in demand, wood product prices had outpaced the general price level. This report confined itself to documenting the statistical facts. In contrast to the Capper Report, it did not extensively probe underlying causes or discuss the impacts of higher prices on the economy.

1.1.4 An Emerging Materials Policy Perspective

The Paley Commission report inaugurated the development of a materials policy perspective on raw materials supply problems. The field of Materials Policy grew from efforts to deal with the economic and foreign policy problems of securing supplies of strategic raw materials such as rare metals and oil. It evolved to encompass the broad consideration of defense, economic, environmental, taxation, and other aspects of raw materials supplies in relation to public policy. Researchers in Materials Policy drew attention to changes in the aggregate materials and energy intensity of the economy and to the policy implications of these shifts (a useful overview is in US Congress, House 1977).

In the early 1970's, several national commissions examined these issues, in each case responding to temporary price spikes in markets for key raw materials (e.g. Anon 1975). The Mideast Oil shock of 1971-72 and later farm commodity price spikes were of particular importance (see, e.g. Anon. 1989 concerning the 1988 drought). The National Commission on Materials Policy received a consultant report from recently retired Forest

Service Chief, Edward Cliff (1973), which emphasized the advantages of wood as a raw material in terms of low energy usage, domestic availability, and renewability. Interestingly, however, the National Commission on Supplies and Shortages, reporting in 1975, did not commission any case study of lumber production and prices, though it studied several other products in detail.

The elaboration of this materials policy perspective was dramatically accelerated by the recurring oil price shocks whose macroeconomic and social impacts embodied the worst fears of the materials policy experts of the 1950's. As the nation grappled with energy policy, analysts began to advocate a more prominent role for the price mechanism in inducing conservation, allocating supplies, promoting development of domestic supplies, and stimulating R&D. These perspectives suggested that higher softwood lumber prices might not be all bad, to the extent that they might promote more efficient conversion and use of wood, more investment in timber management, and increase incentives to use previously unused species and smaller sizes of trees. These views did not receive a great deal of attention during the mid 1970's, however. During that decade, real prices of lumber were in the middle of another historic upward leap propelled by large upswings in demand.

The 1980's saw an increasing interest in timberland as an investment vehicle. Organizations were formed to market pooled timberland investments to institutional buyers, building on practices pioneered earlier by smaller regional groups and taking advantage of increasing pension fund interest in real estate. The research motivated by this trend showed that rising prices of stumpage provided an enhanced incentive for long-term investors to add managed timberland to their portfolios. In addition, diversification benefits were demonstrated. This development was an example of the very hope held by the early foresters -- that higher prices for stumpage and products would eventually motivate improved management. It also helped validate the key materials policy concept that higher prices can promote supply expansion.

1.1.5 Lumber, Housing, and Inflation

During the 1960's, a series of shocking urban riots focused the nation's attention on deteriorating conditions in inner cities and on the poor housing conditions that blighted many neighborhoods and many lives. Responding to this concern, the Nixon Administration in 1968 announced an ambitious ten-year program of National Housing

Goals that would accelerate housing production dramatically over levels reached in the 1960's. For the years up to about 1974, housing production including mobile homes did indeed reach the optimistic levels predicted, aided by a multiplicity of tax and financial incentives.

The resulting lumber price bubble stimulated White House level concern for possible impacts on inflation and on the accomplishment of the National Housing Goals. A Cabinet level Task Force, appointed in 1969, reported its findings in June of 1970 (Exec. Off. Pres. 1970). It concluded that a sizable boost in prices for the 1970's was unavoidable. It recommended mitigating actions in a number of areas. A Presidential Panel (PAPTE 1973) of distinguished experts examined the economic and environmental issues in detail. The Panel pointed to several concerns about higher lumber prices (Report, p. 71):

-- Higher prices were an indicator of more important underlying supply-demand imbalances.
-- Housing costs would be higher, and production lower than otherwise.
-- Energy use would increase due to the higher energy intensity of substitutes.
-- Higher lumber prices would contribute to general inflationary pressures in the economy and to cost burdens on consumers.

The Panel concluded, however, that though higher prices were an important concern, it may not be attainable or even desirable to stabilize prices permanently at recent levels.

Additionally, extensive Congressional consideration was given to bills providing one program or another designed to enhance timber supplies and to moderate rising prices of wood products (US Congress, Senate 1972, 1973, House 1977, 1982). Also, the Nixon Administration's price control program focused periodic attention on wood product prices and their causes (Exec. Off. Pres., COWPS 1976, 1977, CBO 1980).

During this period, then, impacts of lumber prices on costs and on inflation were important; availability itself was not considered a major concern. Housing cost and availability were major themes of Congressional, industry, and public discussion during this period. Supply side concerns were important, as the Congress debated the National Forest Management Act and the RPA. At the same time, elements of a broader materials

policy approach emerged. Reports of major commissions often reprised themes used over the decades by the US Forest Service in its analyses, which repeatedly stressed the importance of a reliable domestic supply, of renewability, and of lumber's low energy intensity.

During these years, the US market was able to call on increased Canadian supplies to meet peak demands. The Canadian industry served in this role of shock absorber until the late 1980's, when it exceeded calculated annual allowable cut (AAC) levels nationally and provincial governments were unwilling to further expand timber cutting to enable the industry to meet cyclical peaks in the US market.

1.1.6 Themes of the 1980's and 1990's: Competitiveness and Environmental Advantages

US wood products exports began to rise following the decline of the dollar that began in 1985. The nation's economy was participating more extensively in world trade. Concerns emerged that lagging performance in industrial investment and productivity, in public education, and in infrastructure investment would hinder our ability to compete against other rapidly growing nations like Japan and Germany. This unease led to assessments such as those by the Congressional Office of Technology Assessment in 1983, the US Department of Commerce in 1984 (USDOC 1984), and a spate of books and articles diagnosing the nation's competitive ills and prescribing remedies.

A series of bitter trade disputes over Canadian softwood imports in 1963, 1984, 1986, and 1990-91 drew attention to the longrun implications of heavy US dependence on imported softwood lumber, and produced intense debate over both the underlying causes and what remedies, if any, were in order (Irland 1987).

In the late 1980's and early 1990's public interest in retaining old growth forests, protecting endangered species, and retaining biodiversity increased. This faced the public and the Congress with important tradeoffs between employment, raw materials supplies, and trade performance, on the one hand, and the nation's environmental goals on the other. A concern with community stability and local employment effects that had been largely dormant for decades re-emerged as the likely local economic effects of cutbacks in federal timber supplies became apparent. Despite many indications of an improving forest resources situation (Frederick and Sedjo 1991, MacCleery 1992), it was plain that

the nation's forests would no longer be able to meet all the competing demands upon them.

As this controversy escalated, some commentators began arguing that an additional set of environmental tradeoffs was receiving inadequate attention. They raised anew, with increasingly detailed evidence, the importance of considering the low energy intensity of wood products compared to their principal substitutes (e.g. Koch 1991, Zerbe n.d., Williams 1992, Lippke 1992a, 1992b, Alexander and Greber 1991, Bowyer 1991, Forintek Canada 1991).

1.1.7 Summary

The trend of lumber prices has been an important, though intermittent, concern for most of this century. Public, legislative, and Administration concern with lumber prices has, not surprisingly, usually been stimulated by unusual periods of tight markets and rising prices. The resulting analyses often focus on price increases between periods of unusually low demand and subsequent periods of extreme shortages. As we will see below, this focus can produce a misleading view of the industry's longrun price performance.

Over the decades, concerns about the impact of rising lumber prices have shifted several times. Before World War I, observers felt as often that prices were too low as that they were too high. After World War I, adverse impacts on industry and on consumers were important. Following the Korean War, a broader Materials Policy paradigm appeared, which attempted to integrate a wide range of public policy concerns that had previously not been paramount in the nation's sectoral policies for natural resources. Even as they noted the ill effects of higher wood prices, some of the analysts suggested that higher prices of energy and raw materials would induce market responses with longrun benefits.

By the early 1990's, the choices available to the nation were becoming more tightly constrained. The recession of 1989-91 opened a new period of economic pessimism, with many people believing that a return to the prosperity of the 1980's was unlikely. Public debate returned to the previous concerns with lumber costs as they affect housing. Policy debates also began to display a renewed interest in local employment impacts and in the environmental tradeoffs offered by an organic, renewable raw material.

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1.2 CRITERIA FOR EVALUATING INDUSTRY PERFORMANCE

This report is organized around a number of generally used criteria for evaluating the economic performance of industries (Table 2). These criteria were adapted from the literature of industrial organization and related fields of economics, including the evaluation of natural resource scarcity (see, e.g., Scherer & Ross ,1990, pp. 52-54, Vaccara and MacAuley 1980, Irland 1974, p. 73, Brown and Field 1979, Cohen & Zysman 1987, p. 61, US Dept. of Commerce 1984, Ch. II, Dertouzos, et al. 1989).

Table 2
Performance Criteria
for Evaluating the Softwood Lumber Industry

Criterion	Measure	Relevant Comparisons
Output Growth	Volume of output gross/net Market share	All manufactured goods All raw materials World production
Inflation	Price trend, PPI	PPI, CPI, other materials esp. other construction materials
Trade Performance	Export trend Import dependence Volumes/values Share of world exports	US output US consumption
Progressiveness	Labor productivity Adoption of innovations Training; New products Recycling	All manufacturing
Distribution	Wage and compensation trends Accident rates Profitability Returns to timber	All manufacturing "

The criteria listed in the table could be divided into two major groups: those relating to industry competitiveness, and those relating to the distributional outcomes of the industry's operations. There is no way to integrate all of these different factors into a single index that can be compared to other industries. Analysts commonly do this by ranking industries by each criterion they use and comparing or averaging the rankings (see, e.g. Vaccara & MacAuley 1980).

1.2.1 Output Growth

Though industries are naturally at many different levels of technological and market maturity, there is sense in examining an industry's overall trend in output. This can be done by comparing with the trends in manufacturing as a whole and with raw materials industries. Output share in any given country relative to the world helps give a very broad picture of revealed competitive advantage. Output can be measured in physical terms, or in the economic terms of gross and net output (value added).

In drawing conclusions from these output trends, however, it is important to at least roughly understand what the underlying sources of shifts in output and shares might be. Improvements in share that result from unsustainable rates of resource extraction or from temporary currency devaluations are one thing. Improvements based on more sustainable causes or from successful efforts to reduce real costs and capture markets on the basis of improved quality and service are quite another.

Because it is beyond the scope of this study, we attempt no assessment of the industry's stewardship of land, air, and water.

1.2.2 Inflation

The trend in price level of an industry's output is important for a number of reasons. It may affect the industry's international competitiveness. It may affect the national inflation rate, if only to a small extent. It may affect the industry's social performance in other dimensions. Using the Producer Price Index data, we can readily compare the price performance of softwood lumber to relevant aggregates and to other individual competing products.

1.2.3 Trade Performance

Since the mid 1980's, national trade performance has been an important focus for public policy and for industry executives. The trade conflicts between the US and Canadian softwood lumber industries provide a prime example. Trade performance can be measured by the trend in the nation's imports relative to consumption and by the proportion of production that is exported. Also, North America's share of total world exports can be examined. Again, the raw numbers need to be interpreted against a backdrop of a larger picture providing an understanding of the forces responsible for the trends.

1.2.4 Technological Progressiveness

Productivity trend over time is a major comparative performance indicator for any industry. Productivity can be measured on a single factor basis, as when capital, labor, or materials are considered individually. This can be done in terms of physical measures, as in board feet per employee hour or year, and on a value basis in terms of gross sales or value added per employee. Productivity can also be rated on a multifactor or total factor basis in which all production factors are considered together.

The prime sources of improved productivity are technological innovation and investment in worker skills through training. Improvements in management, production layout, and a myriad of other factors are also involved. Analysis of technological progressiveness is important as a basis for understanding the sources of an industry's changes in measured productivity.

1.2.5 Distribution

The final performance category is distribution. This criterion examines an industry's long-term performance in dividing net output between capital, labor, and land. Such an analysis can shed light on many aspects of an industry's performance and can help in diagnosing causes.

We will examine payments to the timber factor of production. This helps us see how the industry has contributed to long-term incentives for forest management by raising the stumpage value of timber. It also helps us to determine whether market power exists enabling the industry to capture for itself the returns generated during periods of high

prices, or whether the industry is forced to pass those returns on to resource owners. Since many of the largest firms are integrated backward into timber ownership, however, the situation is not a simple one.

1.2.6 Summary

The economic or productive performance of an industry can be rated on a comparative basis with other industries, sectors, or nations to supply the basis for overall assessments of performance and to assist in diagnosing underlying causes. To do this, a number of very different kinds of information must be assessed. There is no preferred way to digest all of the different indicators into a single number defining performance, however.

1.2.7 References

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1.3 THE INDUSTRY AND ITS PRODUCT

This section portrays the softwood lumber industry of the US and Canada and describes the product it produces. It then describes the regional and species changes that have occurred in the industry since 1946.

1.3.1 The Industry

For statistical purposes, the softwood lumber industry has an indistinct boundary, for a variety of reasons. One is that in many of the eastern areas, it is common for sawmills to produce both soft and hardwood lumber, varying the mix depending on demand or log supplies. In a survey of large eastern mills, Bush and Sinclair (1989) found that 45% sawed a mix of hard and softwoods, and only 27% sawed exclusively softwoods. Large western and Canadian mills, however, commonly specialize in softwood, as do the largest southern mills. Further, in many mills, additional value added services are performed, such as cutting up wood for dimension, producing molding, milling boards for interior panelling, or resawing to produce clapboards. These value added products use the lumber as a raw material, which may not show up in the data as lumber but as flooring, dimension, or millwork instead. Finally, many small mills saw lumber for sale locally, and their output is probably not fully counted. There are a number of examples in which official statistics have been shown to undercount production, mills, and employment in this industry (see, e.g., Irland 1975, Bratkovich and Passewitz 1991).

Because of the limited publication of industry detail from manufacturing censuses, we are forced to use the data for the entire lumber industry (SIC 2421) in this section, and cannot focus clearly on only the softwood sector. Within SIC 2421, firms with a primary specialization in softwood lumber accounted for 53% of the employment and 65% of the value of shipments. According to the 1987 Census, 6% of the US softwood lumber output was produced in establishments not classified in the lumber industry.

The North American lumber industry supplied nearly $25 billion worth of output in 1987 (Table 3). Within the US industry, $11.3 billion of the industry's total shipments consisted of softwood lumber; 50% of the board-foot volume is softwood. Shipments included another $2.2 billion of hardwood lumber; $445 million of chips, about $860 million of value added items, and $152 million of contract services. (On the basis of other information, we would judge that this source undercounts chip revenues).

Table 3
Economic Overview: North American Lumber Industry, 1987
(softwoods and hardwoods)

	Canada	US	Total US & Canada
Establishments (no.)	1,207	5,742	6,949
Employment (thousands)	64	148	212
Value of Shipments ($million)	6,878	17,356	24,234

Sources: US Dept. of Commerce, Bureau of Census, MC 87-I-24A; Canada, For. Can. E-X-44.

(Canada shipments adjusted to US on 1987 rate of .077 Canadian per $US from Bank of Canada; amount in $C was $8.933 billion).

Softwood lumber is a major raw material in the US economy, ranking in tonnage and dollar terms above most other raw materials and agricultural products. The softwood lumber industry is important to the economies of both nations, in terms of employment, exports, and impact on local economies.

1.3.2 How the Product is Used

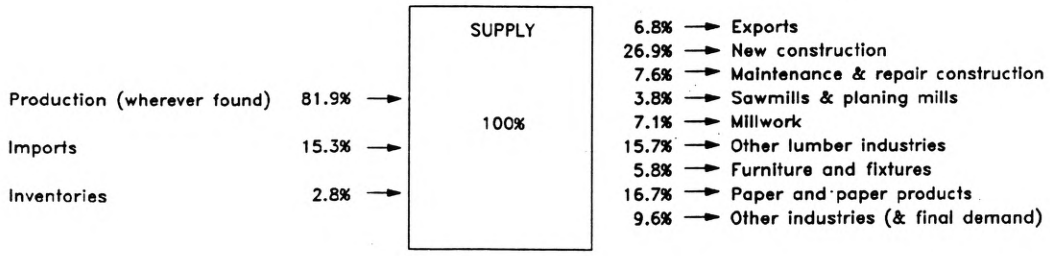
New residential construction and repair and remodeling account for the bulk of the softwood lumber consumption in the US. In 1987, a record 50.6 Bbf (Billion board feet) were consumed in the US. End use market areas were as follows (WWPA 1992, p. 31):

Residential construction	36%
Nonresidential construction	13
Repair and remodeling	30
Materials handling	10
All Other	10

A more detailed breakdown of lumber uses as of 1982, from the national input-output table is shown in Fig. 2.

Figure 2

Sawmills & Planing Mills, General (SIC 2421)
Distribution of Commodity Output to Consuming Industries



Source: BEA 1982, Input–Output Accounts of the US.

Within the residential construction market, softwood lumber is used in all major parts of the building (McKeever and Anderson 1992):

Floor systems	19%
Wall systems	36
Roof systems	24
Garages, etc.	13
Millwork and miscellaneous	7

Use of lumber per home and per square foot of floor area is highest in the North; the West and the South use about 12% less lumber on average. Further detail is available in McKeever and Anderson 1992, Haynes, ed. 1990, Chs. 1 and 2, for the early portion of the period, Zaremba 1963.

Over the years, softwood lumber markets have broadened as export markets and the repair and remodeling sector in particular have grown in importance. Housing starts in 1978 were 2 million, and softwood lumber consumption was 33.8 billion, while with only 1.2 million units started in 1992, lumber consumption was far higher, at 43.5 Bbf.

1.3.3 The Product

Softwood lumber is a quasi-commodity whose production and marketing must deal with a diversity of differences between species, sizes, grades, and product forms. Some markets are fragmented by end user, market channel, and region as well. Most lumber is sold on grades developed by regional grading associations. These grades are based

on strength and appearance properties, and for certain applications visual or machine stress rated lumber is available. Also, significant volumes of rough, green and ungraded lumber are sold on local markets.

A broad indication of the diversity of the US industry's products comes from the Census summary of its output (Table 4). This shows that almost half of the production is in 2" sizes, while almost 8 Bbf are "boards."

Lumber thicknesses describe the nominal thickness of the green board prior to planing. This is the reason that a 2x4 is only 1-1/2 inches thick when the customer buys it. Thicknesses are usually described as follows:

Boards	1" nominal thickness (1-1/2" as a specialty is common for some species), usually used for millwork or remanufacturing
Dimension	2" nominal thickness, usually used for framing
Timbers	More than 2" nominal thickness, used for heavy structural purposes

Table 4
Products Manufactured: US Softwood Lumber, 1987

Softwood rough lumber:	
Boards, less than 2" nom.	2,543 MMbf
Lumber 2" nom. thickness	5,339
Timbers, more than 2" nom.	2,264
Softwood dressed lumber:*	
Edge worked	707
Boards less than 2" nom.	5,359
Two inch	15,304
Timbers more than 2"	1,810
Total	33,326

* Includes ceiling, framing, matched and shiplapped.

Source: USDOC, MC 87-I-24A, Table 6a.

For comparison, AFPA estimates 1987 US softwood production at 38,235 MMbf.

The softwood industry, then, produces a few true commodities: dimension lumber for construction, and one-inch boards for uses such as remanufacturing, strapping, and light utility uses. Approximately one-third of its total output does not fall into these categories but includes items that serve diverse markets and which are not, by and large, sold on the same commodity basis as the high volume items.

The softwood lumber industry uses dozens of species of trees. In some instances, the species are so similar as to be sold together. Examples include Spruce-Pine-Fir (SPF) lumber from the interior portions of western Canada, the Rocky Mountain regions of the US, the northeastern states, and eastern Canada. This species group can include varying proportions of several species of spruce and fir, as well as lodgepole pine. Other examples are fir and larch (douglas-fir and western larch), and hem-fir. Other species, including ponderosa, sugar, Idaho white, and eastern white pines, commonly compete with one another in the specialty markets that they serve.

Southern pine is used for general construction and has gained important specialty markets such as in treated products for decking. The species also has strong recognition in a number of export markets.

Within a species, different grades may be used for widely varying purposes. The grade breakdown for douglas-fir illustrates this (Table 5). The top grades of this species are used in the door and window trade and other applications demanding uniform texture, straight grain, and minimal defects. The middle grades are primarily used for framing in construction, while the lowest grades find a range of local uses.

Table 5
Grade Distribution, Douglas-Fir Lumber
Produced in Coast Mills, 1991

Grade	Percentage
C and D Selects	1.8%
Structural Items	14.3
Heavy Framing	23.5
Light Framing	49.3
Utility	7.3
Economy	4.4

Source: Debra Warren, PNW RB-192, p. 9, based on WWPA data.

1.3.4 Board Production and Trends

Two broad kinds of species are made into boards. In the first instance, species like ponderosa and sugar pine are primarily sawn into boards and similar products for nonstructural uses. These species are valued for their clear wood and its desirable appearance and woodworking traits. In these mills, logs are sawn for grade, sawing, planing, and drying are designed to maximize the value for the demanding end users. In high grades, these species sell at hardwood prices and in limited instances actually compete with hardwoods. At many of these mills, large volumes are worked into paneling, clapboards, cut up parts, or other value added items. In the other case are the dimension species like lodgepole, SPF, and southern pine. These mills are designed and operated to saw primarily dimension, often for yield instead of grade. Boards are a by-product. Value added processing is less frequent, and remanners often meet market demands for boards by resawing purchased 2 inch stock.

Board production of the major species can be roughly estimated as follows, for the US and Canada together, as of 1990-1991:

Ponderosa pine	3.4 Bbf
Southern pine	1.2 Bbf
Eastern white pine	1.1 Bbf
Sugar pine	399 MMbf
Eastern spruce	200 MMbf
Western white (Idaho)	90 MMbf
TOTAL	6.4 Bbf

This working estimate is roughly consistent with other estimates by the US Census Bureau (1989, Table 6a, see also Irland Group 1991).

We do not have species details, but from 1990 to 1992, inland west lumber production fell by more than a billion feet, so 1992 ponderosa volume is probably below what we show here, while southern pine may be higher.

For some species, boards are primarily a by-product from the sidecuts developed while sawing for dimension. This is generally true for southern pine, once a premier board species back in the "roofer" days. According to an SFPA survey (1991), about 10% of sample mills' output was in board grades, the biggest being 1x4. Finish and specialties were only about 3% of the total. If these percentages hold for the industry, then board output of southern pine is on the order of a billion feet a year. Some of this is treated.

Detailed grade breakdowns are available for ponderosa, from WWPA data. According to this source (as summarized in Warren 1992), almost 60% of the ponderosa is sawn into 5/4" and thicker material. Molding and better accounts for 6% of the total volume, while #3 is 23%. The other leading grade is #3 Common and 8/4 dimension, at 22% of the total. Not surprisingly, the proportions of highest grades are slowly shrinking.

For eastern white pine, the grade breakdown was estimated in 1983 as follows for a typical New England mill:

C Select	2.9%
D Select	9.1%
Finish	16.7%
Premium	37.1%
Standard	26.1%
Industrial	8.1%

Grade ratios like this will vary from mill to mill based on sawing patterns and log availability.

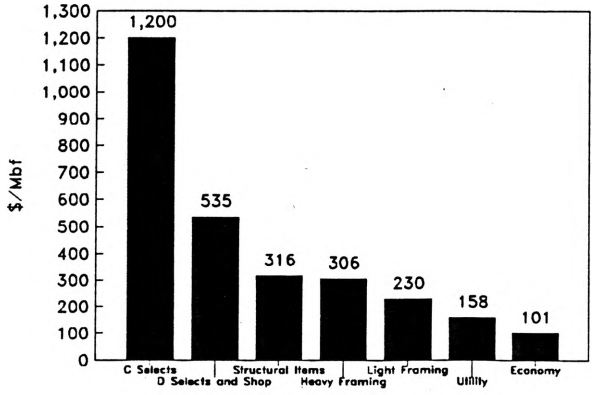
In the eastern spruce-fir market, boards are sold green and dry for a variety of construction and specialty uses. No data exist on the volumes, however, so we have had to use a judgment estimate.

Production data can be deceptive for boards since in the east, significant volumes of boards are produced by reman operations which resaw rough green material they buy on the open market.

Prices for the different grades vary widely (Figs. 3, 4, and 5). A tenfold range of value between selects and the lowest grades is not uncommon. Haynes and Fight (1992) provide a useful analysis and projections and Spelter (1987) speculates on the impact of changing technologies and product grades on log values. Typically, the low grade lumber is actually produced at a loss; the top grades and the residuals bring in the profits. In some areas, when lumber markets are poor and chips are in high demand, mills will throw low grades of lumber into the chippers to feed the pulp mills.

Figure 3

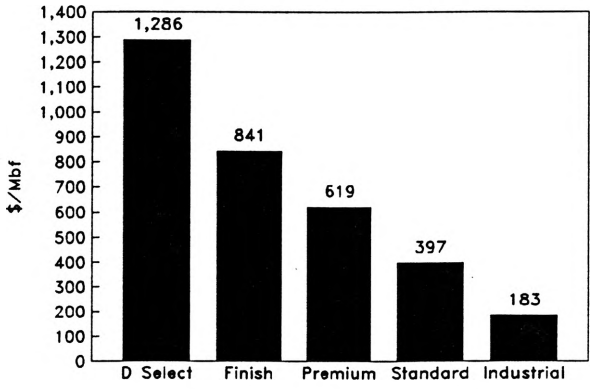
Douglas-Fir Prices by Major Grades,1991



Source: Warren 1992, based on WWPA.

Figure 4

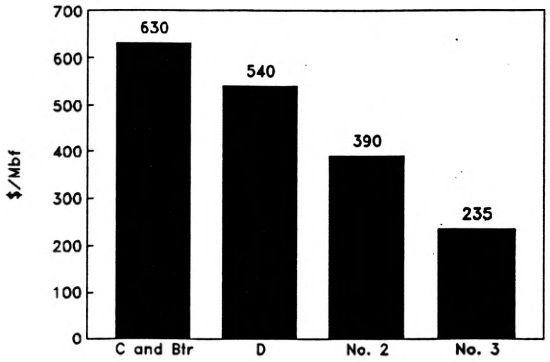
1x6 Eastern White Pine Prices by Grade, 1992



Source: Eastern Quotes & Comments, June 12, 1992.

Figure 5

1x6 So. Pine Kiln Dried Board Prices by Grade, 1992



Source: Random Lengths, June 12, 1992.

Lumber is produced in a range of sizes. Where large logs are available, specialty items may be sawn to 40 foot lengths or longer. For framing lumber and most other purposes, logs are delivered in 16-foot lengths and lumber between 8 and 16 feet in length is prepared. Some mills will make available other lengths on special order.

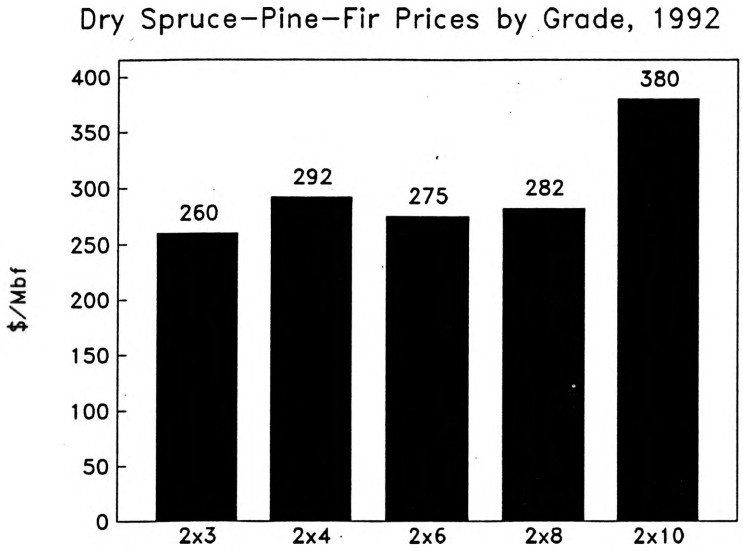
In the past, softwood construction lumber was shipped in hand-loaded boxcars in the mix of lengths as they came out of the mill. Much lumber today is still shipped and priced "random lengths," each mill on its own distinctive "tally" or mix of pieces by length.

Because of the importance of high production rates and efficient log conversion, and also the declining size of logs in many areas, many mills produce only a modest range of lumber sizes. Some specialize in boards (1-1 1/2" thick), especially in species like the soft pines which are not used for structural purposes. Others specialize only in dimension (2" thick framing lumber).

In some areas, "stud mills" specialize even further, producing virtually all of their output in the form of studs, usually 8-feet lengths of 2x3, 2x4, and 2x6 lumber. But even the stud is not a pure commodity. Studs may be sold green or dry, though dry predominates. Studs are sold in several lengths, a common one being 92-5/8" (39% of reported volume in Random Length's 1990 Survey (R/L 1992, p. 236.) This length eliminates trimming when carpenters assemble wall units with headers and footers of 1-1/2" thicknesses and cover them with 8-foot sheetrock panels. Stud production in the US and Canada in 1990 was 6.9 Bbf, or very near half of all dimension production if the 1987 Census data can be used for comparison.

Prices of lumber vary by width of the piece, though not always in intuitively obvious ways (Fig. 6). For example, prices of dry SPF lumber sold at Boston in the summer of 1992 ranged between 260/Mbf and 380/Mbf.

Figure 6



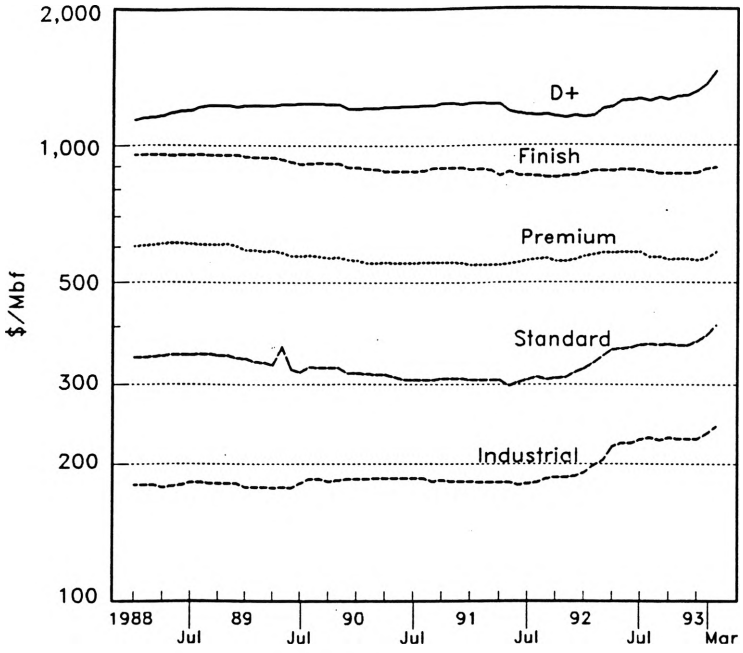
Source: Eastern Quotes & Comments, June 12, 1992.

These differentials between sizes arise because of differences in demand and in sawing costs and conversion efficiency for different widths. They may fluctuate in response to a number of market factors.

Prices of different grades of a given species tend to move together over the business cycle (Fig. 7), but because the high and low grades often serve very different end uses and may be subject to different competing substitutes, prices may diverge in the longrun.

Figure 7

Price of 1x8 Eastern White Pine by Grade
FOB Mills, 1988–93



Source: EQ&C Database.

The diversity of grades, species, and sizes complicates the measurement of price change over time. The mix produced changes as supplies, technologies, and end uses changes. Mills have a certain amount of flexibility in modifying the mix of lengths, thicknesses, and widths to meet changes in demand. While there has been a tendency for modern mills to narrow their size and grade mix, it is not uncommon for a single sawmill to sort for 75 combinations of thickness, width, length, and grade on its "green chain." Mills with a high level of utilization and processing can sort for 100 different items.

A certain volume of softwood lumber is sold directly to consumers through home centers and local lumber and building materials stores, and even, for specialty items, through the mail. Additional volumes are purchased for conversion into doors, windows, furniture, and countless other products. The bulk of the volume is sold through wholesalers and retailers to the construction industry for use in new construction, repair, remodeling and maintenance. Finally, in many export markets, grades and sizes are tailored to the

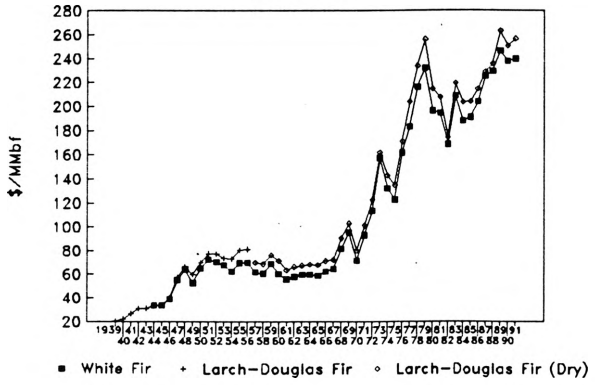
grading schemes, customer preferences, and size requirements of buyers in the importing nations.

Though construction lumber at first glance would seem to be a pure commodity, its markets are somewhat fragmented regionally as a result of regional preferences for using different species, delivered cost differences due to distance from mills, and even building codes in some areas.

Prices for most lumber products move up and down in broad response to the same supply and demand forces. But markets for particular species and grades respond differently depending on whether they are used primarily as specialties, in construction, are exported, or are used in manufacturing. Similar species may or may not move together over long periods, depending on the same factors. As an example, prices of white fir and fir and larch, used most for construction, tend to move quite closely together over long spans of time, showing that they are reasonably close substitutes serving similar markets. In contrast, prices of western pines have diverged, indicating that they are not in close competition with one another in many end uses (Figs. 8 and 9).

Figure 8

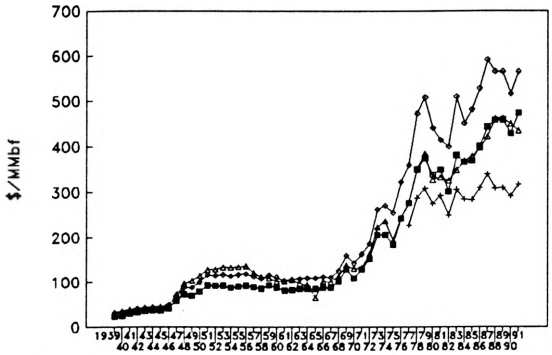
Prices of Western Softwood Dimension Species
1939–91



Source: WWPA. Grade weights were changed in this series in 1933, 1954, 1971, and 1985–86.

Figure 9

Prices of Western Softwood Species –– Pine
1939–91



Source: WWPA. Grade weights were changed in this series in 1933, 1954, 1971, and 1985–86.

Pricing fundamentals and practices for board items are undergoing profound changes. Over the years, boards have been less volatile in prices than dimension. One reason is the pricing practices and long-term business relationships common in the

business (Figs. 10 and 11). Another reason could be that in major markets like window boards they compete at the margin with plastic and aluminum whose producers are able to maintain stable pricing from year to year.

Figure 10

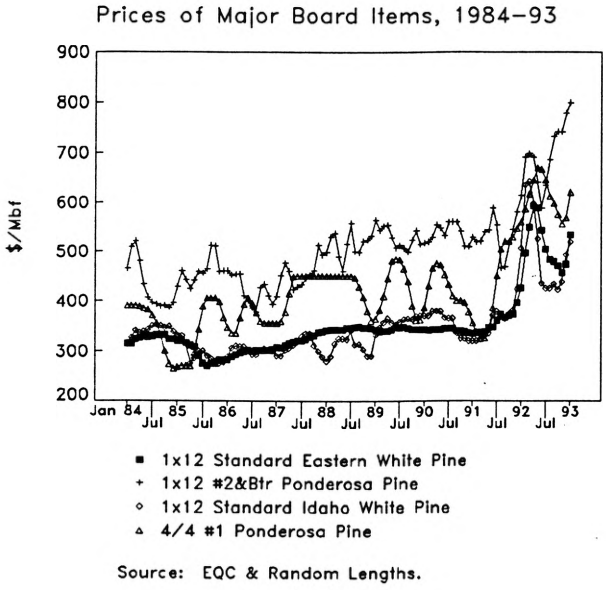
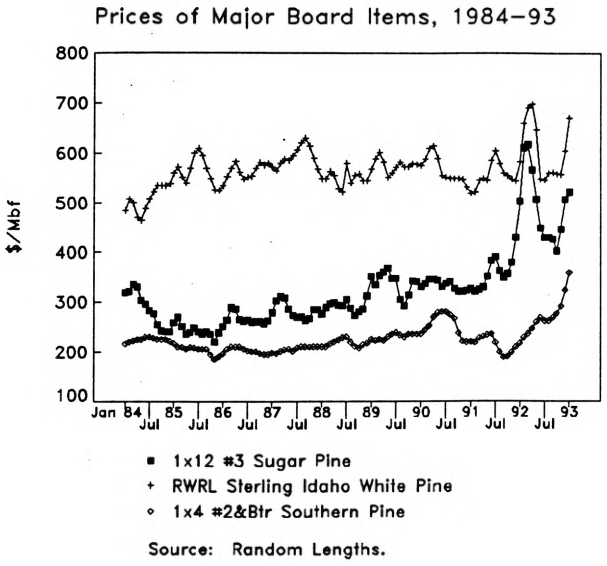


Figure 11



Eastern white pine has been similar to the premium western grades in this respect. Lower grades of western species, have been volatile seasonally and cyclically. The premium grades, though getting scarcer, did not rise significantly in price between 1984 and 1991.

In late 1991 and 1992, for the first time in decades, the board items all took a huge jump. This was following the Dwyer (spotted owl) injunction, but the high prices persisted far longer than they did for the dimension items. The biggest effect of that injunction would be on douglas-fir and hemlock supplies, but other forest planning changes also affected ponderosa. Recently, major changes on California National Forests were announced which will reduce log supplies statewide. This dramatic change in pricing behavior suggests that supply factors are playing more prominent role in the market.

Competition between softwood species depends on their technical features, grades, and end uses. Some end users have built machining, finishing, and customer perceptions around the features of a particular species. Blending different species in their raw material

may be difficult or impossible. In construction, there are urban areas which share strong preferences for a given species based on long-term familiarity. End users may not switch species readily. In the deck market, the strength, treatability, and wide availability of southern pine have given it a commanding position. At the same time, because of southern pine's hardness and weight, carpenters in Atlanta much prefer framing houses in SPF from Canada or the Rockies. To assess substitution relationships between softwood species, then, requires detailed knowledge of the species, user preferences, and technical considerations.

Because of these factors, many wood users are conservative about switching species once they have optimized their processes for a favored species. Yet the science and technology of wood utilization are becoming better and more widely understood. This is helping to bring into use species that were not used at all in the past. In addition, a broader range of species is now being imported, as US supplies of specialty softwoods tighten. End users are trying to familiarize themselves with the technical traits and manufacturing quality of woods from new sources. Noteworthy examples are the expanding use of plantation grown Radiata pine from New Zealand and Chile, and the imports in summer 1992 of Siberian larch and spruce lumber.

1.3.5 How Softwood Lumber is Distributed

This section briefly reviews how lumber is distributed in the US, with a major focus on wholesale distribution. See descriptions provided in Sinclair 1992, USITC 1992, Leckey 1989, and Kohlmeyer 1983 for more detail.

1.3.5.1 Wholesale Distribution

Lumber is sold by its producers in a bewildering variety of ways. Direct sales to end users or retailers most commonly involve high volume accounts, users with specialized needs, or nearby local users. They amount to about 20% of western production.

Most of the product is sold through wholesalers, which are of two kinds. Office wholesalers take ownership of wood but not possession. They are in touch with many buyers and sellers and trade for their own account. They arrange for delivery of the wood but do not bring it to their own premises to sell from stock. The other kind of wholesaler, the stocking distributor, or distribution yard, maintains stock in a yard and sells primarily

from inventory to meet needs of retailers, large contractors, and industrial users. A special type of stocking distributor is the Reload Center, which inventories wood at strategic locations where freight rate advantages can be gained by shifting from rail to trucks. These are often located near major border crossings like Windsor, Ontario, or in the suburbs of major metropolitan markets. The reloads sell from inventory but in high volumes, often to retailers or stocking distributors. They have absorbed part of the function of maintaining seasonal inventories. In the parlance of the Census documents, office wholesalers, stocking distributors, and reloads are all termed "merchant wholesalers" since they all take title to the wood. According to the 1987 Census, merchant wholesalers handled 81% of the total $45.9 billion in wholesale sales of lumber, plywood and millwork (Table 6).

Commission agents and brokers handle particular items and species but are not generally a major factor in marketing commodity items. Commission agents handled only 6% of the lumber, plywood, and millwork sales volume in 1987.

Finally, controlled distribution systems are common, though they have not significantly displaced the traditional independent wholesaling structure. Many a medium-sized lumber company operates one or more local retailing yards nearby, often begun as a way of getting the best possible margin out of high grade items. Company branches and sales offices handled 12% of the wholesale trade in 1987.

Table 6
Structure of Lumber Distribution, 1987

	Establishments (number)	Sales ($bill.)	Percent of SIC 503 Sales
ALL WHOLESALE TRADE			
Lumber and Construction Materials (SIC 503)	19,075	79.9	100%
Lumber, Panels, and Millwork Products (SIC 5031)	8,098	45.9	57%
Merchant Wholesalers			
503	16,133	58.4	73%
5031	7,033	37.2	
lumber w. yard	1,508	8.9	
lumber w/o yard	1,989	11.2	
plywood, mwk, panels	3,546	17.2	
Manufacturer's Sales Offices			
503	1,717	17.0	21%
5031	478	5.7	
lumber w. yard	31	1.7	
lumber w/o yard	62	0.7	
plywood, mwk, panels	385	3.4	
Agents, Brokers, & Commission Merchants			
503	1,225	4.5	6%
5031	582	2.9	
lumber w. yard	224	1.1	
lumber w/o yard	51	---	
plywood, mwk, panels	307	1.6	

Source: US Dept. of Commerce, Bureau of Census, Census of Wholesale Trade. 1989. p. US-12 ff.

Nationally, firms involved in lumber wholesaling are numerous -- according to the Census Bureau, there were almost 14,000 firms distributing lumber and construction

materials in the US in 1987 (US Dept of Commerce, Bur. Census 1991). Approximately 8,000 firms specialized in lumber, millwork, and panels wholesaling -- which exceeds the number of sawmill companies reported in the Census. These firms operated 16,700 establishments. The firms are generally small, with 44% employing fewer than 5 people. The total value at wholesale of the products handled by lumber, millwork and panels wholesalers (SIC 5031) was $45.9 billion in 1987. (Note that Table 6 above deals with establishments, or separate operating locations, not firms.)

As might be expected, the manufacturers controlled sales operations were double the size of independent wholesalers, with annual sales averaging $12 million per establishment compared to $5.3 million for the average merchant wholesaler.

Since wholesale distribution is inherently regional at the end use market level, the structure of the industry in urban areas is of interest. Major SMSA's contain many wholesalers (Table 7). Larger industrial buyers in small towns lacking local wholesale yards have their choice of many office wholesalers who can supply their requirements.

Table 7
Major Urban Areas, Wholesale Establishments Distributing Lumber, 1987

	Establishments	Of Which Merchant
Atlanta	149	117
Chicago-Gary-Lake County	236	191
LA-Anaheim-Riverside	387	331
Philadelphia-Trenton	174	146

Source: US Bureau of Census, Enterprise Statistics, Company Summary, p. 65-69.

Note that the source provides establishments and not companies; many large firms operate multiple yards.

In the West, rail shipment is no longer the dominant shipment mode (Table 8). This is due to the development of large western markets, and to the improvements in the highway system. Improved highways have aided southern producers in competing in midwestern

and eastern markets. The virtual disappearance of waterborne shipments results from three factors: (a) the Jones Act which requires coastwise shipments within the US to move by domestic carriers; (b) the loss of eastern markets, formerly served by water, to Canadian mills; and (c) the decline in timber supply in the areas immediately tributary to West Coast ports. In the South, trucks carried 75% of the lumber to market in 1991 (USITC 1992, p. A-36). For the longer distances traveled by British Columbia lumber, however, rail still dominates the picture, though its importance has declined. Waterborne shipments have dwindled as well (Table 9).

Wholesalers dominate the distribution of western lumber (Table 8). Small mills deliver a larger proportion of output direct to nearby retailers or users than do the large mills, and they also remanufacture a larger portion of their production. For all western lumber, captive distribution only accounted for 6.2% of production in 1990, less than the national average as estimated by the Census.

Table 8
Marketing Patterns, Western Sawmills, 1990, Percentages for Large and Small Mills

Mill Size Class	Over 100 MMbf/yr	Under 20 MMbf
Transportation		
Rail	33.2	19.5
Truck	57.6	80.5
Water	9.2	0.0
Distribution Channels		
Direct to user	5.7	12.0
Direct to retailer	14.9	12.9
Wholesaler	56.9	53.8
Company owned yards	10.1	4.5
Factory for remanuf.	12.4	16.8

Source: WWPA 1992.

Table 9
Shipment Method, British Columbia Shipments to USA, 1976 and 1991
(percent)

	1976	1991
Highway	4	30
Rail	79	62
Water	16	8
(Total shipments	6.2	7.3 Bbf)

Source: COFI, var. yrs., WWPA.

1.3.5.2 Retail Distribution

The retail "lumber yard" is virtually a thing of the past as stores large and small have broadened product lines to encompass many types of products. In its classification for building materials and garden supplies, the Census counted 58,000 firms in 1987 operating 73,000 establishments, making $77 billion in annual sales. A significant volume of the retail sales is made by the regional and national chains such as Builders Square and Home Depot. According to trade sources, this retail market exceeds $100 billion per year; the top ten chains account for 19% of the sales (Irland Group 1991, pp. 5-6). According to the Census, the number of retail establishments in the building supply field nearly doubled from 1972 to 1987.

1.3.6 Substitutes for Softwood Lumber

The relevant substitutes for softwood lumber depend on the species, end use applications, and perhaps even regional differences in end user tastes. The substitutes cover a wide range of competing wood and nonwood products, as illustrated in Table 10.

Table 10
Substitutes for Softwood Lumber Items

Species/Item	End Use	Substitutes
Pine/fir flooring	Flooring	Hardwood flooring Linoleum Wall to wall carpet
White pine siding	Siding	Aluminum Vinyl MDF
Various	Heavy framing	Engineered beams/trusses using OSB/LVL
So. pine boards	Wall sheathing	Plywood/OSB
SPF studs	Light framing	Steel studs
Fir timbers	Structural members	Steel beams; prestressed concrete
Ponderosa pine shop grade	Windows; millwork	Other US softwoods Imported softwood Aluminum Vinyl and PVC
Various	Siding, millwork, studs	Yellow poplar, aspen and other species

Forces affecting substitution are many and complex. While emphasis has traditionally been placed on comparative price trends and own-price elasticities, there are many other factors involved (Table 11). These may affect certain regions or specific applications or they may vary in importance over time.

Table 11
Forces Affecting Substitution of Competing Products for Softwood Lumber

1. Material cost comparisons.
2. Installed cost differentials.
3. Precision and quality of product dimensions.
4. Fire and building codes.
5. Long-term maintenance costs.
6. Cultural, architectural traditions and builder/specifier preferences.
7. Regulations of financial institutions such as FHA.

1.3.7 Summary

Softwood lumber is a quasi-commodity, with markets fragmented by species, grade, and size. The product's diversity and the changes of mix over time make price measurement difficult over long periods. The product is sold through a complex distribution system relying primarily on independent wholesalers. Lumber's competition with substitute products is governed by a variety of factors in addition to own-price comparisons.

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1.4 OUTPUT GROWTH

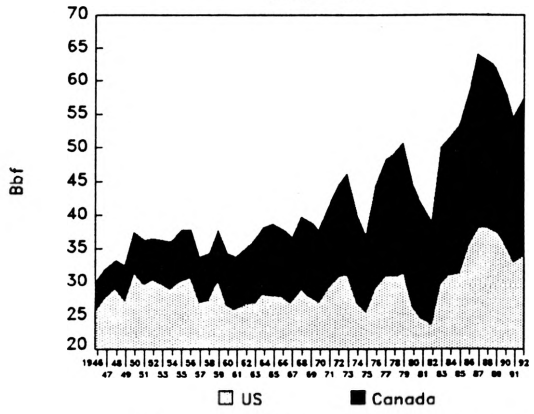
This section reviews trends in softwood lumber output and its regional distribution with comparisons to other competing products. It also considers changes in use intensity for the economy as a whole and how the economy adapts to higher lumber prices.

1.4.1 Output Trends -- US and Canada

North American softwood lumber production has grown strongly over the postwar period, from an average of some 35 Bbf. in the early 1950's to 65 billion in the late 1980's. This was an increase of 85% (Figs. 12 and 13). The bulk of the production growth occurred in Canada.

Figure 12

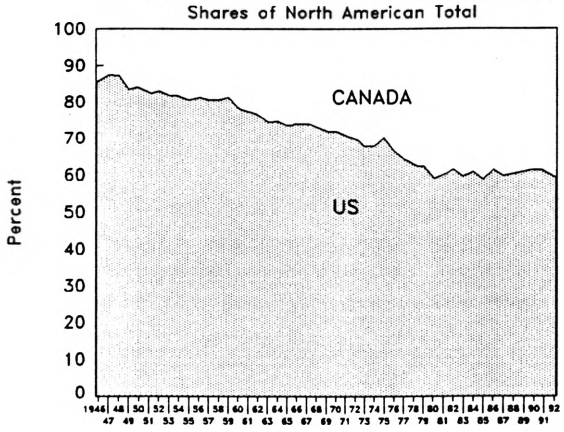
US & Canadian Production of Softwood Lumber 1946–92



Source: AFPA, Adams, Jackson & Haynes 1988, and USITC 1992.

Figure 13

US & Canadian Production of Softwood Lumber: Shares of North American Total



Source: AFPA, Adams, Jackson & Haynes 1988, and USITC 1992.

Growth in lumber output was far slower, however, than US growth in manufacturing (Table 12). Comparing, for example, cyclical peaks in 1951 and 1988, output growth for softwood lumber was modest compared to US manufacturing output which rose fourfold in real terms. The Federal Reserve Board Industrial Production index does not contain a component for softwood lumber. Forest products accounted for a 1.9% weight in the FRB manufacturing production index in 1990.

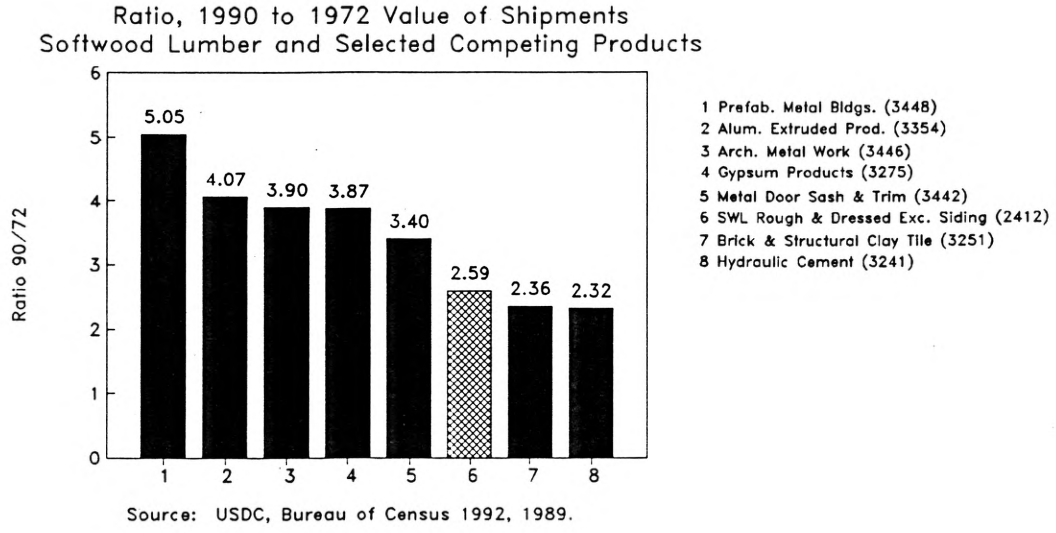
Table 12
Change in Output, Softwood Lumber and Other Products

	Ratios	
	1991/1946	1988/1951
US Softwood Lumber Products (bf)*	119	128
US Lumber & Wood**	242	242
US Durable Materials**	498	385
US Total Manufacturing**	507	405

* Lumber production from AFPA.
** FRB Industrial Production Index.

Many building product markets have seen aggressive penetration by competing materials that are also troubled by maturing core markets. Producers of steel, aluminum, and other materials have developed products that in some applications displace lumber (Fig. 14). In some markets, softwoods have been displaced by hardwoods. Lauan plywood is one example (replacing pine panelling), while increased hardwood usage in millwork is another.

Figure 14

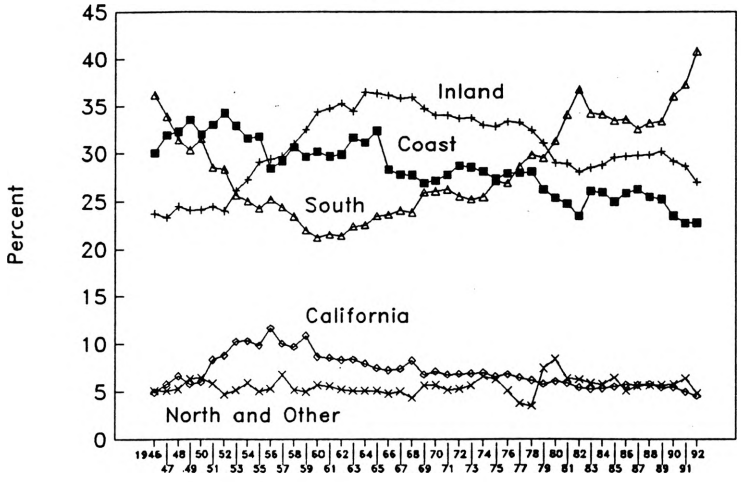


1.4.2 Regional Output Trends

Comparing 1946 to 1991 in terms of where the US softwood lumber is manufactured, the quick impression is one of extraordinary stability. Yet this comparison conceals shifts that occurred during the period (Fig. 15). In the west, these regions do not follow state lines but generally follow ecological divisions.

Figure 15

US Softwood Lumber Production by Region
1946–92



Source: WWPA, AFPA, USFS
Note: These regions do not follow state lines.

The Coast (Westside) in Oregon and Washington has been in a long-term relative decline. Its share of US output has shown minor wobbles around a regular downtrend. No one region has fully counterbalanced the Coast's share loss. The major changes are in the middle of the period in the Inland region and the South. The pre-1960 loss of share in the South is likely due to the substitution of plywood for the one-inch "roofers" and wall sheathing that were staple items in that region. Observers have also suggested that poorly manufactured lumber turned buyers to other species, and that log supply limitations also slowed output. Very likely also, customers liked the lighter, easier-to-nail species coming from Canada and the Inland regions. From 1946 to the mid sixties, the Inland region gained more than ten points of share. But after 1960, based on a growing resource and heavy investments in modern milling capacity, the South regained all of its share losses and a

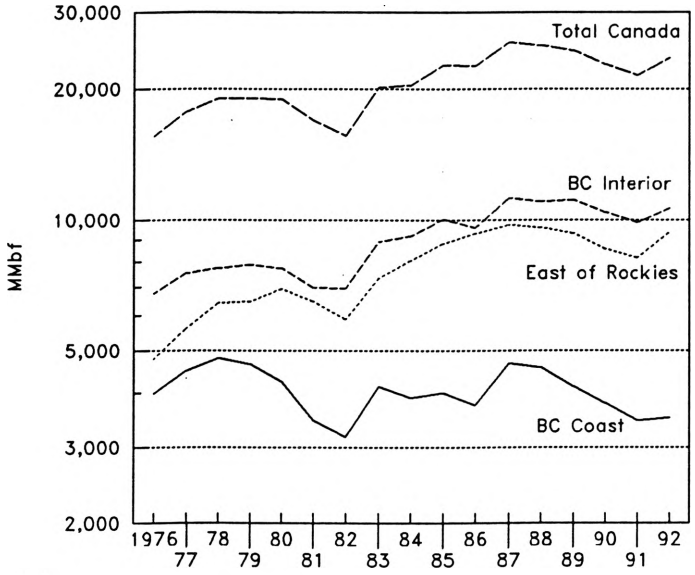
bit more.

The data for the North and California are partly estimated and not especially reliable. But they suggest a continuous loss of share for California and a modest recovery of softwood production in the North after the mid sixties.

Turning to a North American perspective, the key fact is the increasing Canadian share over the period. Production growth in Quebec and in Interior British Columbia contributed to this trend (Fig. 16).

Figure 16

Canadian Softwood Lumber Production by Region
1976–92



Source: COFI.

1.4.3 Production by State, 1991

Viewing production by states, there are twelve states that each produce a Bbf or more of softwood (Table 13), the largest being Oregon. The fourth and fifth largest producers are in the East -- Georgia and Mississippi. There are 15 states that produce 500 MMbf of softwood lumber per year.

Table 13
Softwood Lumber Production by State, 1991*
(MMbf)

State/Region	Volume	% of US Total
Alabama	1,671	11.52%
Arkansas	1,487	10.25%
Georgia	2,287	15.77%
Louisiana	735	5.07%
Maine	781	5.39%
Mississippi	1,838	12.67%
North Carolina	1,174	8.09%
South Carolina	1,214	8.37%
Texas	1,016	7.01%
Virginia	551	3.80%
Total East	14,503	100.00%
California	4,128	22.02%
Idaho	1,923	10.26%
Montana	1,355	7.23%
Oregon	6,479	34.56%
Washington	3,742	19.96%
Total West	18,747	100.00%

Source: US Dept. Commerce, Bur. Census, Curr. Ind. Rept. Lumber Prod. and Mill Stocks, 1991, MA24T(91)-1.

Note: Alternate estimates of 1991 US Softwood Lumber Production: Bureau of Census, 33,250; AFPA, 33,161. (Phelps and McCurdy (1993) did not separate softwood and hardwood.)

* All states producing more than 500 MMbf are included.

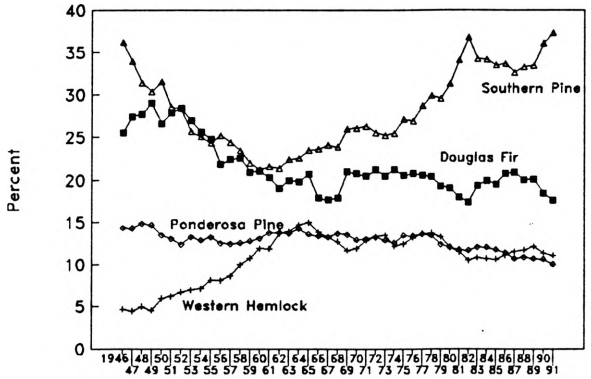
1.4.4 Trends in Output by Species

Changes in species used reflect, and in some ways, underlie the regional changes. Southern pine and douglas-fir trends are virtually identical to the regional trends (Fig. 17). For the four major species, ponderosa pine has steadily lost share over the years, while western hemlock gained share threefold from 1946 to 1965 before steadily declining again.

Among the minor species (Fig. 18), the various species produced in the North clearly lost share during the period after the mid 1970's. Fir and larch, an important Inland species, rose in importance through 1961.

Figure 17

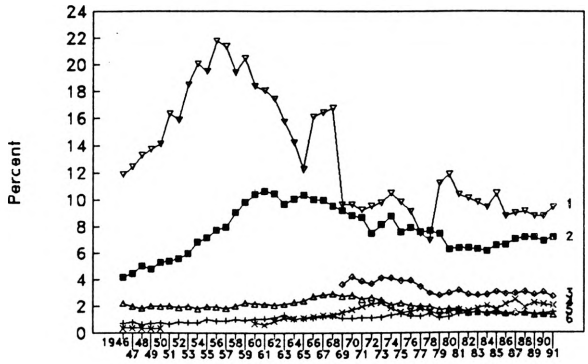
US Softwood Lumber Production
by Species: Major Species



Source: WWPA, NFPA, USFS.

Figure 18

US Softwood Lumber Production
by Species: Minor Species



1.4.5 Geographic and Species Trends: Underlying Causes

A full analysis of the underlying causes of these trends is not needed for this study, but a summary of major factors is useful. The forces at work during these years affected each species differently, but the major forces were these.

First, the Interstate Highway System, completed in the 1970's opened up remote regions of the nation to high-speed trucking service. To compete with longhaul trucks, railroads developed larger cars and improved services. Wholesalers and railroads developed "reload centers" near major metropolitan areas designed to maximize the joint speed and convenience advantages of longhaul rail and shorthaul local trucking. This improved the position of more remote regions.

Second, the geography of demand changed. Population growth in the West, British Columbia, and the South created new local markets in the forested regions. In addition, increased participation in export markets boosted markets for higher grades.

Third, new technologies for processing small logs, for drying, and for using residuals enabled mills to produce lumber from previously unused species. This opened up new

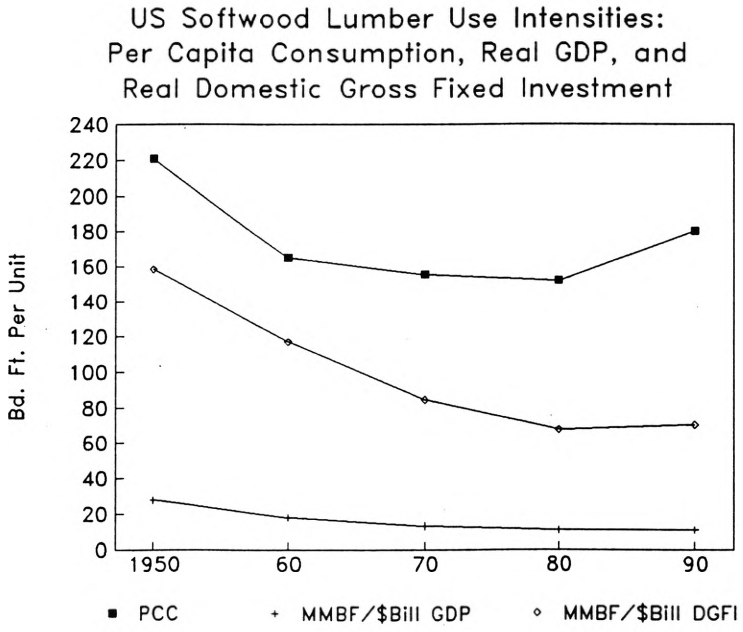
regions for lumber manufacturing, with the Rockies, Interior British Columbia, and the Prairie Provinces benefitting significantly. For a variety of perspectives on these changes, see Schallau and Maki 1986, Gorte 1992, Haslett 1988, and Lange, et al. 1989.

1.4.6 Trends in Use Intensity

The use intensity of softwood lumber has often been measured in terms of per capita consumption, which peaked in 1909 and then steadily declined until the 1960's. Per capita consumption then reached higher levels in the late 1980's. This increase was due to the construction of larger homes, and to increases in repair and remodeling and other uses.

Another way to look at use intensity is in relation to GDP, which is a common approach for many other raw materials. In addition, since so much lumber is not in fact consumed but is "invested" by using it in long-lived structures, it is useful to examine the softwood lumber intensity of private fixed investment (Fig. 19). These indicators also show that the postwar downtrend in use intensity has at least paused, if not slightly reversed itself.

Figure 19



Use intensities of other raw materials declined significantly in the industrialized world after the first Arab Oil Shock (Choe 1991); for some major materials like steel, use intensities peaked long ago (Williams 1992). This is part of a general maturing of basic materials industries that Williams (p. 29) attributes to four forces:

-- substitution of new materials for traditional ones;

-- improvements in the efficiency of their use;

-- saturation of bulk markets;

-- consumer preferences changing toward less materials-intensive goods and toward services.

All of these forces have been at work in the markets for softwood lumber. In part, the rate and direction of these forces can be price-dependent. Falling real prices of softwood lumber in the 1980's probably had a small effect on consumer ability to purchase more housing space in the form of larger and better-equipped houses.

In a searching review of early 1970's materials shortages, the National Commission on Supplies and Shortages (Anon. 1975) identified a range of shortrun adjustments made to shortages, but did not attempt any analysis of the costs such shortages or longer term rising real prices may impose on the economy.

Higher prices of lumber will stimulate many adjustments at all market levels (Table 14).

Table 14
Adjustments to Higher Lumber Prices

Market Level	Adjustment
Stumpage Supply	Closer utilization in logging More intensive forest management
Sawmilling	Better control of conversion processes Reductions in labor content Boosting mill capacity
Industrial Users	Using more abundant species Boosting yields Tighter value engineering Switch to nonwood materials Recycling Better utilization of residuals Design/finish for improved durability
Construction Industry	Tighter value engineering Design/treat for durability Use wood more efficiently Engineered products
Households	Use wood more carefully Adapt to new wood products Switch to nonwood products Recycle
Competing Materials Producers	Improved products Increased emphasis on construction markets

First, utilization in logging will tighten still further in response to higher stumpage prices, even though major strides have already been made in this area. More intensive forest management will also be undertaken. This will yield wood supply benefits in the 1990's, as previously unmerchantable and submarginal stands thinnings are harvested, as well as in 20-60 years when the benefits of higher growth rates can be harvested.

Another result of tighter timber supplies will likely be narrower processing margins in sawmilling, after the tightest supply/demand imbalances have passed. The industry will

respond by further squeezing out labor content, by boosting capacity of existing mills, and by improving yield ratios, as well as by specializing wherever possible in higher margin items. Mills unable to adapt will close.

The next response will be by materials users. The dynamic process of materials substitution is much more complex than econometric analyses thus far have been able to fully depict, though some useful work has been done (see, e.g. Spelter 1985, Alexander and Greber 1991, and McKillop, et al. 1981). In few instances is substitution simply triggered by price change alone. For many materials substitutions, superior technical traits of the new product are a key factor. For example, the ability to make prefab trusses in a range of sizes and configurations using laminated veneer lumber (LVL) and oriented strand board (OSB) confers a technical advantage on these products compared with lumber. Also, the superior performance of wood trusses in fires, compared to steel, is often important.

In other situations, substitution is driven by total installed costs or by long-term cost relationships, and not primarily by the price ratios of the materials themselves. As an example, softwood plywood is more costly on a materials basis, but is cheaper on an installed basis, than sheathing made of lumber. This is because less labor is required to sheath a building using the panels. Likewise, the labor costs of building in brick have been a major incentive to substitute away from it in light construction. In some applications, wood is cheaper than substitutes on a life cycle, longrun cost basis when durability and maintenance costs are considered. But frequently, as in low cost speculative housing units, initial costs are more important to the specifiers.

Higher priced lumber will increase the effort devoted to using wood more efficiently in structures and to insuring its longer life through better design and preservative treatments. Industrial wood users will optimize processes to employ lower grades of lumber than formerly and to boost yields in their processes. Also, recycling of lumber and its end products will increase at different levels of the marketing system, including households.

Within the wood industry, there will be significant capacity growth in engineered products which usually rely on low cost fiber sources. While these fiber sources usually come from second growth forests, they are not immune from environmental concerns. For this reason, and because capital commitments to build the plants will be significant, a swift supply response is unlikely.

The final response will be by suppliers of competing nonwood materials. These

suppliers will seek to expand their market shares on the basis of their more favorable costs and, where applicable, their ability to deliver with less volatile prices. Expanded market potential could lead to lower unit costs as the industry expands. It is also likely to lead to innovations that further exploit the new opportunities presented by more costly lumber. At the same time, for some nonwood substitute products it is possible that needed to replace wood will only be available at higher unit costs.

These forces, over time, can be expected to moderate further inflation in real lumber prices, as occurred following past upward leaps of lumber prices from 1946-53 and in the late 1970's. Still, over time the nation's raw material needs will be met at higher costs.

1.4.7 Summary

Softwood lumber is a mature industry, whose output has grown slowly relative to the economy as a whole, though its decline in use intensity appears to have stabilized. Lumber suffers from heavy competition from substitutes. Some of the most successful substitutes, like plywood, are produced elsewhere in the forest products sector. The largest US lumber producing region is the South. The Inland West and the Pacific Coast (Westside) portions of Washington and Oregon, have been declining in production share since the mid 1960's. The Province of British Columbia dominates Canadian production. Changes in species mix over time reflect these geographic factors. In response to higher prices, producers, marketers, and end users will make a variety of adjustments.

1.4.8 Note on Production Data

Production data used in this report were assembled from a variety of sources. In some instances, sources provide different estimates. Most authorities seem to agree that the trade association data provide the most complete coverage of US production. For this reason, we have employed WWPA, SFPA and AFPA data for total production and for species and regional detail.

For the North, we estimated production 1946-49. For 1950-59 we used US Forest Service estimates, which in turn rely on Census estimates that are recognized to be underestimates. For succeeding years, we calculated the North as a residual from the national total and from the other regions. This means that other eastern species are included in the North. This procedure probably leads to an overestimate of North and

Other Production since we do not think that regional softwood production has grown as much as these estimates suggest.

For reference, we note the estimates of production by species in the East, according to the Bureau of the Census, MA24T (90)-1, p. 3:

	Softwoods Other than So. Pine 1990 Production, New Sample MMbf	
Eastern white pine	367	
Other pines	165	mostly jack and red
Spruce fir	605	
Other E. softwoods	877	
Total	2,014	

In contrast, our residual for North and Other totals 3.8 Bbf, which is probably too high.

An independent estimate, relying on US Forest Service removals reports as done for hardwoods by Luppold and co-workers, produced an estimate of 730 MMbf per year of white pine lumber production for the entire East, or double the amount reported by the Census (Irland Group 1991). Where data for individual species are lacking, we have not attempted any estimates.

A recent paper by Phelps and McCurdy (1993) developed a statistical sample from the Dun and Bradstreet database for 1991. They estimated that total US lumber output in 1991 was 56.4 Bbf, compared to 51.1 Bbf as estimated by the AFPA. In their sample, 33% of the output was rough lumber, and 19% was pallet lumber and parts.

1.4.9 References

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1.5 PRODUCTIVITY, CONVERSION EFFICIENCY, AND TECHNICAL PROGRESSIVENESS

Progressiveness in productivity, technology, and product quality all contribute to higher living standards, more efficient use of natural resources, and national economic competitiveness. Determining how the lumber industry compares to all manufacturing by these measures is therefore important. This section discusses how the industry has performed in harvesting and conversion efficiency, in improving labor productivity, in R&D and innovation, and in new product development.

1.5.1 Harvesting and Conversion Efficiency

The physical conversion efficiencies of the industry have improved dramatically. This has been caused by changing price and cost ratios, by public policy, by developing new technology and products, and by efforts to economize on capital and labor.

In the Canadian lumber industry, it required 2.67 m3 of logs to produce one cubic meter of lumber in 1970; this fell to 2.13 in 1984 (Runyon 1991, p. 40). In the US, improved technology and sawing techniques led to improvements in recovery factors by as much as 20% in some regions from 1952 to 1985 (Haynes 1990, p. 127ff). This may seem a modest increase but in many areas it was achieved while also overcoming declining size and quality of logs, both of which tend to reduce recovery ratios. Lumber recovery factors have been found to be significantly higher in larger sawmills (Steele, Wagner & Skog 1991), so that rising mill sizes have helped to boost industry-wide conversion efficiencies. This remained true when different log sizes used were considered. While only about half of the cubic wood volume of a log can be converted into lumber, considerable progress has been made in converting the residuals into valuable products, as we note below. In the US as recently as 1970, it was estimated that in harvested areas 37% of the softwood growing stock was left on the ground; this had been reduced to 10% by 1986 (UN ECE/FAO 1990, p. 48).

Ghebremichael, et al. (1990, p. 36) found that lumber conversion efficiencies of logs decreased in several Canadian provinces. They attributed this to the decline in log sizes that could not be offset by improved technologies. At the same time, chip yields per unit of roundwood rose dramatically.

At a typical large sawmill in 1946, conversion efficiencies were relatively low, partly

because logs were much less expensive than today. Further, customers demanded the highest quality lumber, and the level of technology was very simple. The result was that for each car of lumber shipped, a large quantity of bark, slabs and edgings, sawdust, and planer shavings accumulated near the mill or was dumped in the river. The Refuse Act of 1899 was prompted partly by the resulting clogging of waterways. The West Coast paper industry was developed in part to solve this problem.

Today, log conversion efficiencies are far higher. Bark, sawdust, and shavings are sold to different markets for a variety of uses. In some areas, they may be burned in on-site boilers or sold to nearby cogenerators. Slabs, edgings, defective logs, and rejects are chipped to precise specifications and sent to paper mills for pulping. In most areas there is little "residue" that is not spoken for. An important effect of these trends is to increase the value of standing timber. This provides improved incentives for forest management and allows the industry to move down the scale of timber quality to use smaller logs, previously undesirable species, and stands of lower stocking. It can help provide the financial incentive for thinning and intermediate treatments that boost future yield. Some of the industries like particleboard that originated as users of sawmill by-products now have grown to the point that in some regions they use purchased roundwood.

Integration with the paper and board sector has been an important force. Pulp makers at first acquired sawmills along with land. Paper mills with no sawmills often built them (usually chip-n-saw mills with chipping headrigs), thus gaining control of chip supplies. The entry of this capital intensive industry into sawmilling brought many changes. It provided a major impetus to improvements in chipping technology and in utilization levels, and supplied an incentive for the use of smaller trees whose lower lumber conversion ratios previously made them unattractive to free-standing sawmills. The integration with pulp and paper -- whether accomplished through the market or through ownership -- brought more stable markets for chips and by-products and even created incentives for mills to continue sawing at high rates when lumber markets were poor.

As an example of the importance of by-product markets, in Quebec from 1970-91, the value of softwood lumber shipments rose by 833%, while the value of by-product shipments rose by 1,129%. In 1991, 30% of the Quebec lumber industry's (soft and hard) shipments value was in chips and by-products (QLMA 1992).

Energy uses of residuals have been significant in some regions, particularly where

alternative sources of energy are costly. Improved equipment for handling and firing a variety of wood-based residuals has enabled many mills to become virtually self-sufficient in energy and solve by-product disposal problems at the same time.

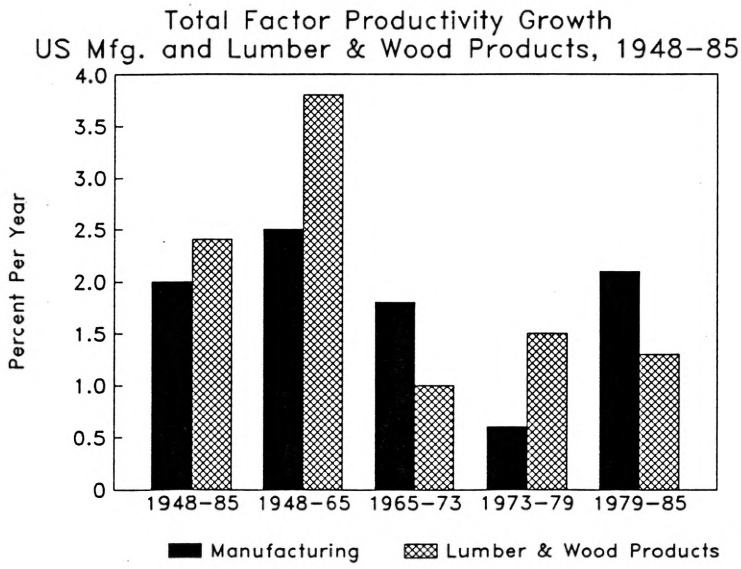
1.5.2 Total Factor Productivity

Total factor productivity is difficult to measure because it requires estimates of capital as well as labor inputs employed. The few analyses available show that the lumber industry as a whole has performed relatively well by this measure.

Kaiser (1975) cites Kendrick's results for the entire lumber and wood sector showing total factor productivity rising by 3.5% annually from 1948-66, partly due to an increase in capital intensity that exceeded the national average for all manufacturing.

From 1948-85, total factor productivity growth in the lumber and wood sector has at times exceeded manufacturing as a whole, but in 1979-85, partly due to declining output, it fell behind all manufacturing. The lumber and wood sector is far larger and more diverse than the lumber industry, so it is an imperfect proxy, but these results are consistent with the overall picture of an industry performing in line with all manufacturing except during recessions (Fig. 20).

Figure 20



Source: Dertouzos, et al. 1989, p. 28

A recent comparison of TFP trends in sawmilling (Murray, et al. 1992) found an actual long-term decline in the British Columbia Coast, with relatively high rates in every other region led by the US West (Table 15).

Table 15
Average Annual Rate of Change in Total-Factor Productivity, by Sub-Period and Region (%)

	BC Coast	BC Interior	Ontario	Quebec	US South	US West
1965-1970	0.0	-0.1	0.4	2.9	1.0	2.7
1970-1975	-3.7	1.5	1.5	-1.0	0.4	-1.4
1975-1980	1.6	-0.9	1.2	0.4	1.6	-0.1
1980-1985	1.4	3.2	1.9	1.6	-1.4	2.6
1985-1988	0.8	1.3	-0.5	1.7	5.4	3.4
1965-1980	-0.8	0.2	1.2	0.8	1.1	0.4
1980-1988	1.3	2.7	1.1	1.9	1.4	3.3
1965-1988	-0.1	1.2	1.2	1.2	1.3	1.5

Source: Murray, et al. 1992, p. 147.

1.5.3 Labor Productivity

The only possible way to provide rising living standards in the longrun is for workers to be equipped with improved capital, technology, and training to enable them to produce more. For this reason, long-term improvement in labor productivity has been a major factor when comparing the performance of different sectors of the economy.

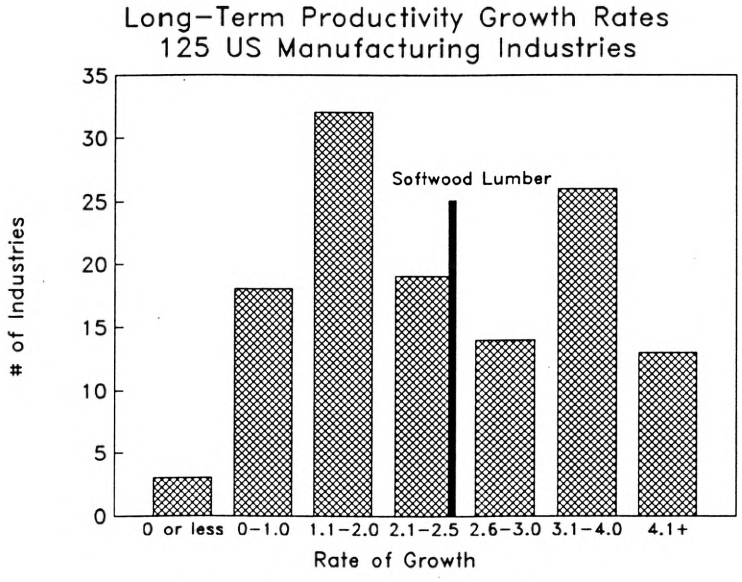
In addition to improving efficiency in the physical utilization of energy and materials, an industry must continually increase its efficiency in the use of labor. In rural areas where most sawmills operate, they have been forced to do this in order to retain workers in a period of rising wage rates. Comparing the labor intensity of typical sawmills of the late 1940's with that of current best practice mills displays an astonishing contrast. First, the mills are now far larger. Second, virtually all of the labor intensive operations of placing logs on headrigs, moving lumber from one process to another by hand, and hand sorting,

stacking, and loading have been eliminated.

Over the postwar period, the lumber industry's labor productivity record has broadly matched that of manufacturing as a whole. Data are sparse for the 1940's and 1950's (see, e.g., Irland 1974, p. 47), but industry price behavior does not suggest that cost inflation was an issue in those years. Kaiser (1975) found that from 1954 to 1972, the US sawmill industry increased labor productivity by 3.0% per year. Census data examined by the US International Trade Commission for the US industry showed a rate of productivity improvement in board feet per employee hour of 2.6% per year from 1977 to 1984, and an identical rate in 1988 to 1991 (USITC 1985, p. 76, and 1992, p. A-39; but note that the samples differ).

A comparison by the US Price Commission found that sawmills (SIC 2421) improved productivity from 1958 to 1969 at 3.6% per year, exactly equal to manufacturing as a whole (cited in Irland 1975, p. 199). In the US from the late 1950's to 1990, the lumber industry performed at about the median level in a large sample of manufacturing industries (Fig. 21, based on Dumas 1992).

Figure 21



Source: Tabulated from Dumas 1992.

In the Canadian lumber industry, labor productivity advanced at respectable rates over the years 1962-85:

British Columbia Coast	2.1% per yr.
British Columbia Interior	3.2
Ontario	4.0
Quebec	3.9

(Ghebremichael, et al. 1990, p. 39)

According to a US International Trade Commission analysis, Canadian mills increased board foot production per manhour by 3.8% per year from 1977-84, compared to 2.6% for the US industry (USITC 1985, p. 76). During the 1980's, the poor economic conditions forced many mills to extensively upgrade or to close. The results were dramatic. At Noranda, cash costs per MMbf were cut by 30% in the years 1982-85, according to Chairman Adam Zimmerman (as cited in Irland 1988).

In Canada, mill sizes grew dramatically, as a result of the construction of modern large mills as well as by the closure of small ones. In Interior British Columbia, average production per mill increased nine-fold from 1960 to 1984, while it increased eight-fold in Quebec. Large plant sizes usually enable the same size of a crew to perform more work because they typically improve materials flow and increase speed of machine centers without increasing labor requirements. There are "supermills" in Interior British Columbia that can saw upwards of 200 MMbf per year. Three such mills could produce as much as the entire Maine softwood lumber industry. These mills can operate with about 20 direct production workers on a shift (Simons 1989). Because of the prevalence of large, new mills, and their concentration on high volume commodity products, the Canadian industry on average displays significantly higher labor productivity than US mills. In 1984, board foot output per employee hour was 85% higher in Canadian than American mills (USITC 1985, p. 76).

Improvements in labor productivity in the US industry have been similar to all manufacturing over this period, which is notable when the relatively low rate of output growth is considered. Productivity gains have been accomplished by such changes as:

-- The dropping out of thousands of small, labor intensive plants.

-- Construction of larger, more automated mills.

-- Improvements in materials handling.

-- Development of faster feed rates for saws, edgers, and planers.

-- Improvements in drying.

-- Improvements in yield that inherently improve labor productivity as well.

-- Replacement of labor intensive activities -- such as sorting by size and length -- by automated facilities.

-- Improvements in packaging and loading systems, e.g. fork lifts loading banded units compared to hand loading of individual boards into boxcars.

As a result of these productivity improvements, employment in the US lumber industry (hard and soft) fell from 232,700 to 182,100 workers between 1978 and 1992, a decline of 50,000 (unpub. BLS printout; note that these figures do not match Census data). This was a period in which US softwood production increased from 30.9 Bbf to 34.1 Bbf.

Care must also be taken in using published employment data, which has at times led US government agencies themselves to incorrect conclusions (USITC 1986).

These improvements have occurred despite the challenges posed by declining log size and quality in many regions, and a shift of large volumes of production to regions where the timber is smaller (Lange, et al. 1989).

A source of bias in evaluating productivity trends in any industry is that results need to be standardized for quality change in the product, which is often difficult if not impossible. In the lumber industry, comparing 1991 with 1946, significant improvements in quality and additional services are provided with each load of lumber:

-- more of the product is dried;

-- more of the product is planed;

-- quality of size, uniformity, grading, and drying are improved;

-- strapping and waterproof coverings are provided.

These quality and service changes require additional labor, so that the measured productivity trend has probably been underestimated. Also, these improvements result

in cash cost savings to distributors, retailers, and end users. This bias applies to other manufactured products as well. Existing price indices such as the PPI do not adjust for these changes.

1.5.4 Research and Development

The forest products sector is not an R&D intensive part of the economy, as has been observed many times. Yet it has achieved a productivity improvement record over time that roughly matches the overall manufacturing sector. How can this be? The answer lies in the nature of the industry and its products.

First, in competitive industries, producer control over price is absent. Firms are unable to maintain price-cost margins that will enable them to engage in discretionary programs of research and development.

Second, lumber is a classic mature product. While lumber is being improved in particular ways for specific uses, as in the increased use of drying, or the development of machine stress rating, the basic character of a 2x4 does not change. It is an industrial good with uses that are well established. Users do not expect a new release each year offering higher speed, more elegant styling, or a new range of colors. Producers do not compete with one another to any degree on the basis of product refinements, although even in softwood dimension markets, certain producers with a reputation for quality are able to capture small premiums over prevailing market prices.

Finally, softwood lumber is a mature industry. As such, it experiences slow growth in output as its established markets grow. Being in a mature industry, the companies do not have the incentive to invest in R&D to produce dramatic improvements in product performance or the radically cut costs. Nor does a modest rate of capacity growth provide an opportunity to upgrade the technology level of the industry by installing state of the art plants at a high rate. In fact, the spread of innovations and improvements that has been achieved has been remarkable for an industry growing so slowly. The improvements are testimony to the power of competitive forces in this industry.

1.5.5 The Innovation Process

Economists studying technological change distinguish between R&D, which is the development of new products and processes, and innovation, which is their application

in the production process. This topic has been little studied in the forest industries. But recent work has helped characterize the situation. Cohen and Sinclair examined a large sample of large lumber and plywood producers. They found that the lumber producers were focusing heavily on new processing technologies in computerization, process monitoring, and efforts to increase productivity. They also have processes to identify performance characteristics to facilitate the use of wood in engineered building systems (Cohen & Sinclair 1989, p. 1632). In their sample, firm size and level of vertical integration did not affect the pace at which firms adopted new technologies (Sinclair & Cohen 1990, see also Kamien and Schwartz 1975, Baily, Hulten, and Campbell 1992, and Scherer and Ross 1990, ch. 17).

In highly competitive, mature industries, the primary source of process and equipment innovations is the supplier industries providing equipment and materials. This is true in agriculture and it is also true in sawmilling. Any glance through a recent industry trade journal or equipment show directory will show the diversity of small, medium, and large suppliers offering improved machines, mill designs, lubricants, saws and planer blades, computer process controls, software, management information systems and online data systems, and a host of other items. Specialized engineers and consultants help firms to evaluate new concepts for either incremental improvements or for complete new mills. An excellent overview of the role of suppliers is provided by Hayter (1988).

Given the modest rate of demand growth in this industry, much of the productivity improvement comes from incremental improvements and rebuilds at existing plants, supplemented by more dramatic improvements at new mills. A significant part of the net improvement in productivity comes from the exit of high cost, inefficient plants. Investment in yield-increasing and productivity improving equipment and processes has actually expanded output so much as to create a condition of overcapacity for much of the period.

1.5.6 Progress in Developing New Products

The forest products industry has generated important successes in other wood products that have provided stiff competition for lumber. This has had the effect of producing additional downward pressure on lumber costs and prices, to the benefit of consumers. Examples are:

-- particleboard/medium density fiberboard;

-- southern pine plywood;
-- waferboard/oriented strand board;
-- engineered wood products like parallam and PSL-111.

These products compete with wood by offering superior performance and design flexibility. In every instance, they also enable producers to turn to raw materials that are lower in cost or that were not previously being used at all.

Over much of this period, the lumber industry did not aggressively pursue new product development, but was oriented toward production and cost issues. In a number of important instances, the development of important new products originated in or was significantly assisted by other industries seeking new markets. As an example, the manufacturers of truss fasteners took a leading role in developing the truss industry, and market leadership in this field was taken not primarily by established lumber companies but by new startups.

Major opportunities exist to improve performance of structures, reduce wood required to build them, and economize on labor, energy, and other materials through further development and application of these products. In addition, many of these products can be produced from species of trees that are abundant supply (see papers by Leicester, Wilson, and Maloney in Anon. 1992).

1.5.7 Summary

Softwood lumber is a low-tech product, produced in mid-tech mills that employ a wide variety of high-tech individual components. In best practice plants, it is sawn, graded, dried, and packaged in highly automated processes and produced to exacting quality specifications. The industry has been able to maintain a rate of improvement in labor productivity that is broadly comparable to that of all manufacturing, despite conducting little R&D of its own. Much of the advancement is attributable to improvement made by equipment suppliers. Characteristic of a basic raw material in a mature market, innovations in the product itself have been few and mostly incremental. But in recent years, several major companies have brought to market entirely new products developed in their own labs and pilot plants.

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1.6 LONG-TERM PRICE PERFORMANCE OF THE SOFTWOOD LUMBER INDUSTRY

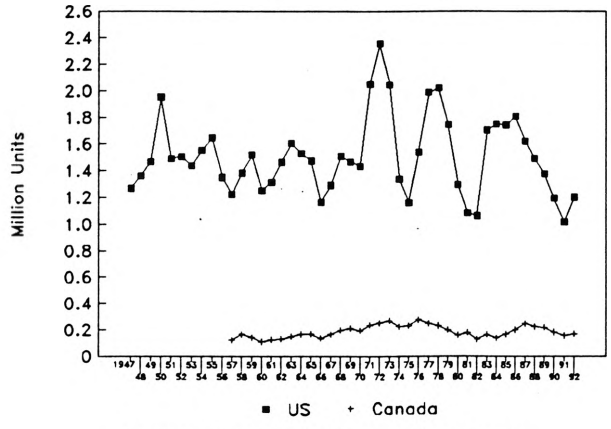
A critical dimension of an industry's performance is the ability to deliver products to customers at stable real prices over time. A high capacity to overcome rising input costs and declines in their quality benefits an industry's own customers and the economy as a whole. This ability will help an industry and a nation remain competitive in international markets.

1.6.1 Cyclical Behavior of Demand Drivers

As proxies for the level of activity in major end use markets, we examine trends in housing starts, real new construction spending, and industrial production (Figs. 22-25). Cycles in housing starts account for a significant part of the variability in total softwood lumber demand. Following the peak in 1950, starts fluctuated in relatively mild cycles until the historic boom of the early 1970's, when they jumped upward by 64% in 3 years. The two succeeding cycles each reached new lows, and their highs were also successively lower. Their relative amplitude, however, remained similar.

Figure 22

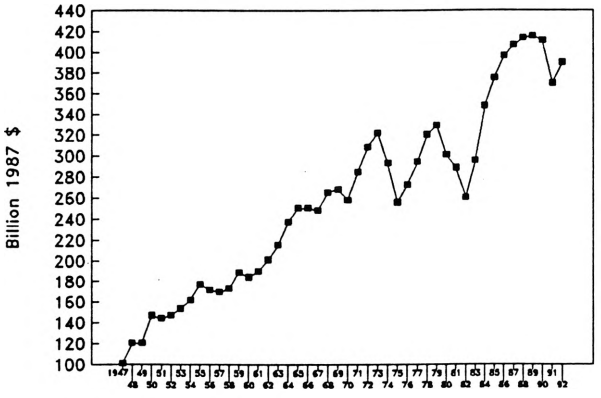
Housing Starts, 1947–92



Source: Econ. Rept. of Pres., Stats Canada.

Figure 23

Real New Construction Spending, 1947–92

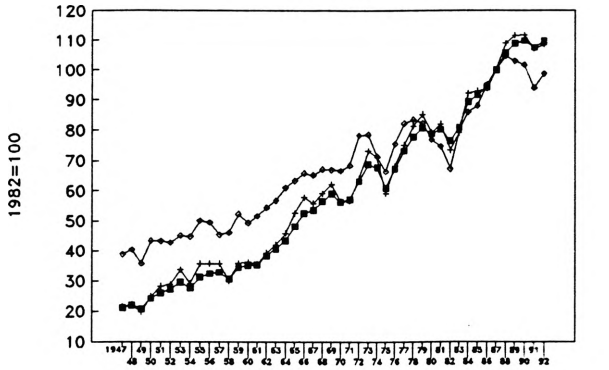


Source: Econ. Rept. of Pres.

New Construction GDP Component deflated by GNP deflator. 1987=100

Figure 24

Industrial Production Indexes, 1947–92

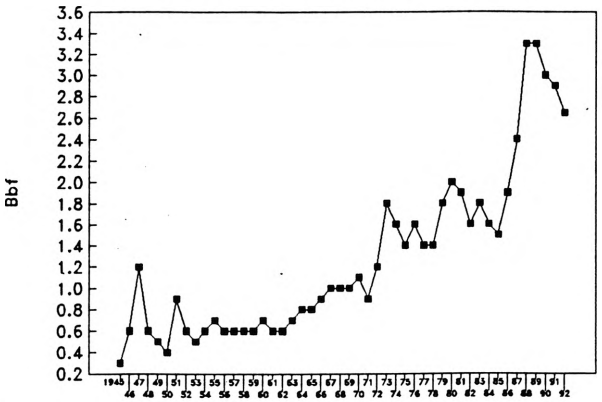


▪ Total Mfg. + Durable Mfg. ◦ Lumber & Wood Prod.

Source: Econ. Rept. of Pres. 1992.

Figure 25

US Softwood Lumber Exports, 1946–92



Source: AFPA/WWPA/USFS.

Real new construction spending showed a dramatic uptrend over the period, with cyclical variations growing more pronounced over the period. The index of industrial production, as a proxy for total manufacturing demand for lumber, was relatively well behaved, with the relative magnitude of cycles remaining roughly the same over the period along a fairly regular upward trend.

Softwood lumber exports during the 1950's and 1960's were relatively small; as they have increased in the 1980's their cycles have become significant. While not precisely synchronized with domestic demand proxies used here, they have tended to accentuate the effect of domestic business cycles.

In short, the lumber industry has met with modest average rates of growth in end use markets over this period, but has had to deal with significant increases in cyclical instability. Other building materials suppliers face the same challenges. During the downturns, lumber capacity is often closed down, leaving the industry unable to quickly respond to swift increases in demand. At the peak of demand cycles, firms reinvest profits in upgraded machinery and in new capacity, creating a subsequent tendency toward overcapacity. But this tendency does not seem to enable the industry to respond to rapid and sustained increases in demand without increases in real prices, as our analysis shows below.

1.6.2 Comparison to Aggregate Price Measures

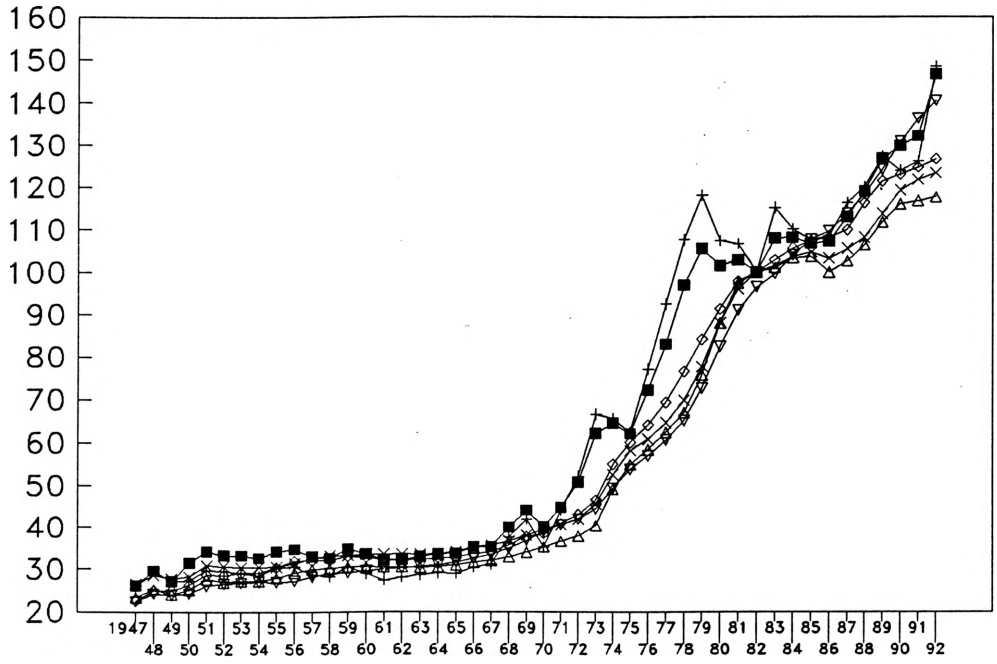
Over much of the period 1947-1991, the price of softwood lumber has moved in broad harmony with broad measures of price changes for important categories of intermediate products in the economy, as measured by PPI components (Fig. 26). Up to the early 1970's, all of the price measures used moved in a narrow range. The softwood lumber price index increased at 1.74% per year, less than other construction materials, and well below the CPI (Table 16). During the Korean War housing boom and materials price inflation, softwood lumber price was rising somewhat faster than other industrial commodities. During the 1970's this changed radically as all building materials suppliers attempted to keep up with a historic housing boom. Price controls were in effect in various forms between August 1971 and August 1974 (Freeze in August 1971; Phase II from November 1971 to December 1972; and Phase III January 1973 to August 1974). A detailed discussion of these controls and their effects can be found in Rinfret-Boston Assoc. 1974. But in these years, softwood lumber prices -- and those of other construction and industrial materials -- rose far more rapidly than all producer prices. Between the peak in 1979 and the recession of the mid 1980's, price inflation in softwood lumber receded to match the general economy, where it remained for the balance of the period to 1989-91.

Relative weights of lumber products within the PPI components are shown in Table 17.

Figure 26

Price Performance, 1947–92

Producer Price Index, 1982=100



- ■ Lumber & Wood
- \+ Softwood Lumber
- ◇ Materials & Components for Construction
- △ Industrial Commodities
- × All Finished Goods
- ▽ CPI 1982–84 = 100

Source: Econ. Rept. of Pres. 1992 with TIG Ests. 1946–49 by linking from various sources, and USDA–FS Misc. Publs. 1453, 1486, for SWL, with 1988–92 from BLS PPI Monthlies.

Table 16
Lumber and Wood Products Price Performance, 1947-92
Compared to Relevant Price Measures
(Index, 1982 = 100) (comparing three-year averages)
- Index Value, Three-Year Average -

Midpoint of 3-yr Average	Lumber & Wood	Softwood Lumber	Materials & Components for Construction	Industrial Commodities	All Finished Goods	CPI 1982-84 = 100
1948	28.97	27.60	24.53	24.50	27.70	23.50
1970	42.87	40.33	38.93	35.20	39.27	38.67
1979	101.30	111.00	84.00	76.90	78.47	73.40
1985	107.27	108.60	107.00	102.33	103.87	107.03
1990	136.10	132.74	124.63	116.57	121.37	135.73
Percent Change						
1970	1.80%	1.74%	2.12%	1.66%	1.60%	2.29%
1979	10.03%	11.91%	8.92%	9.07%	8.00%	7.38%
1985	.96%	- .36%	4.12%	4.88%	4.78%	6.49%
1990	4.88%	4.10%	3.10%	2.64%	3.16%	4.87%

Source: Economic Report of the President, BLS.

Table 17
Wood Within Major PPI Stage-of-Process Categories
December 1991 Relative Importances (percent)

Crude materials for further processing	100.000%
Lumber and wood products	4.663
Softwood logs, bolts and timber	3.706
Hardwood logs, bolts and timber	0.255
Pulpwood	0.553
Other roundwood products	0.149
Intermediate materials, supplies and components	100.000%
Lumber and wood products	3.816
Douglas-fir, dressed	0.925
Southern pine, dressed	0.117
Other species, dressed	0.105
Rough softwood lumber	0.364
Flooring, siding, and cut stock	0.265
Hardwood lumber	0.073
General millwork	1.186
Prefabricated structural members	0.157
Miscellaneous millwork products	0.089
Wood pallets and skids	0.111
Boxes	0.045
Other sawmill & planing, mill products	0.188
Prefabricated wood buildings & components	0.187
Treated wood and contract wood preserving	0.179
Finished goods	100.000%
Lumber and wood products	0.110
Softwood lumber	0.025
Douglas fir, dressed	0.003
Southern pine, dressed	0.003
Other species, dressed	0.010
Rough softwood lumber	0.007
Flooring, siding and cut stock	0.002
Hardwood lumber	0.005
General millwork	0.031
Miscellaneous millwork products	0.039
Materials and components for construction	100.000%
Lumber and wood products	21.190
Softwood lumber	4.970
All industrial commodities	100.000%
Lumber and wood products	2.976
Softwood lumber	0.594

Source: BLS.

Rapid increases in the relative price of softwood lumber generally occur during periods of unusually high demand. Following those periods, price performance returns to more closely match the general economy; often real prices decline for a time. These relative price increases in lumber are often associated with major increases in price levels of many other primary commodities, suggesting that some role is played by supply and demand factors of widespread influence. The more damped response of prices to demand changes in the 1950's is often attributed to the large number of smaller mills of that period, which could quickly expand output or even restart after being closed during market downturns. These smaller mills helped dampen swings in prices. By the 1970's, however, many of them were gone. In any case, the demand surge of the 1970's exceeded what was seen in the 1950's. As we note above, the volatility of major end use markets was also unusually high in the second half of the period.

A further analysis is shown in Figs. 27-36. Here, the softwood lumber PPI is compared one at a time to each of the major aggregates studied. Because of the clustering of points in the 1940's and 1950's, we provide a blown up version of the years 1947-69 to clarify trends in the earlier periods.

These charts show differences in softwood lumber trends over the period compared to the other aggregates (they do not show year-to-year changes). For example, softwood lumber rose at a pace about equal to the PPI through the mid fifties, and then fell well below it. On contrast, softwood lumber rose faster than the CPI through the late fifties before falling below it during the resurgence of inflation of that period. Compared to materials and components for construction, softwood lumber rose less rapidly through the late fifties to the mid sixties.

After 1970, the broad patterns are quite similar across all the aggregates examined, and they mirror the national cycles in housing and industrial production.

Figure 27

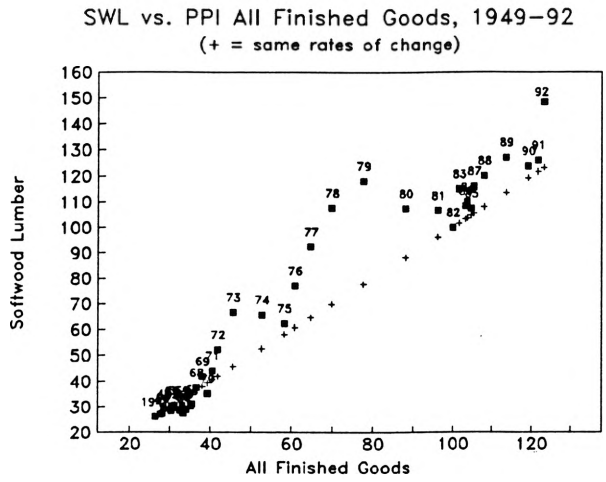


Figure 28

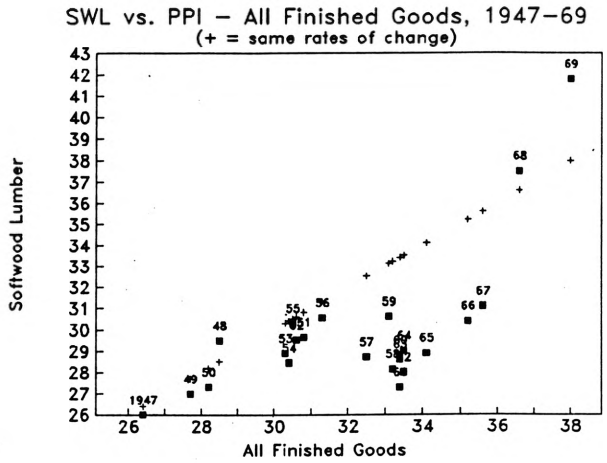


Figure 29

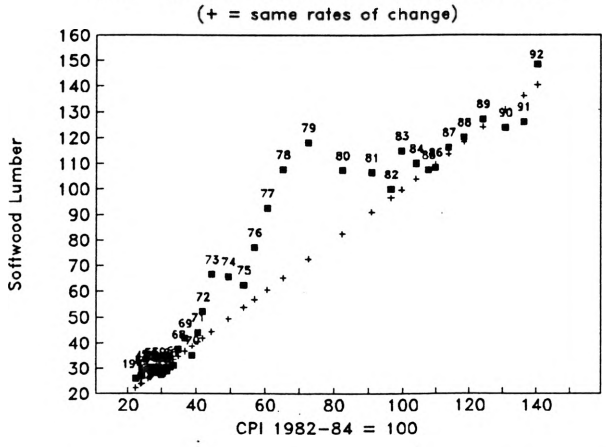
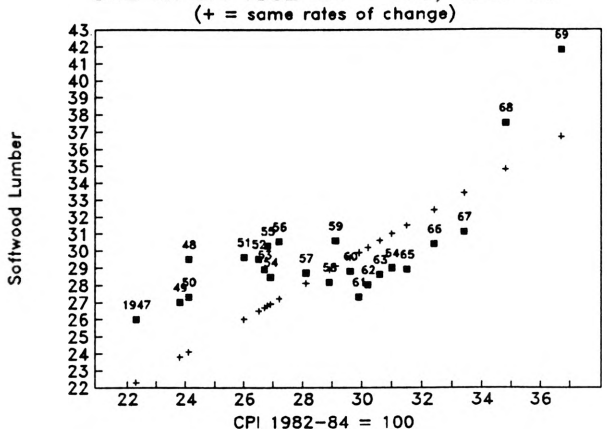


Figure 30



Note: These charts show the scatter of index points for pairwise comparisons of softwood lumber versus other PPI/CPI components. In Fig. 27, for example, the point for 1982 shows that over 1947-82, cumulative price change was essentially identical for softwood lumber and for all finished goods. The cumulative price change for most of the 1970's, however, was faster for lumber.

Figure 31

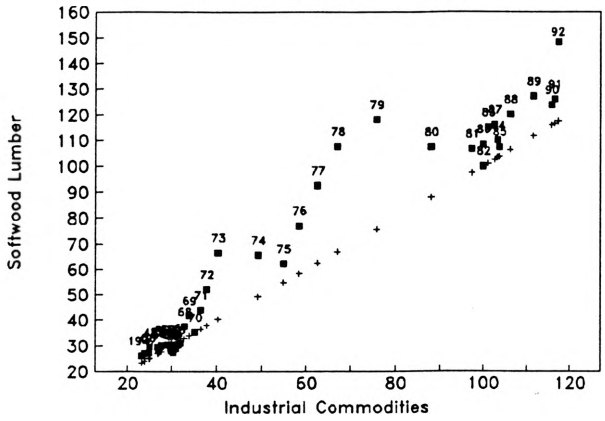


Figure 32

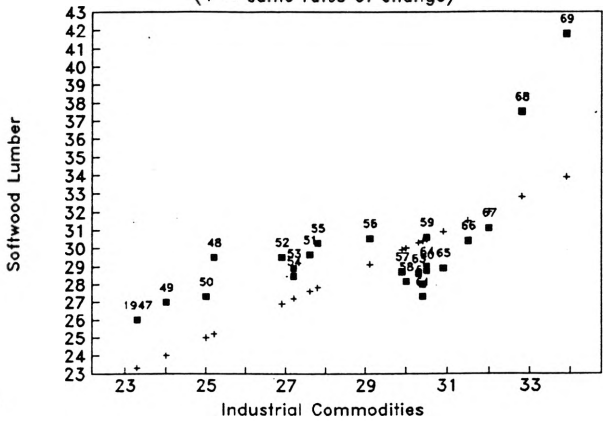


Figure 33

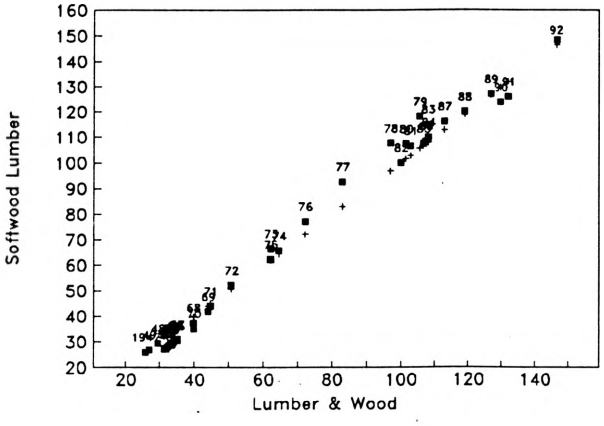


Figure 34

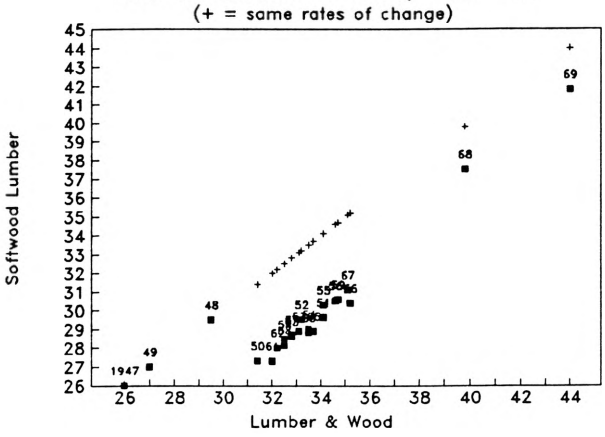


Figure 35

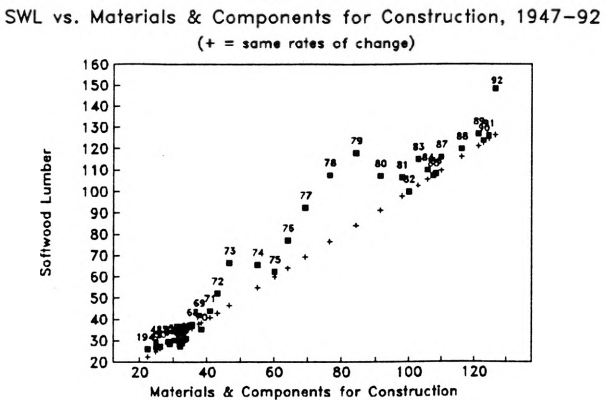
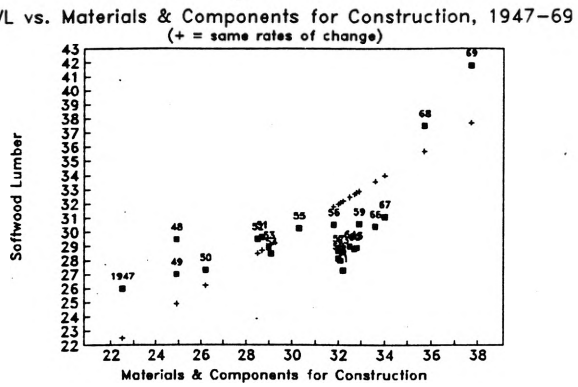


Figure 36



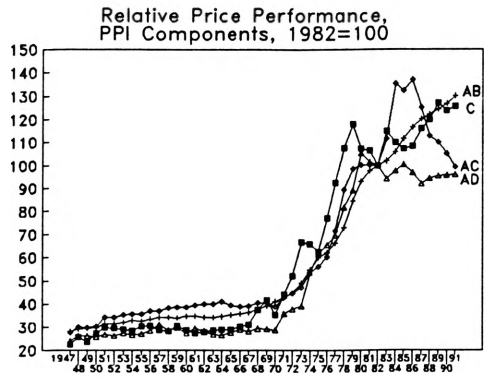
1.6.3 Comparison to Other Raw Materials and Components

In addition to examining how softwood lumber compares to other aggregate price indices, it is useful to make more direct comparisons with competing raw materials. Using PPI components available from BLS, softwood lumber price trends can be compared with several related clusters of construction materials which are competitors to at least some extent (Figs. 37-40). These clusters are: masonry and related items; wood and competing moulding items; metal structural and siding components, and fabricated metal components for construction. Unfortunately, the price database does not cover the entire time period of interest for all items.

In the case of masonry related products, all products shown rose in real prices during the 1970's, with softwood lumber in the lead. After the peak in 1979, concrete block stayed even with lumber while asphalt products remained stable. Gypsum products, in contrast, increased even during the mid 1980's recession, then fell back sharply, ending the period at a level well below softwood lumber.

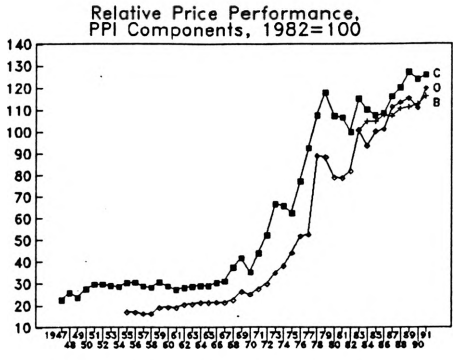
Since 1980, plastic moulding products have moved in close step with softwood lumber. Similarly, prefab structural members and aluminum siding moved in tandem with softwood lumber. For the period of data available, fabricated structural steel rose at a far faster rate. For the more highly fabricated metal items, softwood lumber outpaced the others during the boom to 1978-79 and then the others slowly caught up.

Figure 37



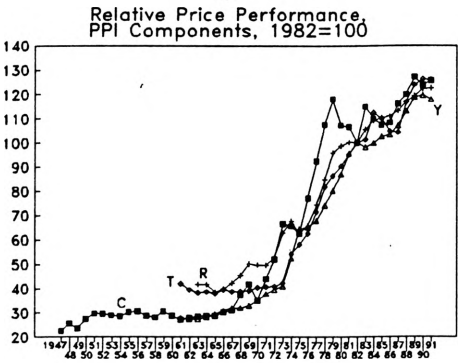
C Softwood lumber
AB Concrete block and brick
AC Gypsum products
AD Prep. asphalt & tar roofing & siding prod.

Figure 38



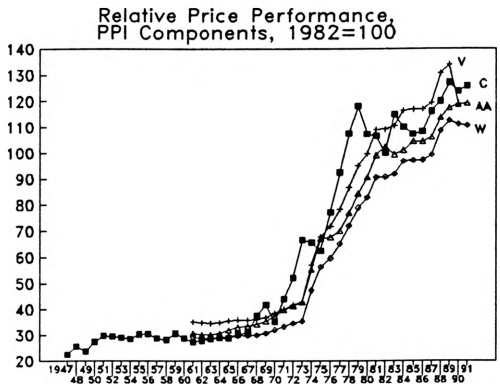
B Plastic furniture components and furnishings
C Softwood lumber
O Wood mouldings, exc. prefinished from purchased mld.
*** Linked with Moulding, Ponderosa Pine (0821 0182) 1955-1982

Figure 39



C Softwood lumber
R Prefabricated structural members
T Siding, aluminum
*** Linked with Siding, aluminum, noninsul. mfr. to dist. (1073 0111), 1961 to 1982
Linked with Sheet metal products (1073), 1989 to 1991
Y Fabricated structural steel for bldgs. net ton

Figure 40



C Softwood lumber
V Soffits, facia, and shutters, aluminum
*** Linked with sheet metal products (1073), 1961 to 1987
W Cornices, skylights, ceiling domes, coping, etc.
*** Linked with sheet metal products (1073), 1961 to 1987
AA Architectural and ornamental metalwork
*** Linked with struct. arch. pre-eng. metal products (1074), 1961 to 1983

Since they respond to the same demand forces, it is not surprising that the other construction materials studied show broadly similar price behavior. The time period since 1946 can be divided into three broad periods. The first is the period to about 1970, when all materials moved in roughly similar ways, some rising faster than lumber did. The second is the boom period from 1970 to the late 1970's, when softwood lumber rose at the highest rate in almost all cases. The final period is one of continued fluctuations around a more

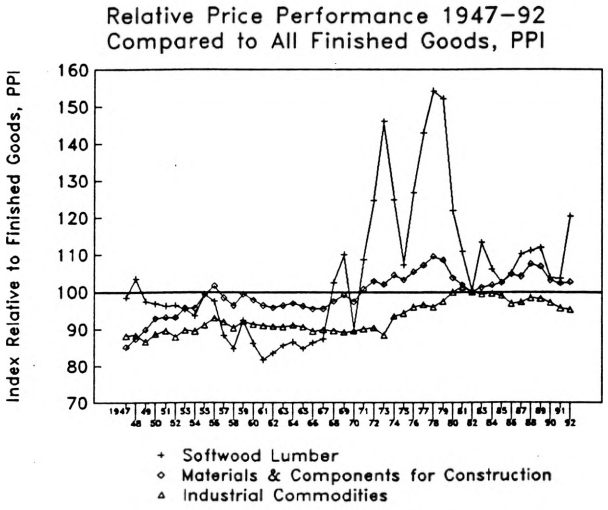
moderate but still rising trend for softwood lumber, while competing products increased at varying rates. While only one year of data is available, the weight of the evidence suggests that a new period began in 1992.

1.6.4 Real Prices

The above analysis has compared undeflated lumber prices with a number of other price measures. The purpose has been to show how lumber has moved with or diverged from other prices in different subperiods since 1947. It is now time to take the next step to examine real price behavior. As Fig. 41 shows, the periods of rising lumber real prices are separated by periods of declining real prices. The underlying causes of these periods of inflation and deflation are complex and vary from period to period. The ability to expand supply in response to higher prices has usually been a significant factor.

For an analysis of Canadian prices, see Coletti 1993, Chart 7.

Figure 41



Source: Econ. Rept. of Pres. 1992 with TIG Ests. 1946–49 by linking from various sources, and USDA–FS Misc. Publs. 1453, 1486, for SWL, with 1988–91 from BLS PPI Monthlies.

1.6.5 Summary

Cyclicality and increased variability in demand have made the latter half of the 1947-92 period one of unusual difficulty for producers of basic materials. Over the first half of the

period, price performance of softwood lumber was similar to other construction materials. Since 1970, lumber prices have ratcheted upward to new levels with each upward surge in demand. Generally, significant increases in lumber real prices have been associated with price inflations in a wide range of commodities. In the past, when demand stabilized for lumber, industry price performance returned to its normal pattern of little or no increase in real terms. Whether this pattern can be expected to continue in the future is uncertain, however.

1.6.6 References

Coletti, Don. 1993. The long-run behavior of key Canadian non-energy commodity prices: 1900-1991. Bank of Canada Review, Winter 1992-1993, p. 49-56.

Economic Report of the President, various issues for aggregate price indices, linked where needed to bring to a common base year.

Periodic summaries of WWPA invoice data, per John Combes, Timber Mgt., US Forest Service, Washington office.

Unpublished computer file of PPI annual data for individual components, 1947-91. From BLS, per Joel Popkin and Company.

1.6.7 Note on Price Data

Assembling a consistent price series on lumber prices over long periods is no mean task. As a practical matter, there is little chance of developing a sound quality-adjusted index that would account for the differences in mix of lumber by wood quality, knottiness, species, accuracy of grading, quality of drying, planing, and packing. The other option is to track price quotations for specific items over time, using for example the WWPA data as we have done above.

The most consistent price data are available at the FOB mill level. While data on delivered prices do exist, they are not published in time series form. An initial analysis of delivered price data is provided later in this report.

1.7 TRADE PERFORMANCE OF THE SOFTWOOD LUMBER INDUSTRY

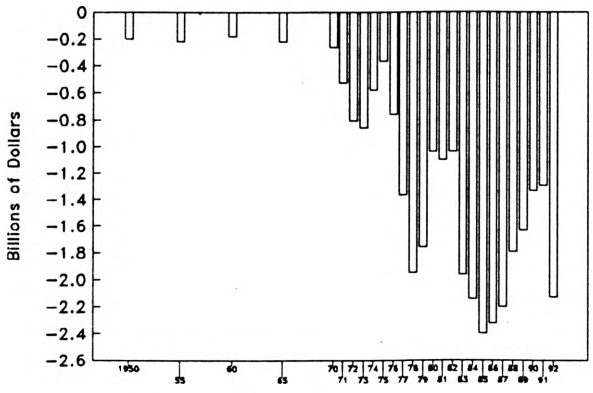
Trade performance is another important indicator of an industry's economic performance. In this area, the US softwood lumber industry has experienced many challenges and considerable public policy controversy. Trade issues highlight a major difference between the US and Canadian industries. Because of its small domestic market relative to the size of the resource, and the geography of its forests, the Canadian's industry has always been highly export oriented. In turn, because of its location, the US has long been Canada's top export market.

1.7.1 US Trade Balance

The US trade balance in softwood lumber has been adverse since about 1940. During the 1950's, net imports accounted for less than 10% of US consumption. The impact on the trade balance was on the order of $200 million in current dollars. By the mid sixties, the balance began to deteriorate dramatically, as rapidly growing Canadian production entered the market. When the demand increases of the 1970's occurred, Canada was positioned not only to meet the increased demand but to increase its market share. The US trade deficit for softwood lumber rose from the $200 million area in the 1950's to a peak exceeding $2.4 billion by the mid 1980's (Figs. 42 and 43). Then, as the Canadian exchange rate appreciated and the US market began to decline in the late 1980's, the trade deficit in dollar terms improved sharply, before worsening sharply in 1992.

Figure 42

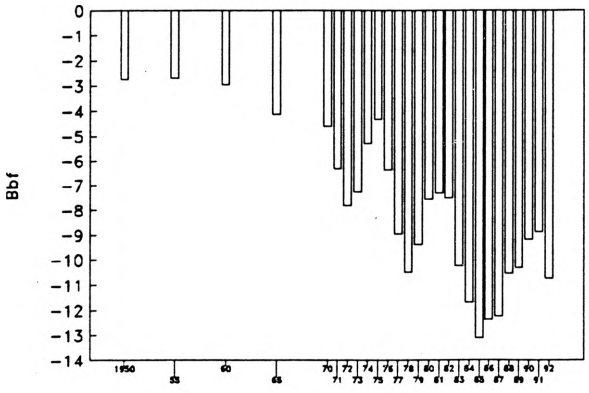
US Net Trade Balance in Softwood Lumber
Value, 1950–92



Source: USDA–FS and FAS.

Figure 43

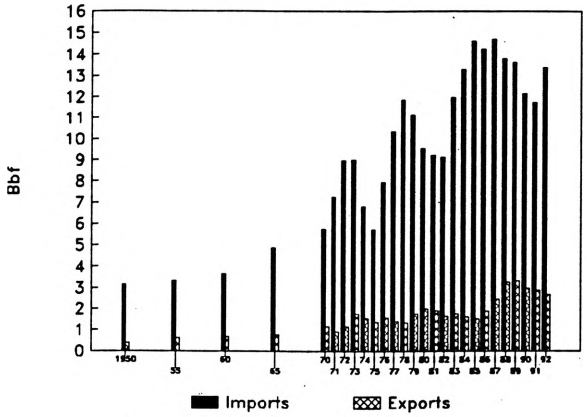
US Net Trade Balance in Softwood Lumber
Volume Basis, 1950–92



Source: USDA–FS and FAS.

Figure 44

US Softwood Lumber Imports and Exports
Volume, 1950–92

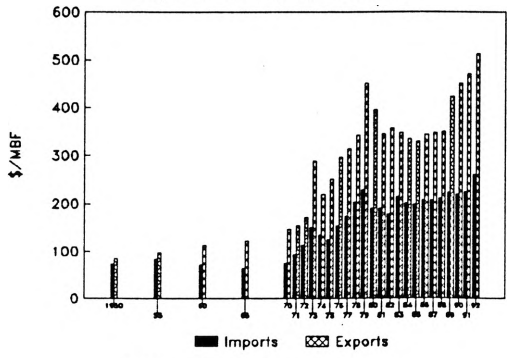


Source: USDA–FS and FAS.

The differences in unit values of US imports and exports are striking (Fig. 45). Because of the Canadian industry's species mix, its large, efficient mills, and its focus on commodity items, unit values (average prices) of Canadian imports were lower than the unit values of US exports. These reflect US industry that is ceding low value, high volume markets to a nearby low cost producer, while pursuing higher value offshore markets. Comparing the unit values (indexed to 1982=100), to the PPI shows that both import and export unit values rose rapidly during the 1970's boom. US export prices then fell until the mid eighties and then rebounded, probably reflecting exchange rate trends.

Figure 45

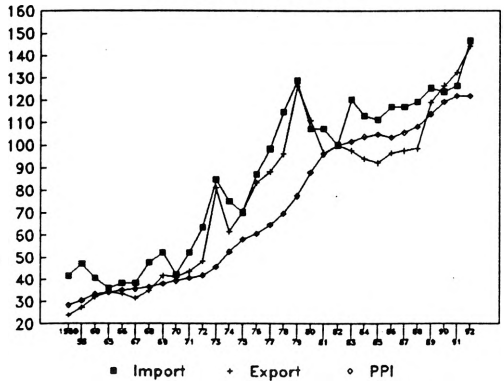
US Softwood Imports and Exports
Unit Values, $/M, 1950–92



Source: USDA–FS and FAS.

Figure 46

US Import and Export Unit Value Index
and PPI, 1950–92



1.7.2 US Production, Consumption, and Trade

It is also useful to examine imports and exports relative to domestic production and consumption. These display varying trends (Figs. 47-49). Exports relative to production have grown significantly from 1950-1991, suggesting an improvement in competitiveness. But this occurred at the same time that US import dependence increased massively, however, which would suggest the contrary. There is no simple picture here. The picture is one of an industry losing competitiveness in low cost high volume items, while gaining competitiveness in other market niches.

Figure 47

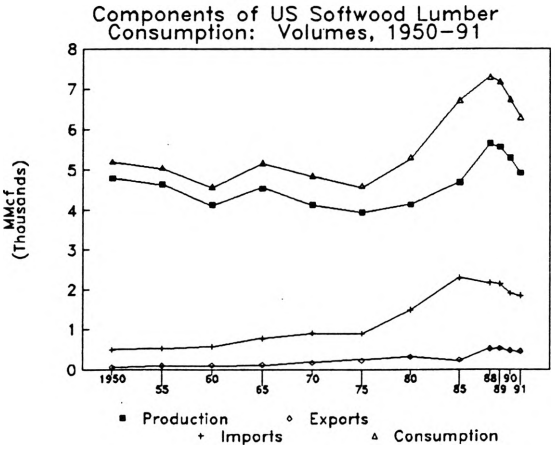


Figure 48

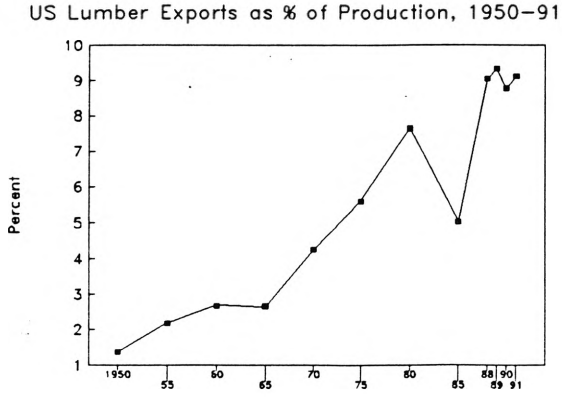
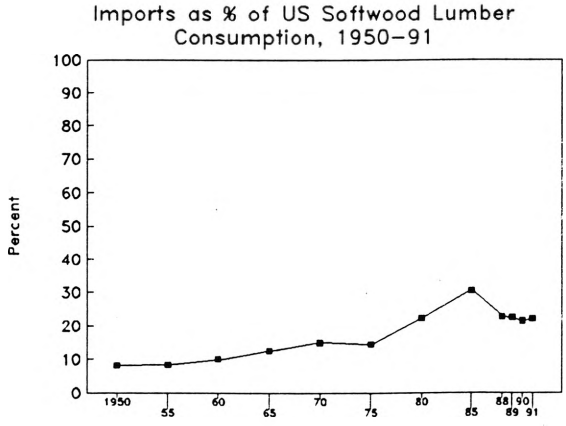


Figure 49



The US is a major exporter of softwood logs and wood chips to world markets. This suggests that the nation's competitive position in lumber has not been determined solely by resource conditions. Softwood log exports grew eight-fold in only 2 decades after the mid sixties (Fig. 50), outpacing rising lumber exports by a wide margin until the 1970's (Fig. 51). It is interesting to adjust the share of consumption accounted for by lumber imports to account for this net export position in logs. When this is done, in comparable units, we see that the US net import position in logs and lumber together has hardly changed over this time period (Fig. 52).

Figure 50

US Lumber Exports and Log Net Exports, 1950–91

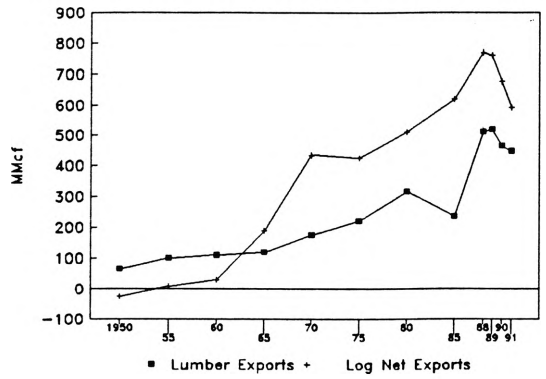


Figure 51

US Log Net Exports as % of Lumber Exports, 1950–91

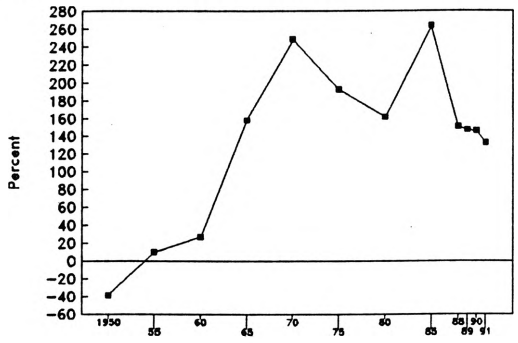
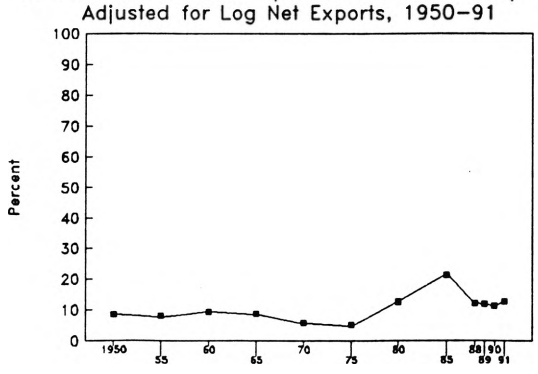


Figure 52

US Softwood Lumber Import Share of Consumption Adjusted for Log Net Exports, 1950–91



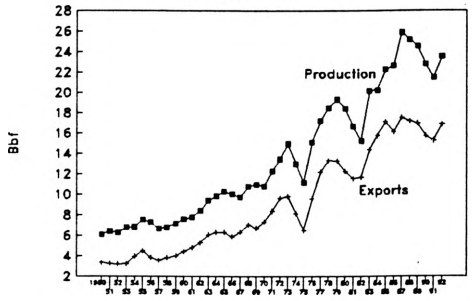
1.7.3 Canadian Trade Balance

A similar analysis can be conducted for Canada. Considering Canada's huge exports, our analysis ignores imports, which accounted for less than 6% of Canada's apparent consumption in recent years. Canadian production has clearly been driven by increasing production for export markets, largely the USA (Figs. 53 and 54). Canadian dependence on the US market increased rapidly until the mid seventies, when it began a gradual decline (Fig. 55).

The role of changing exchange rates in enhancing Canadian market share in the US is disputed (Irland 1985, Buongiorno, et al. 1988, Toronto Dominion Bank 1991), but it is difficult to imagine that they played no role at all.

Figure 53

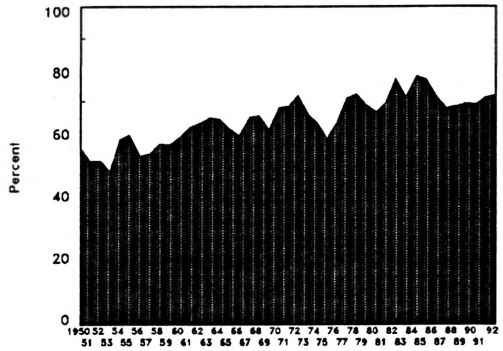
Canada Softwood Lumber Production & Exports, 1950–92



Sources: Adams, Jackson, and Haynes 1988 for 1950–88; USITC 1992 for 1989–91, p. A–67.

Figure 54

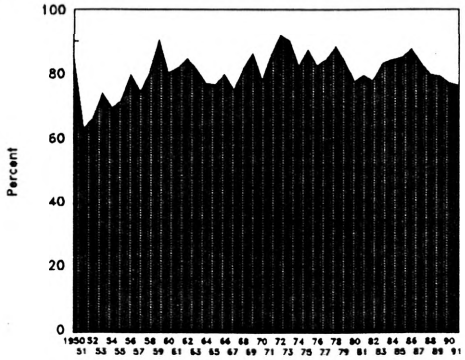
Canada Exports as Percent of Production, 1950–92



Sources: Adams, Jackson, and Haynes 1988 for 1950–88; USITC 1992 for 1989–91, p. A–67.

Figure 55

Canada Exports – Dependence on US Market, 1950–91



Sources: Adams, Jackson, and Haynes 1988 for 1950–88; USITC Publ. 2530 for 1989–91, p. A–67.

1.7.4 Revealed Comparative Advantage: North American Export and Production Shares

A straightforward way to examine a nation's trade competitiveness is to review actual trends in production and export shares. The results are often termed "revealed comparative advantage," since they represent the bottom line of all factors affecting a nation's competitiveness (for illustrative applications, see Yeats 1991, and Bonnefoi and Buongiorno 1990). One would naturally expect a nation that is noncompetitive to be losing share of world production and exports, and conversely for a competitive nation to be gaining. What do the facts show?

Given Canada's rapid increases in production and its strong export orientation, it is not surprising that the 2 nations together have increased their share of world softwood lumber production from 1962-89 (Table 18). Considering the above evidence on increasing US import dependence, however, it is surprising that the US has increased its world production share during this period. Canada's strong dependence on the US market, however, leaves open an important question -- how have its exports to the rest of the world performed? Here too, Canada doubled its share from 1962 to 1989. The US industry increased its share by an even larger multiple.

Table 18
North American and World Production and Exports of Softwood Lumber: Volumes and Shares (Volumes in million cubic metres)*

	1962	1970	1978	1989
PRODUCTION				
USA	62.8	64.6	78.9	85.0
Canada	19.7	25.4	43.6	58.0
Total	82.5	90.0	122.5	143.0
World	265.3	311.6	348.7	373.4
N. Amer. Share	31.1%	28.9%	35.1%	38.2%
US Share	23.7%	20.7%	22.6%	22.7%
EXPORTS				
USA	1.4	2.7	3.2	8.2
Canada	13.1	17.3	31.3	40.5
Total	14.5	20.0	34.5	48.7
World	38.1	49.5	65.9	81.5
N. Amer. Share	38.0%	40.4%	52.4%	59.8%
US Share	3.7%	5.4%	4.8%	10.1%
MEMO				
Canadian Exports other than US	1.9	3.8	3.6	8.0
Share of World	5.0%	7.7%	5.5%	10.1%

* One cubic metre = 424 bf
Source: FAO Forest Products Yearbooks and TIG estimates.

1.7.5 Summary

The softwood lumber industries of the US and Canada are linked by the large volumes of Canadian lumber used in the US. Since the 1960's, US dependence on this lumber increased dramatically. Yet at the same time, the US share of its own production being exported grew significantly. After the mid 1970's, Canada began slowly diversifying its export markets as its dependence on export markets continued to increase.

After 1978, the revealed comparative advantage of both nations relative to the rest of the world improved.

1.7.6 References

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1.8 CHANGING ECONOMIC STRUCTURE OF THE SOFTWOOD LUMBER INDUSTRY

Price behavior is conditioned by industry structure in a variety of ways. It is important, then, to understand the economic structure of the industry in order to interpret how pricemaking forces will work. Industry structure refers to the manner in which firms are organized, their size distribution, and trends in these traits over time. Structure includes such matters as plant and firm numbers, seller concentration, vertical and horizontal integration and diversification of firms, and other structural conditions that may affect how pricemaking forces function in the market. Major economic trends in the lumber industry mirror those of American industry in general (Table 19).

Table 19
Lumber Industry: Trends in Economic Structure
1991 Compared to 1946

At the end of the period, we see --

1. More vertical integration:
   ...backward to landownership;
   ...forward to distribution of products;
   ...some integration into construction;
   ...significant increase in downstream integration into value added processing.

2. Extensive integration with the paper industry.

3. Increasing integration with board plants and related engineered wood products.

4. Major increase in integration of sawing, drying, and planing into the same establishment or firm; fewer separate planing mills.

5. Significant increase in multinational investment.

1.8.1 Mill Numbers and Sizes

The number of sawmills and sawmill firms has declined dramatically since the late 1940's (Table 20). Today, the Census counts roughly 6,000 US sawmills and Canada official statistics count another 1200 or so. In the 1940's and 1950's, some estimates placed the total number of US sawmills as high as 39,000, when all the tiny local mills were included (Reappraisal, p. 52).

Table 20
Sawmill Number and Firm Numbers, SIC 2421

Year	Number of Mills	Number of Firms
1947	19,000	--
1958	15,600	--
1963	12,200	11,931
1967	10,300	10,016
1972	8,071	7,662
1977	7,544	6,802
1982	6,316	6,810
1987	5,742	5,244
1987	5,662	
1991	5,680	
1991*	7,511	

* Phelps and McCurdy 1993, report that Dun and Bradstreet's database lists 9,630 firms in the industry, and they concluded that 7,511 mills were active in 1991.

Source: US Bureau of Census, Census of Manufacturers, var. issues, e.g. 1987 Census Publ. MC-87-1-24A. ITC 2530, p. A-17 for 1987 and 1991. 1987 is shown twice since values shown differed in the two sources used.

This is an industry of mostly small plants: in 1987, only 30% of the sawmills counted in the Census of Manufactures had 20 or more employees.

Mill sizes have grown over the period. In 1942, according to the Forest Service's Reappraisal, 45% of the lumber cut in the US was by mills sawing 5 million feet per year

or less. A large mill was considered to be one cutting 25 million per year. Today, in the West, only 5% of the output comes from mills sawing 20 million feet or less, while 40% comes from the 100 or so mills sawing 100 million feet per year or more (Table 21).

Table 21
Sawmill Size Structure, 12 Western States
1972 and 1990

	Mills		Output (Bbf)	
Annual Output Class	1972	1990	1972	1990
Less than 20 MMbf	491	213	3,104	961
20-50	191	146	6,331	4,078
50-100	84	148	6,219	7,917
100 +	25	94	3,724	8,219
Total	791	601	19,378	21,175

Source: WWPA.

1.8.2 Seller Concentration

The lumber industry is recognized as one of the least concentrated industries in the US economy (Ellefson and Chopp 1978). In 1982, the lumber industry was in the lowest quartile of concentration ratios in the US manufacturing sector (Scherer and Ross 1990, p. 77). Generally the only manufacturing industries that are less concentrated are ones naturally serving regional markets such as dairies, and firms with local markets like machine shops. The concentration ratio is simply the cumulative market share of the leading producers, often the top 4 or top 8. Like all manufacturing, however, concentration by this measure has increased in the lumber industry (Table 22). Separate analyses for hardwoods and softwoods are unavailable. Very likely hardwoods are less concentrated than softwoods, so that the published concentration ratios for lumber will slightly underestimate concentration in the softwood industry. The 1987 Census changed its method of reporting

on concentration, suppressing industry detail. For 1987, the Census reported the sales by firm sizes. From these, we can calculate that the 4-firm concentration ratio for lumber and wood products was 10% in that year. This ratio applies to total sales of $60 billion.

Table 22
Concentration Ratios, US Lumber Industry, SIC 2421
1947--1987.

Year	Top 4	Top 8	Top 50
1947	4.8	6.4	N/A
1963	11.0	14.0	29.0
1970	16.0	20.0	N/A
1982	16.0	23.0	46.0
1987	15.0	21.0	44.0

Source: US Bureau of the Census, as compiled in Irland 1975, p. 59, and 1987 Census of Manufactures, Enterprise Statistics.

1.8.2.1 Concentration: Firm Data

Company production data can be used to study concentration ratios for the entire US and Canadian industry, which is the relevant approach for analyzing the continental supply situation. Given the large imports of Canadian lumber, the wide substitutability of major species, and the many ownership and other ties between US and Canadian firms, US ratios alone do not tell the full story on industry structure. Also, given the lower unit values of Canadian production, concentration ratios for board feet will be different from those for dollar sales volumes. Readily available firm production data do not distinguish between softwoods and hardwoods, so these estimates probably overestimate concentration in softwood slightly in view of the smaller average size of hardwood mills. When the US and Canadian industries are analyzed together, concentration ratios are lower than when the US is analyzed separately.

Between 1973 and 1990, concentration in the US and Canadian industry hardly changed (Table 23). Output growth, and mobility among the leading firms had a great

deal to do with this. From 1973 to 1990 total US and Canada output increased from 54 Bbf to 69 billion, or 28%. The total output of the top 4 firms rose by 31%, to total 9.2 Bbf in 1990. In 1990, the joint US/Canadian industry had a concentration ratio below 20%.

Table 23
Concentration Ratios, Top 8 US and Canadian Lumber Firms
1973 and 1990

Rank	Firm	US/ Can.	No. of Mills	Production (MMbf)	Concentration Ratio
1973					
1.	Weyerhaeuser	U	22	2,405	
2.	Louisiana-Pacific	U	44	2,162	
3.	Macmillan-Bloedel	C	7	1,286	
4.	Georgia-Pacific	U	35	1,147	
	TOTAL		108	7,000	13.0%
5.	Boise Cascade	U	20	744	
6.	US Plywood (CI)	U	15	665	
7.	Pack River	U	14	598	
8.	Canadian Forest Products	C	9	595	
	TOTAL		58	2,602	17.8%
1990					
1.	Weyerhaeuser	U	35	2,921	
2.	Georgia-Pacific	U	46	2,664	
3.	Louisiana-Pacific	U	56	2,189	
4.	Canfor	C	11	1,431	
	TOTAL		148	9,205	13.3%
5.	Weldwood Canada	C	8	1,011	
6.	WTD Industries	U	23	996	
7.	West Fraser	C	8	993	
8.	Sierra Pacific	U	9	967	
	TOTAL		48	3,967	19.0%
	SUBTOTAL TOP 8		196	13,172	
	US AND CANADA TOTAL			69,284	

Source: US plus Canada output - 53.8 Bbf; FI 1991-92 FI Factbook, p. 28, Irland 1975, p. 63.

Data include soft and hardwood.

1.8.2.2 Mobility Within Top 20

A widely used method of detecting whether entry barriers exist or whether large firms have strong advantages relative to smaller competitors is to analyze mobility among leading producers.

From 1947 to 1973, Weyerhaeuser retained its leadership in production on the continent, based on its privately owned timber resources and large milling capacity. Boise Cascade rose from 14th on the list in 1947 to 4th in 1973. Georgia-Pacific appeared on the list from obscurity in 1947, taking the 4th place in 1973. New entrants in the top 20 were a few growing lumber companies, accompanied by a list of major paper and plywood companies, which O'Laughlin and Ellefson (1982) called the "new diversified entrants."

Three top 20 firms fell in rank. But most importantly, three out of four of the 1947 top 20 were gone in 1973, mostly by merger. In a few cases, the firms remained in business at a smaller size. It seemed likely that because of their control of timber resources, the top firms of 1973 would likely retain that position (Irland 1975, p. 66).

Yet, from 1973 to 1990, further shifts occurred. Interestingly, Canadian firms accounted for exactly half of the top 20, compared to 6 in 1973, and held three of the top 8 positions. Several firms made large jumps in rank, including Canfor (8 to 4), Weldwood Canada (13 to 5), and Sierra Pacific (20 to 8). A new firm created in the early 1980's, WTD Industries, ranked 6th in 1990 and did not even exist in 1973. Equally important were major departures from the list. MacMillan Bloedel dropped off the top 8 after being 3d in 1973; Boise Cascade reversed its previous rapid rise and fell to 13th. Both firms declined through asset sales and planned shrinkage. US Plywood and Pack River vanished due to mergers.

This shows that mobility among top firms was indeed high in the lumber industry over the past decades. The waning of large powerful firms and their replacement by newcomers demonstrates that the industry's structure is not based upon unchallengeable advantages held by leaders. The contrast with more concentrated manufacturing industries is striking.

1.8.2.3 Integration and Diversification

The North American forest products industry has participated in the various waves of horizontal, conglomerate, and multinational mergers in the American economy. Since the 1950's, the leading firms have at times increased their degree of conglomerate activity,

and then later reduced it again. Other firms with primarily lines of business in other fields have entered the industry (for descriptive reviews, see O'Laughlin and Ellefson 1982, Clephane & Carroll 1982, and Irland 1975).

Vertical integration involves a firm acquiring companies providing their raw materials ("upstream" mergers) or using or distributing their products ("downstream" mergers). In 1981, Clephane's sample of 22 leading companies were 45% self-sufficient in wood fiber (Clephane & Carroll, p. 64).

The leading wood products companies have at times been net buyers of timberland. At other times, individual firms have reduced ownership of timberland for financial, location, or other strategic reasons. From 1976-81, for example, major US forest products firms in the US were net sellers of timberland. During the mid 1980's, when company market values on Wall Street were at deep discounts to asset values, firms took steps to immunize themselves against takeovers. A major concern in these moves was to diminish the temptations offered to raiders by undervalued timberlands.

In another major trend, some industry leaders integrated forward into distribution, usually by building their own organizations rather than through mergers (see discussion under wholesaling and retailing above).

Changes in these dimensions of corporate structure are complex and have not been measured by company surveys recently. Some of these changes could raise concern for noncompetitive effects if they occurred in a highly concentrated industry. Yet with the large fringe of small independent producers and marketers in the North American lumber industry, the changes among the largest firms have not been accompanied by any diminution in the force of competitive pressures. A useful overview of conditions in the early 1970's is given in Rinfret-Boston Assoc. (1974, p. 15).

1.8.3 Determinants of Structure

1.8.3.1 Cost Structure

The advances in mechanization, conversion efficiency, and the increases in realized values for bark and residuals have brought about a significant change in the industry's cost structure. In the 1960's, logs were a modest portion of total cost -- only 16% of total cost of lumber was stumpage in 1962 (Mead, p. 49 quoting WCLA). Allowing for logging cost, delivered logs could not have been more than 30-40% of cost. Today, however,

delivered logs account for 75-85% of total cost. This change in cost structure has many implications for local economies, for the value of wood and the elasticity of log demand, and for analyzing the industry's response to changes in demand and cost factors.

1.8.3.2 Scale Economies

In the softwood lumber industry, optimum scale for sawmills is determined by a number of factors. The technology of sawing, edging, sorting, drying, and packaging can be adapted to mills in a wide grange of sizes.

Very small sawmills continue to operate in many parts of the country. Often they provide rough lumber to nearby markets or sell their output to other firms that grade, sort, and dry the material for resale. The next stage of size is in the several million feet per year bracket, which is the minimum for a mill to economically plane and dry product suited to association grading. Since the 1940's, the bulk of the loss in mill numbers has been in these sizes. Some types of equipment such as laser scanning, computer networks, and optimizing edgers are costly and may only be justified in larger mills.

The one factor that seems to determine mill size, when comparing across regions, is the availability of logs. In areas where logs of the necessary species are scarce and must be hauled long distances, mills are usually small. In regions where a single mill can control the supply from large areas, mills can reach "supermill" sizes, as they do in Interior British Columbia. Another major factor affecting sawmill size is integration with pulpmills at the same site. Where such mill complexes occur, pulpmill chip requirements and the expected log merchandising opportunities are considered in sizing the sawmills. This very likely leads to larger sawmills being built than might be built in a a freestanding situation.

Mead (1966) concluded that a fairly wide middle range of mill sizes was optimal in the douglas-fir region, with cost disadvantages at both large and a small sizes (p. 31). Gregory (1972, p. 113-115) reached a similar conclusion following a somewhat different line of analysis. Since availability of log supply is a major determining factor in optimal mill sizes, it is sensible to analyze the question on a regional basis, as did Mead. For the South, Granskog (1989) analyzed mill scale economies using the survivor technique. He concluded that from 1966 to 1976, the Minimum Economic Size (MES) for a southern sawmill rose from 20 MMbf/yr. to 50 MMbf/yr. He observed that about 200 mills saw 75% of southern production in the late 1980's.

Mill level scale economies cannot explain the size of the large multiplant companies that are the industry's production leaders, however. Throughout US industry, large firms exist for reasons unrelated to plant-level scale economies. A common approach in analyzing industry structure is to ask what proportion of US consumption could be served by a MES plant. Assuming for discussion that a MES plant is 100 MMbf, which is at the low end of the size range of new mills being built in the South today, the MES could serve only 2% of the national market. On Granskog's estimate of 50 MMbf, the MES would serve only 1%.

1.8.4 Structure of Wholesaling and Retailing

Important shifts have occurred in lumber distribution methods over this period. These changes have increased the options available to end users and consumers and have increased the competitiveness of the lumber market.

Changes in transportation have been important. Trucking is now a major shipment method. This eliminates advantages held by individual shippers holding favorable locations for rail shipment, and also increases the delivery options for sellers. Rail and trucking deregulation during the 1980's undoubtedly helped spur national competition in the industry. For example, a major market for Interior British Columbia lumber production is the Southeastern US. Serving this market in the late 1940's would have been extremely difficult. As a result of this change, Georgia producers are subject to intense competition in their own backyards from sawmills across the continent. A truly continental market exists.

Improvements in communication, such as WATS lines and Fax machines, together with declining real prices of long distance phone calls have increased the speedy flow of price lists, market reports, and other information. A leading price letter, Random Lengths, even issues a midweek price report.

The existence of a futures market since 1969 probably helps in generating more expert analysis of the market and its trends, and in providing daily trading quotes. It has provided hedging opportunities for some sellers and buyers. The volume and open interest in the market, however, are so limited that is it difficult to say that any fundamental changes in market operation have occurred as a result of the futures market (see further details in Part Two below).

Mills have generally not been interested in hedging away price risk, and wholesalers attempt to hedge away risk by developing "back-to-back" orders whenever they can. On other occasions, they are not averse to speculating by buying extra "rollers" when they expect prices to rise, or "going short" when they expect the opposite.

For strategic reasons, several major producers have extensively integrated forward into controlled distribution. Since no one believes that these firms can operate distribution facilities cheaper than can independents, there must be strategic reasons other than "capturing the middleman's profit" for doing this. One may be to increase corporate name recognition in major urban areas. Another may be to attempt to increase mill operating rates during down markets by having captive markets for the product (see Merrill Lynch 1977, vol II. p. 46). This strategy has not, however, come to dominate the industry, involving only 12% of wholesale volume in lumber, plywood and millwork (SIC 5031) in 1987.

The independent wholesalers have long dominated the distribution system, relieving mills of maintaining sales and credit staffs and relieving buyers of having to handle freight and to search for sources to meet their changing needs.

1.8.5 Behavior of Prices

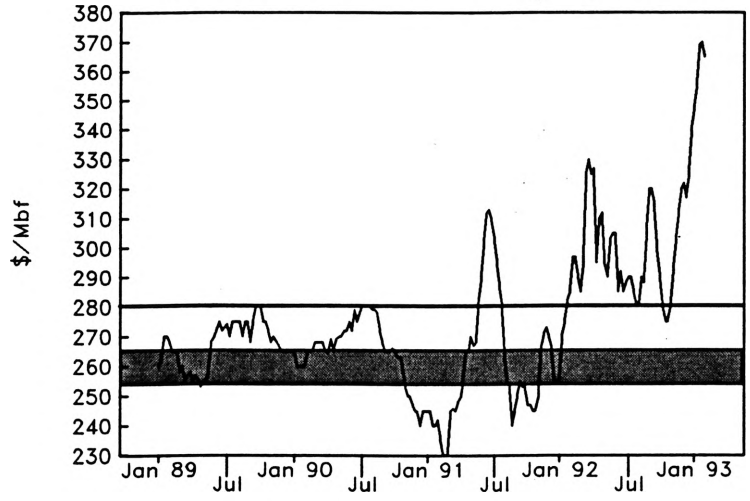
The behavior of prices themselves has often been used to provide clues to pricemaking forces and competitive structure in an industry. Two perspectives that are relevant here include how rigid or flexible prices are, and how prices of lumber are transmitted to the stumpage market.

1.8.5.1 Price Rigidity

In some concentrated industries, prices are commonly set and maintained for periods of many months, with changes in production being used to respond to shifts in demand. Economists have studied this phenomenon (Carlton 1986) finding that the prevalence of rigid prices is higher in the more concentrated industries. Mead (1964) analyzed price fluctuations in douglas-fir lumber. From the prevalence of price changes, he concluded that the industry was effectively competitive. Weekly SPF lumber prices at Boston since 1988 provide an example indicating that for commodity construction items at least, what Mead found in the early 1960's still holds true (Fig. 56).

Figure 56

Spruce–Pine–Fir, R/L Dry 2x4
Delivered Boston, 1989–93 Weekly Prices



A = Previous Highs.
B = Previous Support.

Source: Eastern Quotes & Comments.

1.8.5.2 Lumber and Stumpage Prices

In raw materials-based industries, strong markets are usually accompanied by widening margins for processors and distributors of the product. This has been seen in oil, in farm products, and in wood products. In some raw materials-based industries, market data on raw materials values is not available. For wood products, however, we can compare product and raw material prices in several ways.

In areas where sufficient diversity of ownership exists and timber is not in surplus, higher lumber prices are very quickly bid into stumpage prices (Figs. 57 and 58). This suggests a competitive industry structure in which firms must bid aggressively for raw material in order to meet demands in strong markets. Most of the nation's lumber production comes from regions in which this is true.

Stumpage price determination in Canada is very different, because of the heavy reliance on Provincial lands in which timber is priced and allocated in very different ways.

The integration of the lumber, paper, and panels industry over the period has affected these pricing relationships, since stumpage prices are now affected by prices of plywood

and chips instead of just by the lumber market as would have been true in the late 1940's. Further, in the Northwest, shifts in export demands for logs and chips have a significant effect on the level and cyclical behavior of stumpage prices. Moreover, in recent years changes in federal timber supplies are playing an additional role.

Figure 57

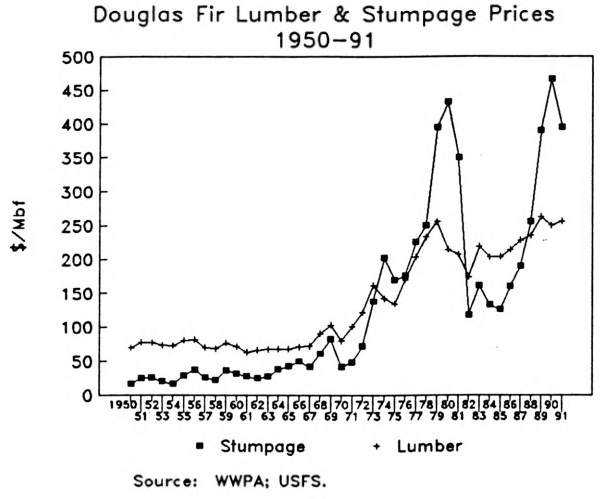
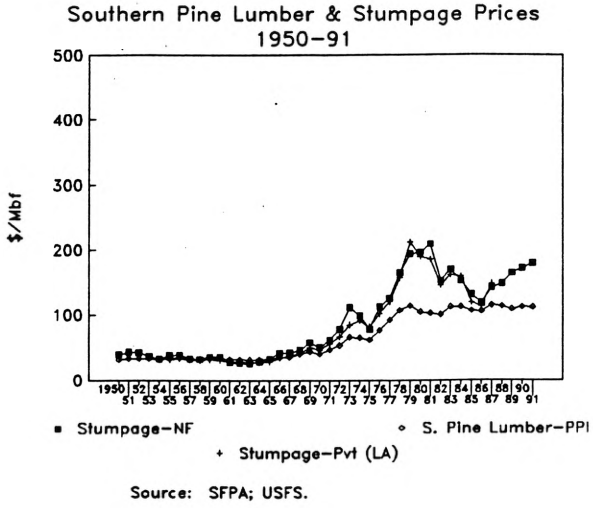


Figure 58



1.8.6 Futures Trading

A futures market has existed in softwood lumber since 1969. The commodity exchanges do not attempt to establish futures markets in industries in which a small group of producers could conspire to fix prices or in which price behavior like prices leadership by producers is common. For a variety of reasons the lumber futures market has never generated a large amount of commercial hedging or public speculative interest. Yet the very fact of its existence suggests that conspiracies to fix prices are unlikely.

1.8.7 Competitive Structure and Performance -- Views of Other Authors

Various writers have commented on the structure and conduct of the lumber industry, based on varying levels of detailed investigation.

"The US lumber industry and the douglas-fir segment of it have highly competitive structures at both production and wholesale distribution levels." (Mead 1966, p. 110).

"The price and output response shown for the lumber industry...is precisely the kind of behavior that one would expect to follow from the competitive structure outlined in this

study. The impressive merger movement notwithstanding, the industry remains sufficiently competitive in its structure that no firm is able to restrict its output in a weak market and thereby prevent a price decline." (Mead 1964, p. 75).

"The lumber-manufacturing industry, especially that of the East, is often referred to as essentially competitive." (Duerr 1960, p. 289).

"There seems little question that the purely competitive model is directly applicable to lumber markets as long as the view is national.

...Low concentration ratios indicate the lumber industry is still one of the most competitive in the entire US economy, although the degree of concentration has been rising significantly. " (Gregory 1972, p. 112).

(Gregory goes on to state that: "On a regional basis the purely competitive model may not be applicable." But he does not fully develop the argument).

Sinclair (1992, p. 92-93) also cites lumber as an example of a purely competitive market structure.

Security analysts at Merrill Lynch characterized the lumber market as "a true commodity product that is sold in an auction market." (Merrill Lynch 1977, vol II, p. 6).

"Mill Pricing Procedure. Once a mill has consulted the sources of demand and pricing information considered relevant, it sets prices for its own output. Prices are commonly set on a weekly basis but may be revised more frequently during periods of rapid price fluctuation. Most mills develop a price list, which may or may not be circulated among wholesalers. This list usually serves as a starting point for negotiation rather than as a source of firm quotations.

We think it is important to point out that costs play a very minor role in setting prices in the short-term. Essentially, lumber mills are faced with a price determined by market forces; competitive pressures do not permit significant deviation from general industry levels.

It should also be noted that no single manufacturer is large enough to unilaterally determine industry prices. The industry's largest producer accounts for only 7 to 8 percent of total output. An individual firm may account for a more substantial proportion of the market in particular geographic regions, but the industry's highly competitive nature precludes price-setting by even the very largest producers...

Softwood lumber and plywood wholesaling is a highly competitive business involving

thousands of individuals and firms all over the US. The general level of prices at any particular time is determined by the interaction of supply from the mills and demand from wholesalers' customers, chiefly the retail lumber and plywood outlets." (Rinfret-Boston Assoc. 1974, p. 43).

"The wood products industry, especially lumber production, is relatively fragmented with a large number of products and a low level of concentration among major producers....

"Lumber prices and timber stumpage bids...have generally moved together. In fact, the rise in stumpage bids since 1975 (53 percent) has exceeded the increase in lumber prices. If the cause of price increases were a lack of sawmill capacity or efforts of lumber producers to hold back supplies, we would have expected to see a widening of the margin between lumber prices and the bids for timber stumpage....the opposite has occurred." (Exec. Off. Pres. COWPS 1977, p. vi, 14).

These opinions from a wide variety of investigators support the view of the lumber industry as one in which prices are determined in a highly competitive manner.

1.8.8 Summary

The evidence reviewed here supports the contention that the softwood lumber industry displays an unconcentrated structure that is workably competitive. The industry has seen a significant decline in numbers of firms, and an increase in concentration, integration, and diversification over the years. Contrary to what might have been expected, however, US-Canadian seller concentration barely changed from 1973 to 1990. Certainly, what Scherer and Ross (ch. 8) term "conditions limiting oligopolistic coordinator" seem to be abundantly present in the softwood lumber industry.

Weekly price behavior shows a high degree of flexibility in response to the changes in supply, demand, and expectations. Many authors have reached the conclusion that the industry is workably competitive, and none have been found drawing the opposite conclusion.

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1.9 DISTRIBUTIONAL OUTCOMES

A final measure of industry economic performance is distributional outcomes. For this review, we will consider three of these -- compensation and working conditions for workers, payments to the timber resource, and returns to capital. If evidence emerges showing that capital is regularly being overpaid over time relative to other manufacturing industries, and that other production factors are being underpaid, then grounds exist for suspecting the presence and use of market power, barriers to entry, or some other factor enabling supranormal profits to be maintained over time.

1.9.1 Industry Cost Structure

The starting point for examining distributional outcomes is to determine the industry's cost structure. The softwood lumber industry's costs are dominated by the delivered cost of logs (Table 24).

Table 24
Current Industry Economics of Lumber Production
(MSF)

	NW	%	South	%
Stumpage	300		150	
Harvesting	120		100	
Delivered Wood Cost*	420		250	
Overrun/Recovery	1.9		1.45	
Wood Cost Per MBF	220	84.62%	170	75.56%
Conversion Costs	70	26.92%	75	33.33%
Overhead & Depreciation	35	13.46%	25	11.11%
Manufacturing Costs	325	125.00%	270	120.00%
Residual Sales	-65	-25.00%	-45	-20.00%
Net Mill Costs	260	100.00%	225	100.00%

* Log Basis

Source: Prudential Securities 1991.

In its investigation, the ITC analyzed 50 questionnaires on costs from a sample of large and small firms. Its results show a lower proportion of costs in logs, but generally support the data in Table 25. Cost breakdowns for 1987 by the Census broadly support this picture (Table 26); in these the by-product revenues are shown as part of total revenue rather than as an offset to costs.

Table 25
Proportion of Total Costs
Softwood Lumber, 1992

Direct materials	77.7
Direct labor	20.3
Factory overhead	19.2
Subtotal	117.3
By product revenues	-17.3
Total costs	100.0

Source: USITC 1992, p. A-55.

Table 26
Summary Data on Cost Structure
Sawmills and Planing Mills, General, 1987

Item	Amount ($MM)	Percent
REVENUE COST ITEMS:		
Value of Shipments	17,356.5	100%
Less-Cost of Materials	10,636.0	61%
Equals: Value Added	6,757.5	39%
Less-Wages	2,298.1	13%
Equals: Available for Capital Cost and Profit	4,459.4	26%
BALANCE SHEET ITEMS:		
End of Year Inventories	7,275.7	42% of shipments
Depr. Assets		
End of Year Inventories, Finished Goods and WIP	1,531.5	9%

Source: Adapted from US Bureau of Census, Census of Manufacturers 1987, MC87-1-24A. p. 9.

Note: This table treats residues as a revenue item rather than as a cost offset.

1.9.2 Returns to Labor: Wages and Working Conditions

The lumber industry developed as a relatively labor intensive industry in largely rural areas. It still fits this description in most of the East. There has probably been an interaction between labor and skill intensity and labor supply in such areas. Since rural areas have had higher unemployment rates and lower wages than urban areas, it would follow that incentives for employers to reduce labor content and raise compensation levels were lower (see, e.g., Killian and Hady 1988, Pharand 1988).

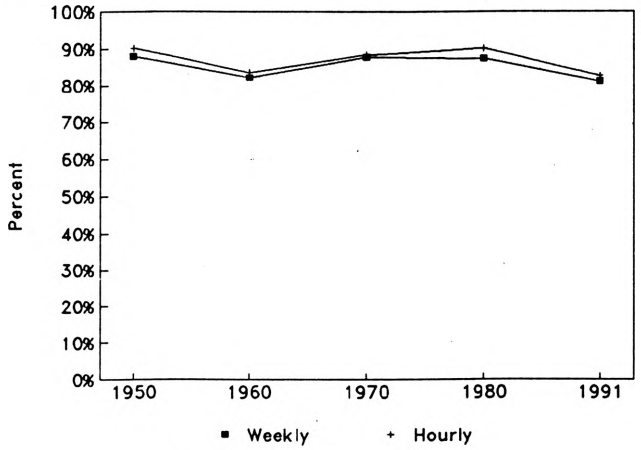
In parts of the US West and Canada, however, lumbering communities had to import labor and were remote from rural labor surplus areas. Also, the large size of the timber demanded a high degree of mechanization. Finally, the high value of the logs and resulting products enabled logging and mill workers to produce high value per worker hour and to be compensated accordingly. But these workers' pay levels have had little effect on the

national averages.

For these reasons, then, we would generally expect sawmill industry wage levels to be lower than those for all manufacturing, and this is what we find. Further, wage increases in the sawmill industry have been slightly lower than for all manufacturing (Fig. 59).

Figure 59

Average Hourly & Weekly Earnings of Production Workers
Lumber and Wood Related to All Manufacturing, 1950–91



Source: BLS.

Compensation consists of many forms of nonwage benefits beyond the pay packet. It has not been possible to assemble a detailed portrait of these conditions for this study. When the occupational statistics from the 1990 Census of Population become available they will provide a detailed and up to date database on this topic (for an earlier summary, see Irland 1975).

An examination of national BEA data for Lumber and Wood Products showing personal income and employment by industry led to a similar result:

	Personal Income Per Worker, Lumber & Wood Products Compared to All Manufacturing
1969	78.6%
1980	79.0%
1991	73.9%

(Source: Irland Group calculations based on US Dept. of Commerce, BEA.)

Working conditions beyond wages encompass a wide range of factors. It is generally recognized that the lumber industry has had a high accident rate. It has been identified as a target industry in the past for enforcement efforts by OSHA. Additional issues include wood dust standards, exposures to chemicals in treatment plants, and noise control. Cyclical employment stability is a common concern, but is very difficult to provide in industries subject to widely fluctuating end use markets.

National data do not allow refined comparisons between industries. Comparisons using the total lumber and wood products industry contain a bias in that several industries in this group other than sawmills have extremely high accident rates. The rates for lumber and wood are substantially higher than for all manufacturing (Table 27).

Table 27
Occupational Illnesses and Injuries
Manufacturing and Lumber and Wood Products, 1975 and 1990
(Incidence rates per 100 Workers)

	1975	1990
MANUFACTURING		
Total Cases	13.0	13.2
Lost Workday Cases	4.5	5.8
Lost Workdays	75.4	120.7
LUMBER AND WOOD PRODUCTS		
Total Cases	20.4	18.1
Lost Workday Cases	8.5	8.8
Lost Workdays	157.8	172.5

Sources: BLS Handbook of Labor Statistics, Bull. 2340, Aug. 1989, 585 pp., and Monthly Labor Rev. July 1992, p. 90.

1.9.3 Returns to Capital: Profitability

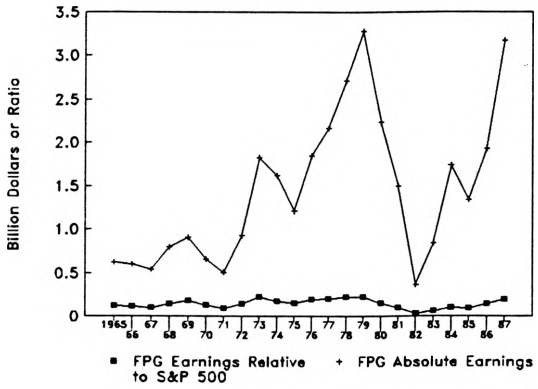
The high level of integration of lumber production with other industries has made it difficult to prepare profitability data for the industry. The FTC stopped publishing profitability information for the lumber industry many years ago, and the S&P Forest Products Group

earnings summaries were discontinued in 1988. So it is necessary to resort to some rough proxies for industry profitability. These are supplied by the S&P summaries of stock prices compared to the S&P 500, and by the S&P earnings summaries.

These comparisons show that for the group of S&P 500 firms studied, there were definitely high returns to share owners during periods of booming lumber prices, but on average over time there is no clear trend in level of returns relative to the S&P 500. Further, the variability of returns in the paper and forest products companies was very high.

Figure 60

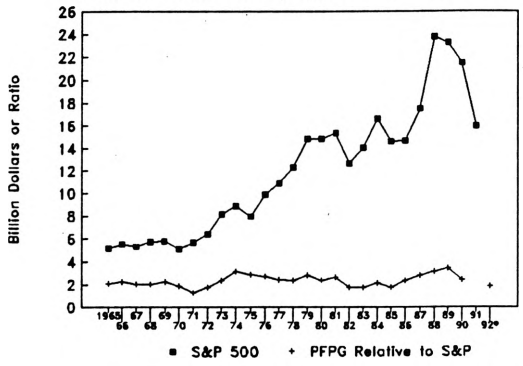
Annual Earnings, S&P Forest Products Group



Source: Prudential Securities Paper and Forest Products Monthly Review, Mar. 4, 1993, p. 23.

Figure 61

Earnings for S&P 500 and S&P Paper and Forest Products Group Relative to S&P 500

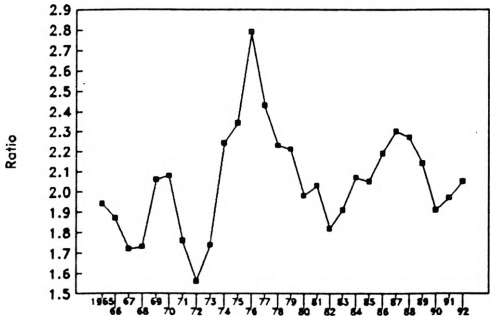


Source: Prudential Securities Paper and Forest Products Monthly Review, Mar. 4, 1993, p. 24 and 25.

* 3d Quarter.

Figure 62

Annual Stock Prices, S&P Paper and Forest Products Group Relative to Total S&P 500



Source: Prudential Securities Paper and Forest Products Monthly Review, Mar. 4, 1993, p. 15.

In a study of returns to capital and labor in manufacturing, Katz and Summers (1989) calculated a measure of "capital rents." By this measure, the return to capital in the lumber industry ranked 15th in a list of 20 industries. The lumber industry's rate was 5.0%, averaged over 1960-85, compared to a weighted average for the industries studied of 6% (Katz & Summers, p. 214).

1.9.4 Returns to the National Resource: Stumpage

Over the period since 1946, stumpage prices have risen far faster than lumber prices (see Sec. 8.5.2 above). This was caused by a variety of forces, which have varied from time to time over these years.

One useful result of this process has been to increase the returns to owning and managing timberland above what they otherwise would have been, thereby providing enhanced incentives to grow timber, whether on government or private land. Another useful result has been simply to extend the resource so that far more products and jobs could be realized from the harvest of an individual tree.

1.9.5 Comparing Returns to the Factors

In an unusually complete analysis, Ghebremichael, et al. (1990) used Census data to study factor shares in the Canadian lumber industry. They found that over the period 1962-85, factor shares in the industry were fairly stable, with the expected cyclicality in returns to capital depending on operating rates and prices. Chips are treated as an output in their analysis, rather than as an offset to costs as is often done. Annual averages over the entire period show the dominance of wood, followed by labor and capital (Table 28).

Table 28
Average Annual Factor Shares in Total Cost by Region, 1962-85

	BC Coast	BC Interior	Quebec
Wood	53%	37%	41%
Labor	22%	20%	18%
Other Materials	10%	21%	18%
Capital	14%	19%	20%
Energy	1%	3%	3%

Source: Ghebremichael, Roberts & Tretheway 1990, p. 11.

Their treatment of capital costs was necessarily simplified, but their results showed that the annual rates of change in input prices were highest for labor, followed by capital and then by wood (Table 29). In all regions studied, all of these three inputs had faster price increases than did lumber and chips, the industry's outputs. The industry was able to increase factor payment rates at higher rates than its output price grew. It did this by increasing conversion efficiency and total factor productivity.

Table 29
Average Annual Compound Change in Input and Output Prices by Region, 1962-85

	BC Coast	BC Interior	Quebec
Labor	9.3%	9.6%	9.9%
Wood	6.8%	6.0%	5.6%
Other Materials	6.0%	6.0%	6.0%
Energy	6.8%	6.8%	6.8%
Capital	7.4%	7.4%	7.4%
Lumber	7.0%	5.7%	5.5%
Chips	5.1%	7.0%	6.7%
CPI*	5.9%	5.9%	5.9%

* Consumer Price Index (CPI) data are not available at the provincial level. The CPI's for Vancouver and Montreal were used for British Columbia and Quebec, respectively.

Source: Ghebremichael, Roberts & Tretheway 1990, p. 11.

1.9.6 Summary

While national data do not enable us to conduct a detailed assessment of distributional outcomes in the softwood lumber industry, using plausible proxies we can develop some rough conclusions. First, the industry's cost structure is dominated by delivered log costs. Its revenue structure is significantly affected by residuals values in most regions. Labor costs are 20% or less of total cost (net of residuals). For a variety of reasons, the industry on average has paid wages lower than the manufacturing average, and the relationship has deteriorated over the postwar period. As far as can be determined with existing data, the industry over time has also paid below average returns to capital, with those returns being highly variable over the years. This outcome is consistent with what we know of industry structure. Finally, the industry has generated rising returns to stumpage owners, which has had at least some beneficial effects on forest management.

The evidence suggests that the softwood lumber industry has utilized labor and wood with steadily improving efficiency. Yet returns to labor have barely kept up with the manufacturing average, while returns to capital have on the average been low. The returns to better productivity have been largely captured by the owners of stumpage, and except in periods of unusually high demand they have been shared with consumers in the form of declining real prices.

1.9.7 References

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2 SHORTRUN MARKET DYNAMICS, 1976-93

2.1 INTRODUCTION TO PART TWO

Part Two of this report examines the shortrun market dynamics of the US softwood lumber industry using monthly data from 1976 to 1993. It builds upon and extends the analysis provided in Part One.

The specific purpose of this Part is to analyze the determinants of short-term lumber price behavior, and to examine the several instances of dramatic price bubbles in softwood prices in recent years and to attempt to determine their causes. The results will assist us in understanding the likely future course of prices when account is taken of likely changes in market forces in the 1990's.

Following a short summary of data and methods, we review major descriptive points about short-run lumber price determination. We then summarize the behavior of end users, mills, and market intermediaries, supplying a basis for a discussion of supply and demand elasticities. We next discuss five underlying intermediate-run supply side forces which condition shortrun price behavior: the exchange rate on the Canadian dollar, the countervailing duty, log exports, timber supply, and regional production shifts. A final section recounts analyses of seven price bubbles which occurred in softwood lumber prices from 1978-92, with a strong emphasis on the extraordinary upsurge of prices that occurred from October 1992 to March 1993.

2.2 DATA AND METHODS

To examine the questions posed in this report, we have assembled a database of monthly data from 1976 or 1978 to late 1992, depending on data availability. We have US data covering production, shipments, orders, mill stocks, and imports and exports, largely from AFPA records. We have assembled a set of 7 monthly prices covering a range of products. These show that the choice of price indicator has a significant impact on the results; our list is based on an effort to cover a range of species without making the analysis or presentation excessively burdensome. As indicators of demand conditions, we have used seasonally unadjusted housing starts and the Federal Reserve Board index of industrial production.

Original econometric analysis is beyond the scope of our project. A careful use of existing results from the literature and a thoughtful presentation of the facts in graphic form, amplified by basic statistical analyses where needed, should provide a sound basis for developing answers to the important questions. Statistical analyses were calculated using NCSS.

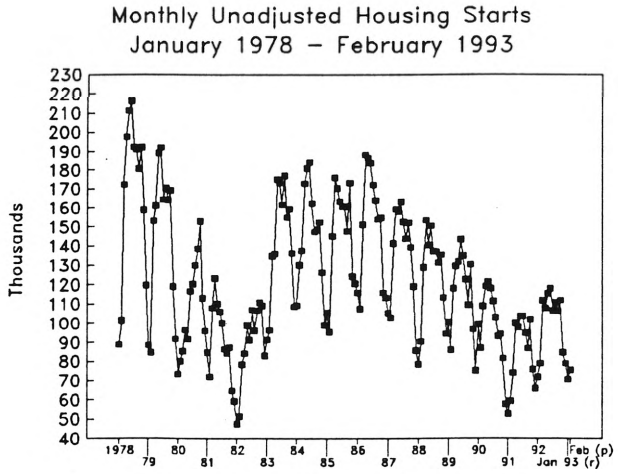
2.3 SHORT-TERM SOFTWOOD LUMBER PRICE BEHAVIOR: BROAD FEATURES OF SUPPLY AND DEMAND

The week-to week and month to month movements in lumber prices are conditioned by the nature of the market participants and the constraints they face. In this section, the major factors are discussed.

2.3.1 Major Demand Sectors are Seasonal

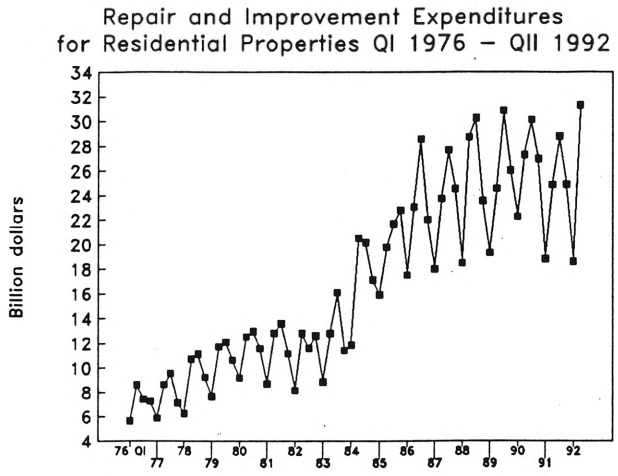
The most obvious feature of shortrun supply and demand is that consumption is highly seasonal due to the importance of construction markets in total usage (Figs. 63 and 67). In 1988, housing starts were 78,200 in January (unadjusted) compared to 153,200 in April and 150,200 in June. This was an increase of 95% in 4 months. The construction industry's need for softwood lumber may not have risen as sharply, since lumber usage is spread out over a period of time following the "start" (pouring footers) of a unit. For comparison, in 1988, total softwood consumption peaked in May at a level 22% higher than January consumption. In that same year, production increased only by 13% between the same two months. The balance was achieved by an increase in imports and by drawing down stocks. Repair and remodeling markets are also seasonal (Fig. 64). This seasonality is mirrored in retail sales of building materials (Figs. 89 and 90 below).

Figure 63



Source: Econ. Rept. of Pres., Business Statistics.

Figure 64

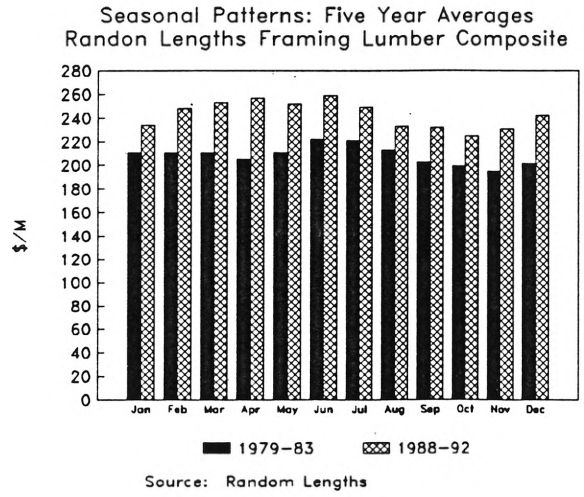


Source: US Bureau Census, C50 Report.

2.3.2 Lumber Prices Display Seasonal Patterns

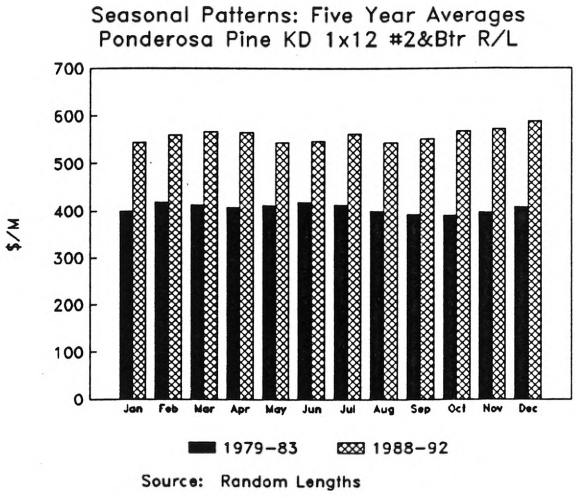
Lumber prices contain a normal seasonal component due to the fluctuations in demands and supplies. These seasonals generally display a range of 10 or 15% of average yearly prices. As would be expected, prices tend to be highest in late winter through mid summer, following the seasonal pattern of building and remodeling activity (Figs. 65 and 66).

Figure 65



Source: Random Lengths

Figure 66



Source: Random Lengths

2.3.3 Production, Shipments, and Consumption are Highly Volatile

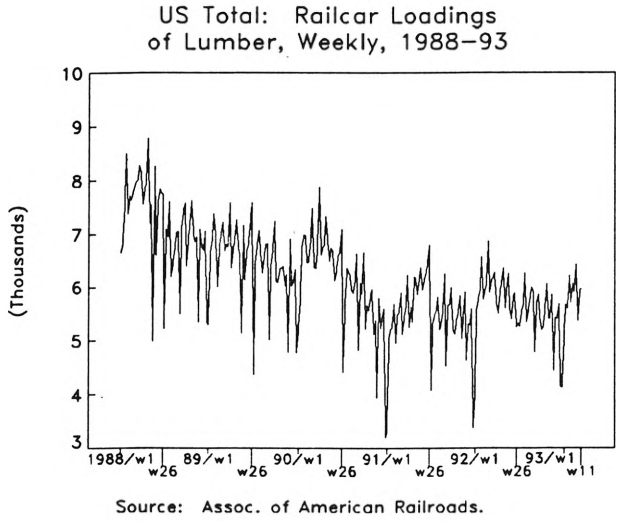
Volatility of production, prices, and demand is a basic structural trait of the softwood lumber market. This high level of volatility limits our ability to definitively resolve important questions about the role played by various possible influences on prices. Because of the importance of volatility we will characterize it here in some detail.

2.3.3.1 Shipments and Production

Production, orders, and shipments, and demand for softwood lumber are highly volatile on a weekly and monthly basis. All mills, users, transporters, and marketers of the product have designed their commercial practices around this fact.

Rail shipments data cover only a portion of the lumber produced today, but they illustrate the extraordinary volatility. Setting aside normal shutdowns, carloadings may vary across a range from 5500 to 7500 cars/week as in 1989 (Fig. 67).

Figure 67



Production, imports, and exports are also highly volatile from month to month (Figs. 68 and 69).

Figure 68

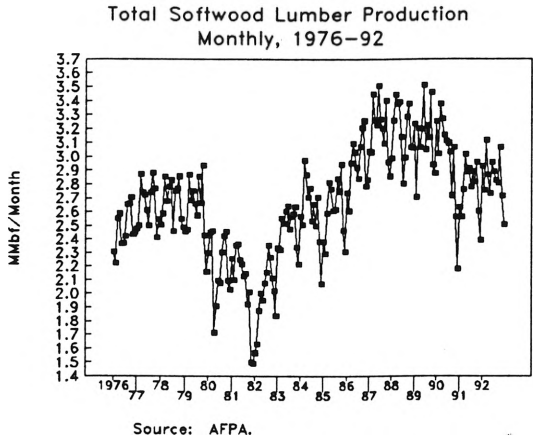
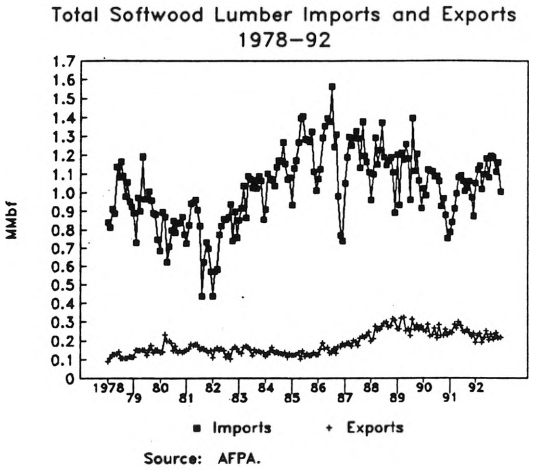


Figure 69



2.3.3.2 Prices

Prices for most lumber items reflect this variability (Figs. 70 and 71). As Fig. 70 suggests, some specialty items are more stable in price than the high-volume commodity items. To provide a clearer view of weekly variability, we also show the SPF for a shorter period on a different vertical scale, showing only 1988-92. These charts show a mild tendency for prices to display a seasonal pattern, but do not display a highly predictable one. They also show within-year price variations as high as 20-25%, and even larger variations during periodic price bubbles.

Figure 70

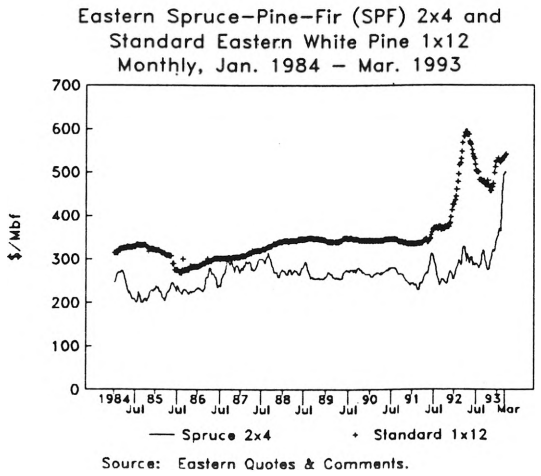
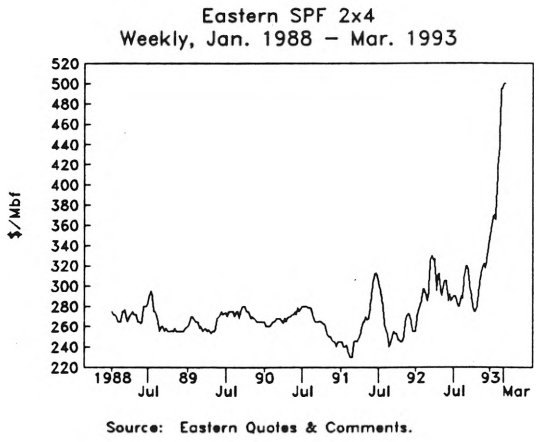
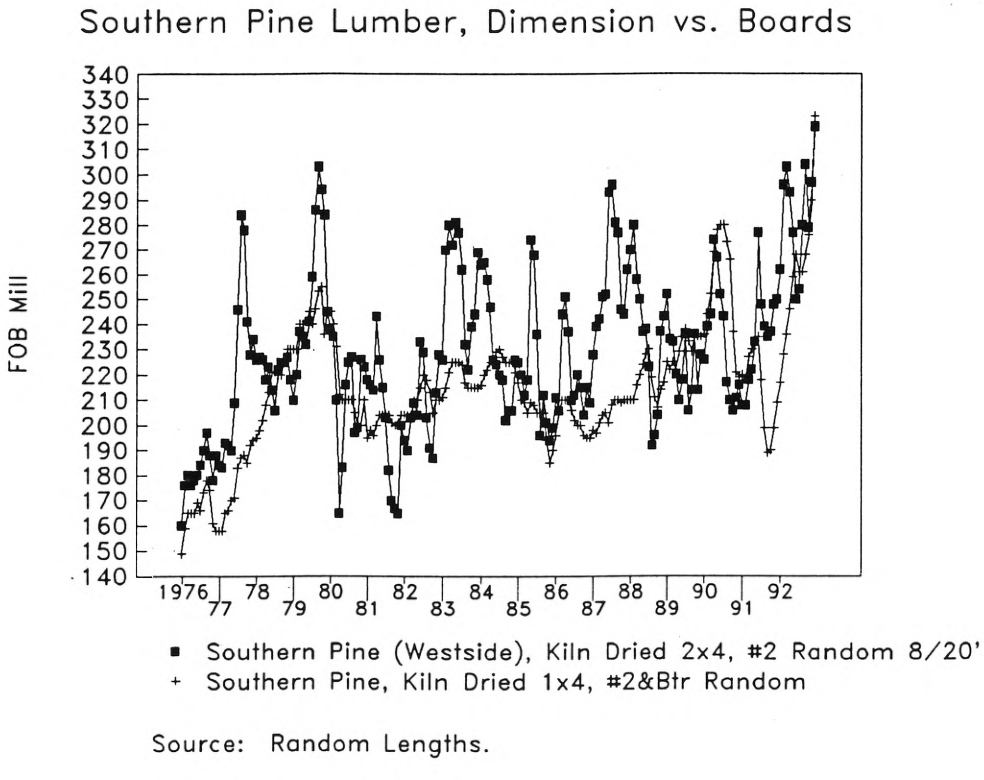


Figure 71



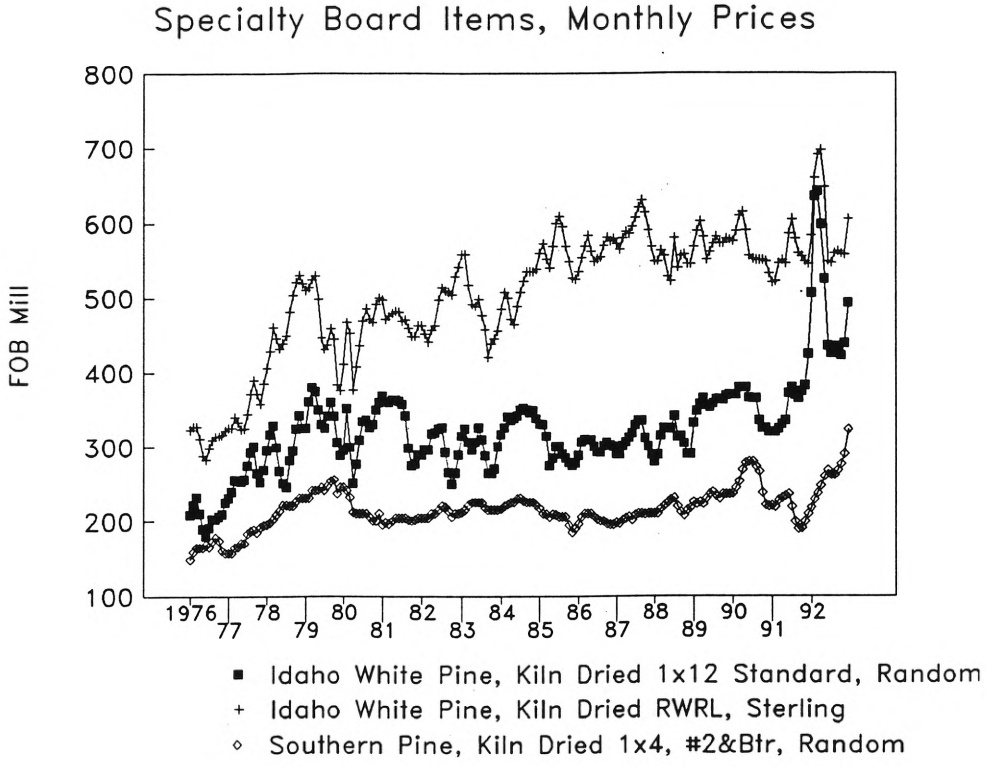
Not only do price levels display high variability from month to month and year to year, but the differentials between major items vary with market conditions. Generally, board grades do not display the month-to-month variability of the dimension items (Figs. 70 and 72). Also, they do not react as violently to major upswings and downswings in demand. Seasonal patterns, however, are often apparent (Fig. 73). The higher grade boards all largely used in door, window, millwork, and retail do-it-yourself (DIY) markets. They are commonly sold on the basis of long-term contracts. The pine spreads between dry and green (Fig. 74), and different species (Fig. 111 below), and narrows and wides (Fig. 75) all vary significantly from time to time.

Figure 72



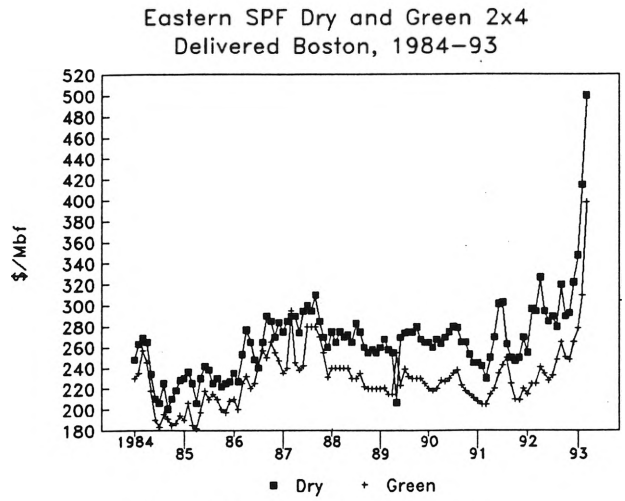
Source: Random Lengths.

Figure 73



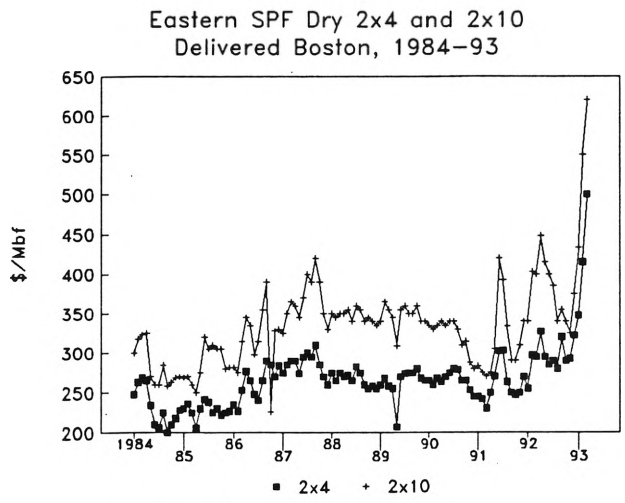
Source: Random Lengths Yearbook.

Figure 74



Source: Eastern Quotes & Comments

Figure 75



Source: Eastern Quotes & Comments

2.3.3.3 Trends in Volatility of Demand and Prices

To examine trends in market volatility, we defined four time periods from 1978 to October 1992. These were:

1. January 1978 to December 1980, to depict the fluctuating market of that period;

2. January 1981 to July 1982 to depict the recession of that period;

3. August 1982 to December 1987 to include the period of highest Canadian market penetration and to reach the rough peak of housing starts in the late 1980's boom;

4. January 1988 to October 1992 to depict the most recent year since the housing peak. Different results might be found if different periods were used; a year-by-year analysis or some form of detrending might yield more sophisticated results, but for present purposes we believe this approach will serve.

For a variety of prices, price composites, and demand drivers we calculated means and coefficients of variation (Figs. 76-81).

The mean is simply the average of the observations. The coefficient of variation (CV) is a measure of the relative degree of variability in a set of data, in this case the time series under examination. Technically, the CV is the standard deviation of the time series divided by its mean. The CV helps us compare the variability of items with different means.

Figure 76

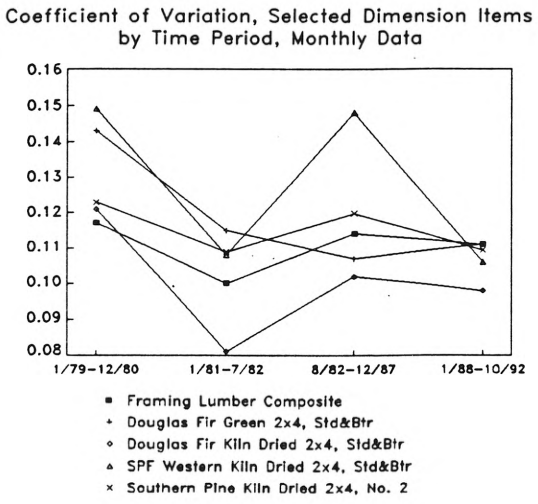


Figure 77

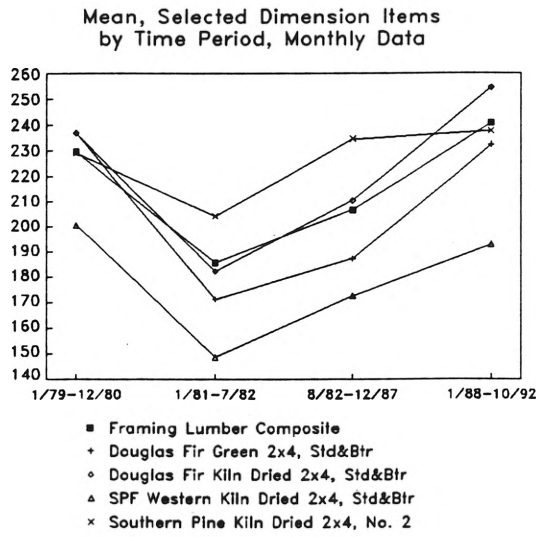


Figure 78

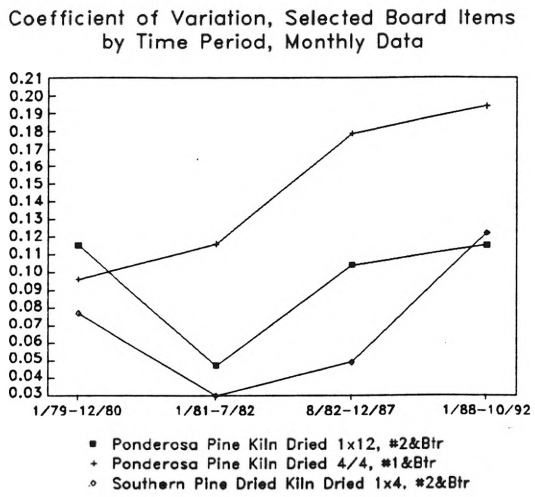


Figure 79

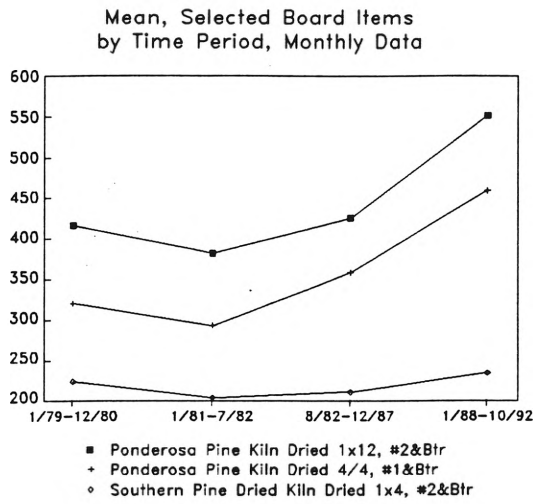


Figure 80

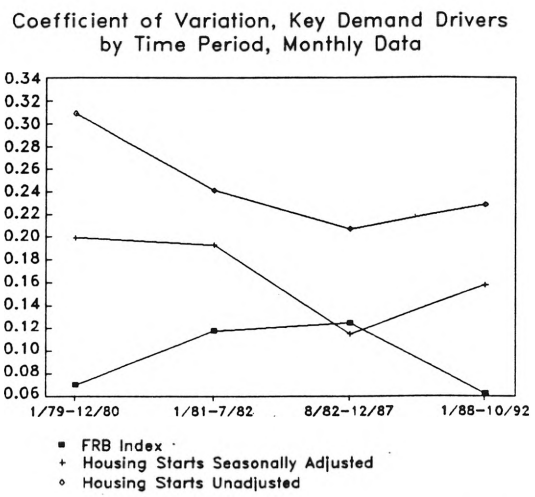
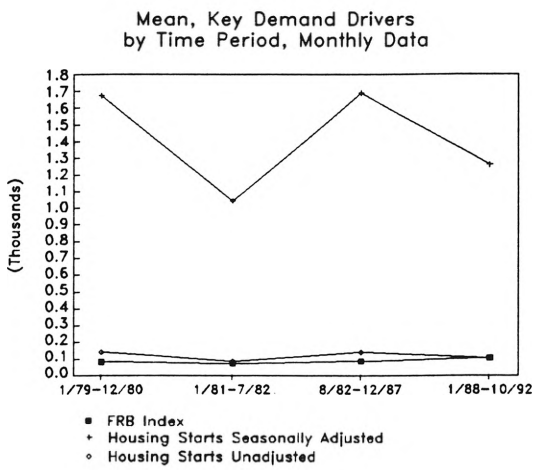


Figure 81



For the demand drivers, the FRB index rose over the period, while the adjusted and unadjusted housing starts measures declined significantly. All three demand drivers displayed lower volatility in the last period compared to the first one.

US production of softwood lumber increased 20% over the entire period, recovering from the low levels of the early 1980's. Volatility of production fell significantly over the period, after a brief rise in the early 1980's. Volatility also fell for shipments, but interestingly, fell only slightly for new orders. If the volatility of production fell relative to the volatility of

new orders, then changes in the volatility of inventories, order files, or imports must also have occurred.

In terms of effects on prices, the results were mixed. Between periods one and four, green fir and KD western SPF actually fell in mean prices; the Random Lengths framing lumber composite only rose about $12.00, or about 5%. KD fir increased by $18.00, while the three board items increased significantly.

In volatility, several items declined noticeably (green fir; dry fir; western SPF), while the framing lumber composite was essentially unchanged, as was the price of KD Ponderosa 1x12's. For KD Ponderosa 4/4 #1&Btr and KD southern pine 1x4 #2&Btr, the price volatility increased significantly. Though the CV standardizes for the mean, the high volatility in the first period may simply be capturing the effect of the dramatic market moves of that period.

2.3.4 Market Channels are Complex

A complex marketing system has developed more wood from mill to market, to maintain inventories in consuming regions, and to deliver the assortments of products needed by manufacturers and builders as required. This system affords a measure of flexibility to many buyers who can choose to deal with a retailer, a stocking wholesaler, an office wholesaler, or a reload center. At times, intermediaries may be in competition with one another for sales. At others, they may be bidding against one another to obtain wood from the mills. Further discussion of the system's behavior is provided below.

2.3.5 Lumber is Essentially a Spot Market

Lumber is generally purchased by users expecting delivery to their plants or worksites in a matter of days or at most weeks, and generally at predicted dates. The costs of failure to meet delivery dates are high, in delayed construction or plant downtime and missed orders due to lack of raw material. Little if any framing lumber is sold -- at any market level-- on long-term agreements specifying either volumes or prices, even in cases where individual mills and customers have had working relationships for generations. But long-term contracts are often found in the board market. The practice is reflected in the more stable prices for these items, as noted above.

At the mills, prices are rarely quoted beyond 4-6 weeks in the future. At any given

time, the production for upcoming weeks is completely sold; buyers seeking immediate shipment may find wood impossible to obtain or may be forced to pay a premium price. At the other extreme, when most shipments are being made in a week or two it is a sure sign of a very slow market.

Softwood lumber has been repeatedly described as a decentralized auction market in which prices move with the ebb and flow of supply, demand, and psychological factors. Participants and experts interviewed for this study also speak of the market in similar terms. While many mills and wholesalers issue price lists routinely (often monthly), these lists are used partly to advise customers of available items; prices given are considered the starting point for negotiations. Buyers often seek several quotes before placing the order.

The lumber market consists of mills, office wholesalers, stocking wholesalers, and controlled distribution systems, together with imports and exporters who are continuously in the market buying and selling. These participants are linked by telephone and fax communications and by access to futures market quotations and to three weekly newsletters covering the national market. The newsletters are on traders' desks on Mondays, showing prices prevailing late the previous week. End users of lumber, by contrast, are typically in the market much less frequently.

The industry's decentralized, unconcentrated character ensures the dominance of market forces in price determination. Supporting that analysis, experts and market participants interviewed for this study could think of no instances in which price behavior was observed that seemed a likely result of anti-competitive practices. In the course of this project, we interviewed officials at the Commodity Futures Trading Commission, the Federal Trade Commission, and the US Department of Justice, Antitrust Division (TIG file memo). We were able to learn of no instances of investigations or actions brought concerning price-fixing in the lumber industry. Finally, the existence of a futures market is consistent with the belief that lumber prices are formed in a national competitive market.

2.3.6 Historically, the Industry Displayed Relatively High Production Flexibility

In past years, the softwood industry displayed a chronic tendency toward overcapacity as might be expected in an industry with relatively low entry barriers, elastic supplies of raw materials, and with dynamic technological change.

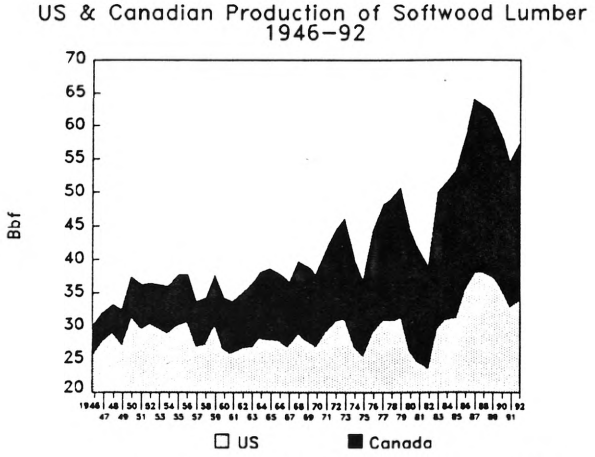
On a year to year basis, production can change dramatically in response to demand.

In the market slump of 1974, output fell by 13%; in 1980, by 16.5%. Following market lows, production increases can be very large, since unused mill capacity is available. In 1976, US output expanded by 14%; in 1983 by 25%, and in 1986, by 13%. Emerging constraints on timber supply, however, are reducing this flexibility.

2.3.7 Canadian Imports Have Served as a Balance Wheel

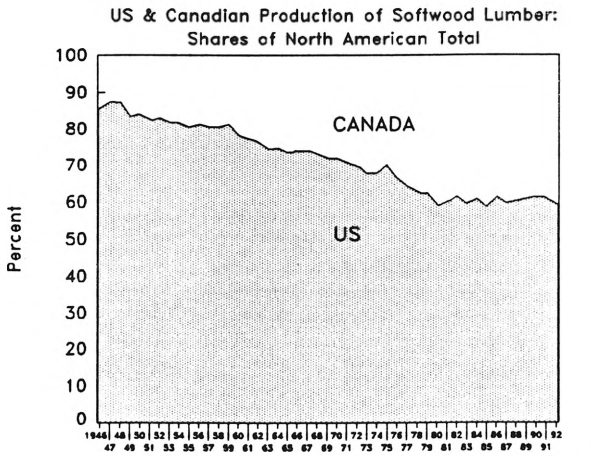
In the past, the US lumber market was able to use Canadian imports as a balance wheel that absorbed a large share of annual and seasonal fluctuations in consumption (Figs. 82-85). During periods of peak US demand, the Canadian market share has been highest, and the share has slipped temporarily during slower markets. This pattern is superimposed on a long-term increase in share through the mid 1980's. As Figs. 82 and 83 show, this trend halted decisively in the mid 1980's. The recent trends (Fig. 84 and 85) and the outlook for Canadian production in the 1990's suggests that the ability of Canadian imports to serve as a balance wheel in filling peak US demands will not persist into the 1990's and into the new century.

Figure 82



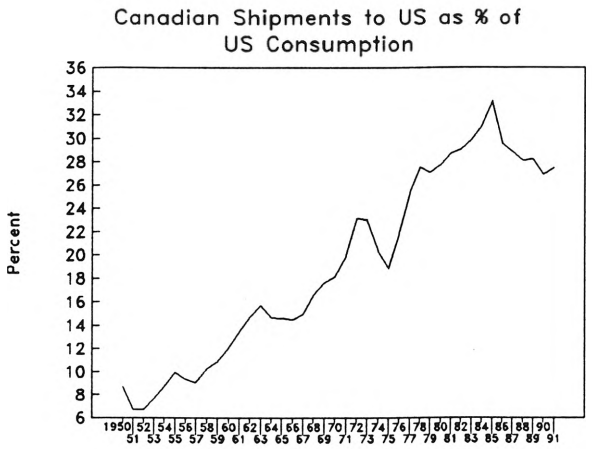
Source: AFPA, Adams, Jackson & Haynes 1988, and USITC 1992.

Figure 83



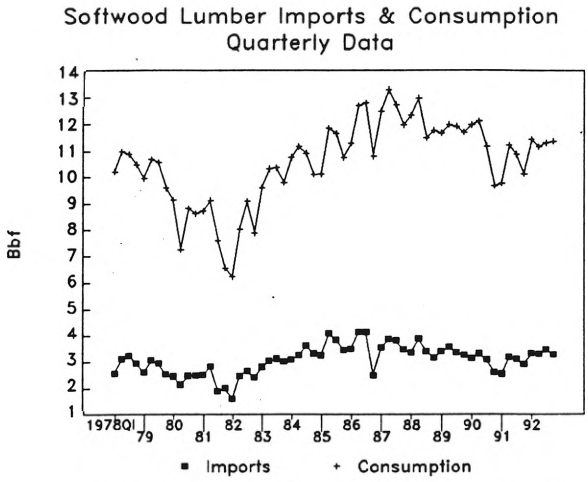
Source: AFPA, Adams, Jackson & Haynes 1988, and USITC 1992.

Figure 84



Source: USDA–FS PNW Res. Bull. 151, and USITC 1992.

Figure 85



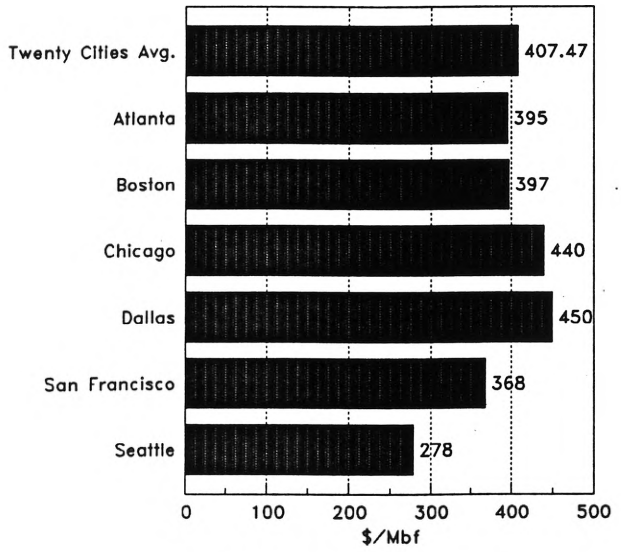
Source: AFPA, as summarized by Prudential Securities.

2.3.8 Freight Costs are Important

Because transcontinental freight costs are so large, end users pay quite different delivered prices for lumber. Delivered fir 2x4's, according to Engineering News-Record's survey, varied by $172/M for a sample of cities in September 1992 (Fig. 86). This differential was very large in relation to the FOB mill price of the same product at western mills.

Figure 86

Fir 2x4's Delivered to Jobsites
Major Metro Areas, Sept. 1992



Source: Engineering News Record, Nov. 16, 1992.

Also, FOB mill prices vary around the continent, in part reflecting these differences. For example, freight from Quebec or Maine mills to Boston may be $30-$50 per Mbf, while freight from the BC Interior may be well above $100.00. These differences could well be one significant source of differences in regional supply responses. An increase of $50.00 in delivered prices, if passed back to mills, will be a much larger relative price increase in Washington or Interior BC than in Maine.

2.3.9 Inventories are not Sufficient to Balance Seasonal Fluctuations in Usage

As described below (Sec. 4), inventory behavior in the lumber industry is designed around shortrun mill shipping and cash flow needs and not around efforts to store product to meet seasonal demand peaks. One reason is that in the past, changes in production and imports helped meet most of the seasonal change in demand. Also, the volatility of prices probably discourages inventory holding in a generally low-margin industry.

Mill stocks are somewhat larger on average than the volume of wood covered by order files, but this is not necessarily a planned situation or one that is managed in order to maintain a given inventory level.

2.3.10 Marketing Margins May Buffer Impacts on Users

Most users obtain lumber from wholesalers and retailers. By using intermediaries, they save themselves the costs of keeping track of supplies from mills and of negotiating over prices and freight rates for their material needs. This helps them reduce the costs of sourcing their complex bills of materials and in obtaining prompt deliveries. Marketing margins may add 20-40% to the FOB price, with freight in addition. The marketing margins may at times buffer the impact of FOB price changes, as we observe below. At a minimum, fluctuations in FOB prices are proportionally smaller as a percent of delivered prices to end users.

2.4 BEHAVIOR OF MARKET PARTICIPANTS

Behavior of the lumber market is conditioned by the business conditions and constraints faced by the various participants. A brief sketch of how these participants behave will build a base for understanding elasticities of supply and demand and other aspects of the market behavior described above.

2.4.1 User Purchasing Behavior

Most users of wood rely on retailers and wholesale distributors to stock inventory and depend on prompt delivery. Exceptions are often volume users of highly specialized items, such as window manufacturers or truss fabricators who require their own inventories. A custom builder may literally order the lumber and panel products needed for a house a few days before pouring a foundation. Its delivery may be expected in a matter of days, as part of several loads of lumber, plywood, and other materials for the building shell. Large scale corporate builders must plan for requirements and deliveries much farther in advance. When tract housing is being built, materials choices in the models become difficult to change.

The individual builder arranges the price of the house with a buyer. In the past, the builder could usually count on a retailer's price quote for major items to be held firm for 30 days or so. Thus, before a house is formally "started" for statistical purposes (footers poured), a builder's price and delivery dates for lumber are fixed. Price changes will not affect the builder and will therefore have no effect on the builder's behavior. Orders for windows, millwork, wood flooring, and other more highly processed wood items may not be placed until after the framing is well underway. At that point, they become absolute requirements and wood prices will not be likely to have much effect on materials choices. But since the price runup of October 1992 to March 1993, more and more builders are pricing houses subject to actual pricing received on lumber.

Considering longer time horizons, price conditions in wood products markets generally have only very small effects on the homebuyer's behavior, even when costing and planning have not yet been completed. This is for several reasons. First, the decision to actually construct a house depends on income, demographic variables, interest rates, anticipated inflation in real estate values, and other factors. Lumber costs may affect the timing of acquiring features like finished basements, garages, or decks, but are not likely

to significantly affect the size and character of the unit built or the number of them constructed.

Further, lumber and wood products represent a relatively small part -- roughly 8% -- of the cost of a finished house plus lot. Additionally, the critical matter for the home buyer's purposes is the total monthly cost of homeownership and operation, including maintenance, utilities, the mortgage payment, the opportunity cost of the down payment, and taxes. When these factors are considered, the portion of monthly cost attributable to lumber is very small (Irland 1974).

2.4.2 Mill Pricing Behavior

Mills sell many items when they are produced, building little inventory. They will produce some items to order to customer specification, but most of their volume is governed by market expectations, log supplies, and by sawing patterns designed to maximize yield or grade depending on the mill and the species being sawn. As price differentials shift between green and dry, or between different thicknesses and widths, many mills can respond by curtailing or expanding production of particular items. Some mills have greater amounts of flexibility in this regard; some can even switch to sawing hardwood. Others, such as stud mills, have little or no flexibility as to the grade and size mix they produce, or even as to their level of production, which may be governed as much by a pulp mills' need for chips as by the weekly changes in the profitability of sawing lumber.

Mills generally try to maintain a few weeks of "order files" covering future production. These order files are as much for the purpose of guiding the assembly and shipping of specified loads as they are for guiding the actual sawing in the mill. When order files dwindle in the face of slackening demand, mills are more inclined to give concessions on prices to rebuild files. But the willingness to cut prices has its limits, which may vary from region to region and mill to mill, as well as by season. Mills will occasionally decline to sell if they feel prices are too low. At these times, however, their position is weak because they may have only a week or two of cash flow embodied in existing orders in their file. During weak markets, buyers do not hesitate to extract nonprice concessions from the mills. These might consist of assurances of prompt shipment, waiving premiums usually charged for additional processing, or providing mixed loads with a greater variety of items, each in

smaller quantities than a mill would usually be willing to offer. Occasionally, buyers may cancel orders but it is not common to do so, being contrary to business etiquette. At times of extremely tight supplies, however, buyers have been known to place orders at several mills and cancel the others when the first delivery occurs. This would amplify the occasional bidding wars for inventory that occasionally occur.

Conversely, when demand rises, mills expand their order files, and quote for shipment farther into the future. When demand is extremely strong, mills are reluctant to quote beyond 4 or 5 weeks into the future, though in the 1950's and 1960's, longer order files were common. They then will "price defensively", by quoting prices they do not expect buyers to pay. Alternatively, they will simply go "off the market", telling customers to call back later as no wood is being offered this week. In the extremely tight market of winter 1992-93, many mills turned to pricing wood on a price-at-time-of-shipment (PTS) basis. This practice shifts price risks to buyers, and actually makes price discovery in the marketplace more difficult.

A mill's ability to vary production volumes in a matter of weeks or months encounters various constraints, especially if the product is being dried. In high demand periods, drying capacity may be the bottleneck that limits output increases. At times, log supplies may be limiting, especially late in mud season as spring inventories are drawn down or in the late summer of a severe fire season. Today, as mills in the northwest draw down contracted volumes of federal timber, log supplies are becoming a more significant constraint than they have been in the past. At times, as we have mentioned elsewhere, regional weather or fire hazard patterns can disrupt log supplies, and briefly curtail production.

Despite these constraints on changing output, production is extremely volatile from month to month, as has been shown above. Given the difficulty of measuring total production, there is always a question of whether this is an artifact of imperfect data.

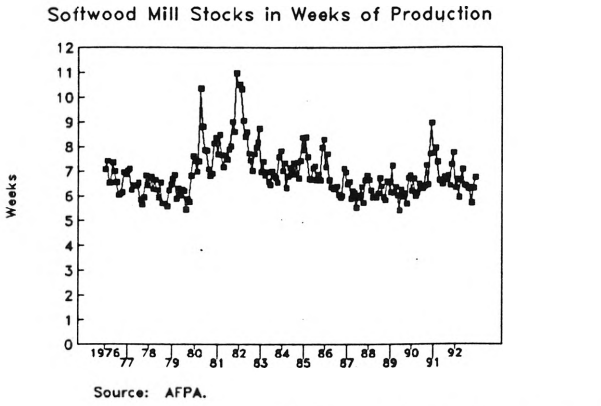
Mills have several opportunities to balance supply and demand when it seems necessary. The Fourth of July shutdowns are a national custom. Mills are closed for maintenance and production virtually ceases. In extremely soft markets it is common for these shutdowns to be extended to enable mills to work off unwanted inventory and to help bring the market into balance. Holiday season shutdowns around Christmas and New Years are also common in many regions; occasionally individual mills will take extra downtime during the November hunting season. The effects of these shutdowns appear

clearly in weekly production data, and in the weekly railcar shipments data.

Inventories held at mills are typically small. Space is limited, stockholding costs are high, and price risks are high. Stockholding costs are high because banks will finance only a portion of finished goods inventory. To hold higher inventories, mills would have to come up with more equity capital, which is costly and usually difficult to obtain. Inventories are held primarily to facilitate the filling of specified orders that may consist of a number of different items, but are not held as a means of balancing seasonal needs. In fact, inventories tend to rise in the winter months, primarily because production is not cut back in line with demand, because of the compensating advantages of maintaining high operating rates. The inventory increases during winter probably cannot be interpreted primarily as efforts to stockpile for higher summer demand, because they are not large enough to play a significant role in meeting building season demands.

In high demand years, average inventories, measured by reported mill stocks, are lower relative to production than in slow years (Figs. 87 and 88). This suggests that mill stocks are in part involuntary accumulations and are not held primarily to take advantage of demand increases, which are hard to predict in any event.

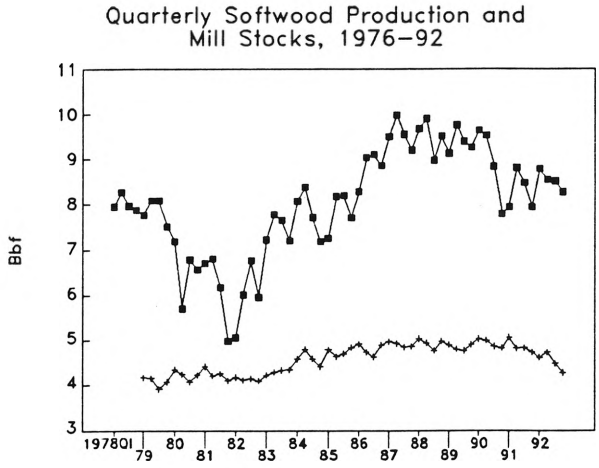
Figure 87



Source: AFPA.

Note: Data shown are calculated as follows: Production for each month is divided by four to obtain weekly production for that month; that result is divided into the level of mill stocks for that month.

Figure 88



Source: AFPA.

2.4.3 Marketing System Behavior

The marketing system includes all the various channels by which lumber is moved to end users from the mills. The marketing system arranges for shipping, delivery, payment,

and financing, and holds inventories.

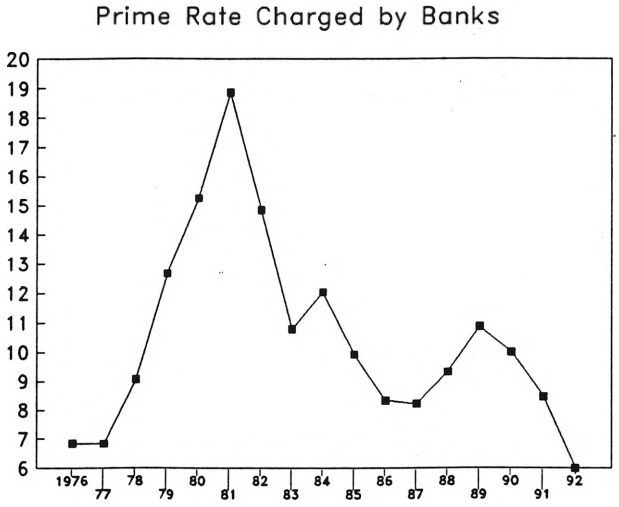
Inventories in the marketing system are held at several levels. Traditionally, office wholesalers took positions in "rollers" or transit cars that are shipped before a destination is known. In strong markets, these traders would "go long" by buying more cars in hopes of arranging buyers at higher prices. In weak markets, they could go short by making a sale to a retailer, for example, before acquiring the car needed to fill the order. In recent years, office wholesalers have been less able to take positions, and have been doing more of their business on a "back-to-back basis. Replacing them in this function have been the reload centers, which are operated by a variety of different market participants and which now hold major inventories in and near major metro areas.

As production has developed in the south, as reloads have developed, and as truck shipment has become more important, the size of the aggregate volume of "inventory" represented by railcars in transit across the nation has declined. Rail car loadings of lumber fell from 675,000 in 1976, to 420,000 in 1987, and then to 286,000 in 1991, then rebounded slightly in 1992 to 295,000 (Miller Freeman 1992, p. 67 and AAR). Part of this decline was due to low demand. Yet the total volume of lumber that is in transit in one way or another must be a significant fraction of the total inventories in existence at any moment. In addition there are the inventories held by retailers and by stocking wholesalers. Improved computers and management systems led large users to practice a measure of "just-in-time" inventory management to reduce space, price risk, and interest and insurance costs of inventories. This has also helped reduce the desired levels of inventories in the system. At the same time, JIT management reduced the inventory cushion available to meet unexpected changes in demands. Differences in inventory levels may well be part of the explanation for why price levels in the 1950's were so much less volatile than recently.

An important factor affecting the marketing system's behavior has been the varying cost and availability of inventory financing. For both office wholesalers and stocking wholesalers, as well as retailers, inventory financing is a significant cost. During the early 1980's, short-term interest rates were at historic highs (Fig. 89); this made it extremely costly at all levels to hold inventories. This fact increased the incentive already presented by the collapse in demand to hold down inventories. It undoubtedly contributed to a lack

of ability to meet subsequent demand surges from mill and wholesale/retail stocks. (Note, in contrast, that mill-level inventories, described above, do not display any evidence of unusual constraint in recent years.)

Figure 89



Late in the 1980's, the building booms in several regions encouraged wholesalers and retailers to expand. When these booms collapsed, lumber dealers were left holding worthless IOU's from their bankrupt customers. In a few instances, dealers went under. Surviving dealers were held on extremely short leashes by their banks, who controlled their inventory financing tightly, as might be expected under such conditions. As a result, the ability of the marketing system to finance inventory has been impaired in recent years, despite historically low short term interest rates.

On the other hand, home center chains have been growing aggressively, adding large stores in major metro areas. Inventory accumulation simply to stock such stores has been mentioned as one source of incremental demand in recent years.

Inventories held in the marketing system are difficult to measure. There is no consistent published data source showing the inventories by month for the (office and/or stocking) wholesalers. Retail inventories are depicted by a Census Bureau monthly series covering building materials dealers, and therefore cover many products other than lumber, though lumber is probably an important component. According to this series, retail inventories of building materials dealers showed a strong uptrend in the 1980's (Figs. 90

and 91). The inventories show strong and regular seasonal patterns and also show marked effects of the 1981-82 and 1991-92 recessions. Interestingly, however, the sales data do not reflect any marked slowdown in 1991-92.

Figure 90

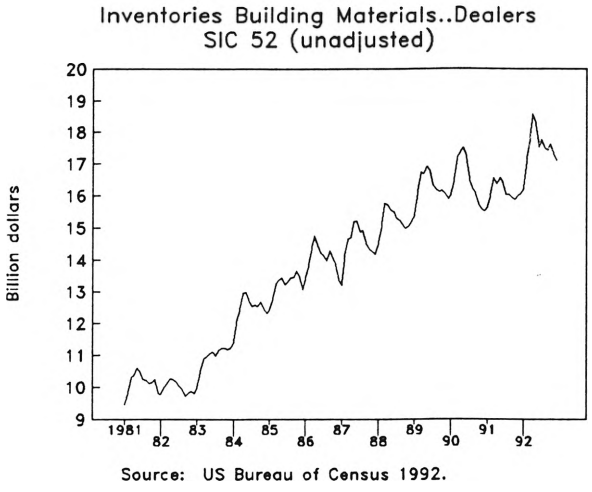
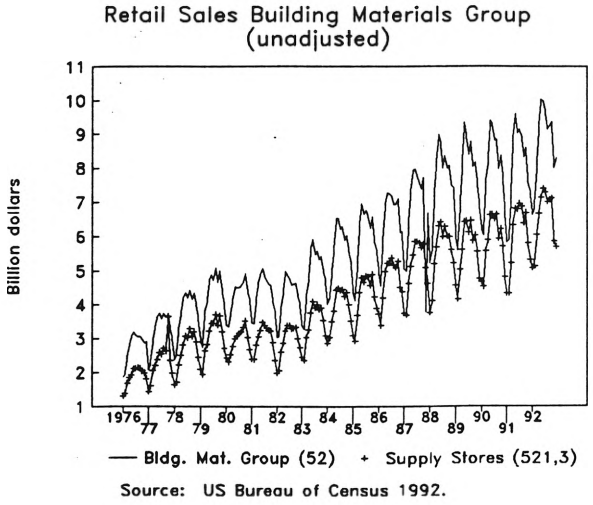


Figure 91



According to this series, retail level inventories may have responded to the late 1980's recession and credit tightness in ways that reduced the availability of stocks as buffers against unanticipated demand increases.

2.4.4 Behavior of Delivered and Mill Prices

Because of the ready availability of FOB mill pricing data, including detail by species and grade, analyses of the lumber industry have traditionally used prices at the mill level. Consumers, however, respond to the delivered prices they pay, not to mill prices. It is important, then, to understand just how changes in FOB prices affect delivered prices. Yet there is no readily available information on delivered prices. One reason is that delivered prices vary from place to place because of transportation costs. For this study, we assembled three datasets on delivered prices for a preliminary analysis.

2.4.4.1 Data Sources

There exist three separate sources of delivered price information:

-- Engineering News Record (monthly)

-- RS Means, Inc. (annual)

-- USDA Prices paid by farmers (annual)

These three indexes have been assembled for this study to help examine how delivered prices change as the FOB mill prices fluctuate. Our analysis points to some most interesting relationships, yet must be viewed as tentative because it has not been possible to explore a large enough portion of the potentially available data.

The Engineering News Record, a trade publication, maintains a database and a widely used construction cost index. The ENR index is intended to reflect labor and materials costs of constructing the very large buildings and other projects that are the primary concern of its readers. It polls building materials suppliers in 20 cities nationwide for prices on a list of materials. The lumber items are published, in monthly form, once per quarter. We have excerpted a sample of ENR price data for four representative cities: San Francisco, Chicago, New York, and Atlanta. We converted the monthly observations to annual averages.

There is some inconsistency in definitions and detail is often lacking so that precise comparisons to FOB prices are difficult. In the case of San Francisco, an anomaly in the data seems to be responsible for an unusual price decline in the early 1980's (we have adjusted for this). The ENR quotes purport to represent the same species across the sample of cities.

The RS Means Company offers a subscription service providing estimates of construction costs that are widely used by cost estimators and others. The RS Means data are acquired for a sample of 30 cities and updated within the year by occasional bulletins. The RS Means estimates are intended to cover a representative mix of types of construction, including housing, in contrast to the large civil projects and buildings emphasized in the ENR index. We acquired a subset of this data from RS Means for this project for the same four cities noted above. The RS Means quotes rely on the species most commonly used in each city, but that species is not always identified, so that again, precise comparisons to FOB prices are not possible.

The USDA prepares a yearly index of prices received and prices paid by farmers as part of its ongoing statistical program. Data on framing lumber and boards are published in Agricultural Statistics each year. We assembled these prices since the early 1950's and can compare them with the other two sources. The USDA index concentrates on items

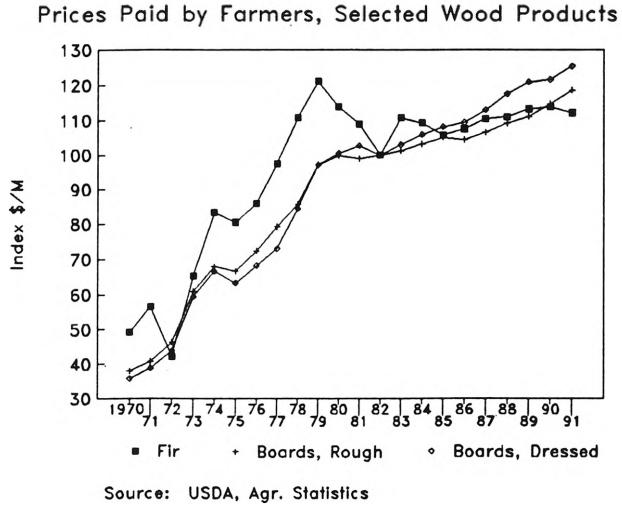
used in general construction and maintenance and would represent price trends in rural areas in contrast to the urban areas covered in the other two sources. Since this is virtually all retail trade, often in markets with limited competition at the retail level, it is not surprising that delivered prices appear to be generally higher and more stable than in the other indexes.

In all, these three sources provide a useful range of methods and geographic coverage for examining delivered price trends.

2.4.4.2 Delivered Price Trends

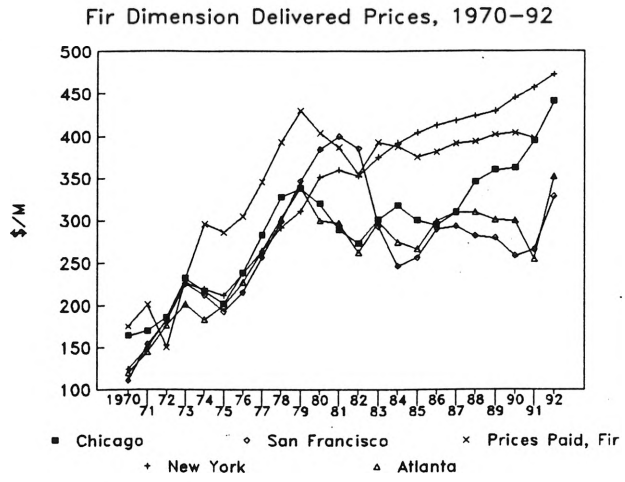
From 1970 to 1978, delivered prices as measured by the USDA index rose steadily (Fig. 92). Similar to the FOB prices noted elsewhere, the prices for framing lumber were more volatile than for boards. Following the 1980-81 recession, prices trended gently upward with very little volatility. Interestingly these delivered prices display little of the short-run volatility shown by FOB mill prices.

Figure 92



Up to the early 1980's the USDA series for fir framing lumber moves with the ENR index for fir dimension prices in the four cities (Fig. 93). In the 1980's, however, it rises faster and is less volatile.

Figure 93



Source: Engineering News Record & USDA.

When comparing delivered and mill prices relevant to the four cities, we have to keep in mind the ambiguities in the data mentioned above. In Atlanta and San Francisco, there is a tendency for delivered prices to follow FOB mill pricing more closely than in the case in Chicago and New York (Figs. 94-97).

Figure 94

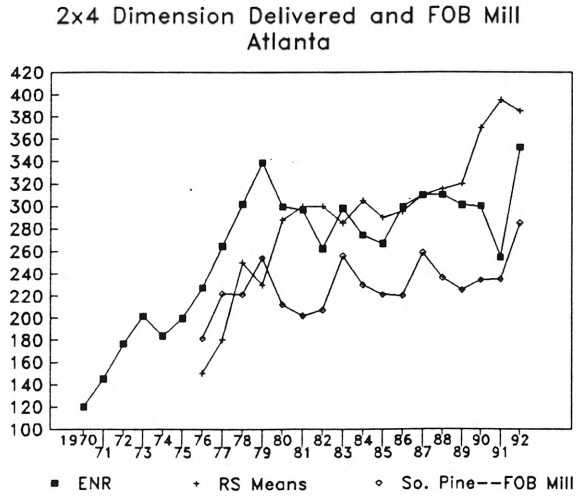


Figure 95

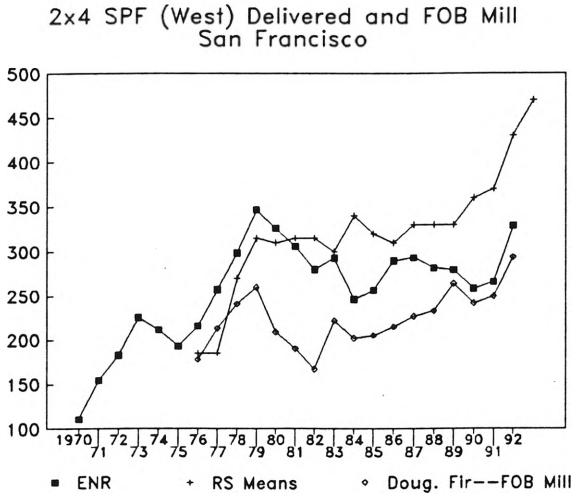


Figure 96

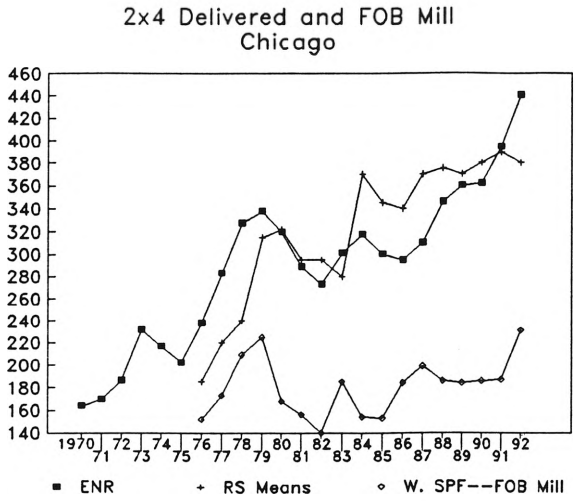
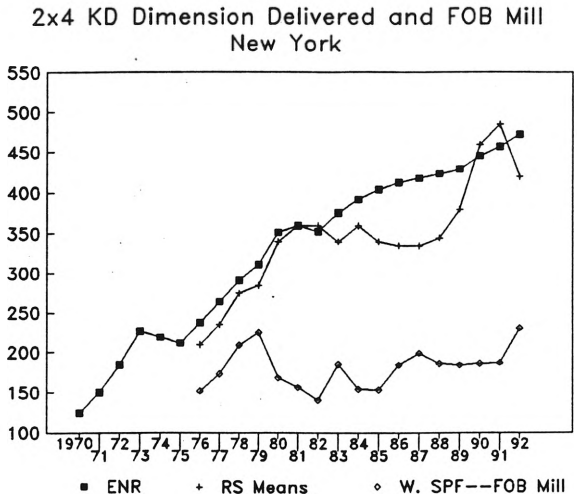


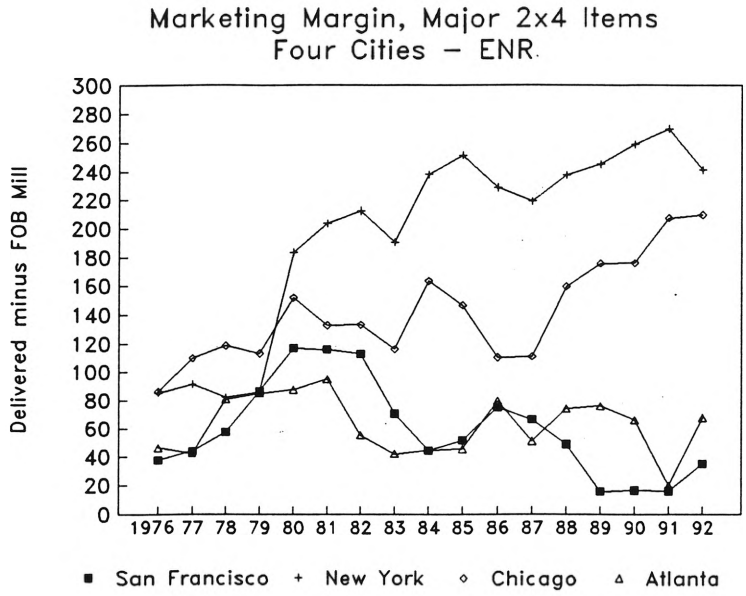
Figure 97



2.4.4.3 Estimated Marketing Margins

A useful way to compare delivered and FOB prices is to look at them in terms of marketing margins in the different cities. The gross marketing margin defined this way includes freight, unloading and wholesaling costs, and wholesaler profit. Over this period, transportation costs were affected by the deregulation of freight rates in the early 1980's and by the regional shifts in production. With this dataset there is no way to tease out the specific sources of changes in this gross margin. It is not surprising that marketing margins are lowest in San Francisco, at the edge of the Douglas-fir region, in Chicago, with its excellent rail access to Canadian lumber, and in Atlanta, in the middle of the southern pine region where output is growing (Fig. 98). The waning importance of waterborne shipments is illustrated by the high delivered prices at New York, where costs are no longer kept low by the low cost of waterborne lumber from BC.

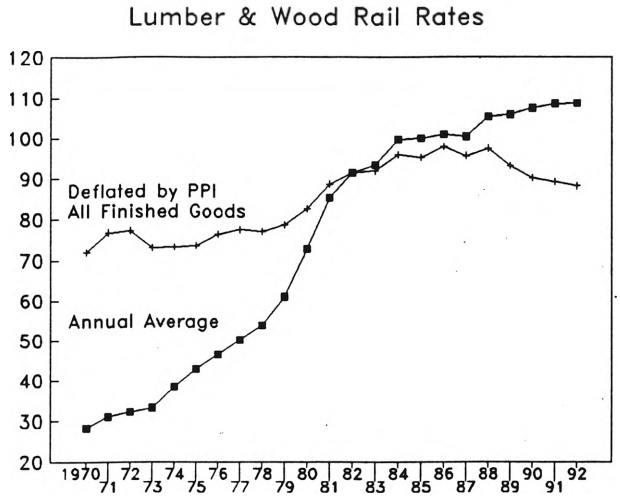
Figure 98



An index of rail rates for lumber is collected by the BLS (Fig. 99). This index shows a significant increase in real freight costs during the early 1980's, followed by a modest decline later in the decade. This trend is mirrored in the marketing margins. This index must be regarded as only a loose proxy for lumber freight costs, given the extreme variability in rates from place to place, time to time, and even from shipper to shipper.

Marketing margins as defined here can change over time in response to the increasing use of trucks, different patterns of direct buying, the rising usage of reload centers, and different ways of contracting for freight.

Figure 99



Source: BLS.

The cyclical behavior of these margins follows no crystal clear pattern, but there is a rough tendency for margins to be low in periods of high demand and high in low demand periods. This could mean that intermediaries price their services on a longrun average basis, and are unable to significantly widen their margins when lumber prices are high.

2.4.4.4 Implications

The implications of this brief analysis are not fully clear, yet we can make a few preliminary observations. The price trends and marketing margin patterns do suggest that FOB mill price increases are not always or immediately passed forward 100% to buyers in strong markets. In fact, in some markets delivered prices seem to be extremely stable. Further, there is regional variation in the relative changes in delivered prices. In areas of lower delivered prices, the percent increase in delivered prices in strong markets tends to be greater than the percent increase in the high cost markets.

The tentative exploration of this topic outlined here is useful for descriptive purposes, but it would be risky to try to use it to predict how delivered prices will behave in 1993 in response to the upsurge in prices early in the year.

2.4.5 The Futures Market

The futures market in softwood lumber often becomes more active during periods of price action in the "cash" markets. Price volatility and news attract public speculators, and the increased price risks may increase commercial hedging. For some major farm products, prices are set primarily on the futures markets. Lumber markets have never evolved in that direction. The level of contracts outstanding at any given moment (open interest) has been very small. Early in 1993, open interest stood at about 2,500 contracts. At 160 Mbf/contract, this represents 400 Mbf, or the equivalent of less than 10% of the mill inventories. Given that total marketing system inventories are much larger, the volume represented by the open interest would be a tiny fraction of total inventories. The likelihood that the futures market could materially affect cash prices for any length of time is therefore remote.

If futures market activity were an important factor in the 1992-93 lumber price upswing, it is difficult to see how that could have occurred without an increase in trading activity. Yet in early 1993, open interest was lower, and trading volume no higher, than during the "countervailing duty rally" of March 1992 (Fig. 100).

Further, during the October-March rally, futures prices were regularly constrained by daily trading limits, so that futures prices fell to a wide discount below cash. Again, it is hard to imagine futures prices driving cash under such conditions.

The existence of the futures market has at times affected inventory practices of commercial participants in the market. And the market watches futures prices as one of a number of indicators of market sentiment.

Attracted by the price increases, investors have increased their participation in the lumber options market. In the options market, volume and open interest have shown a much higher correlation with prices than has been the case in futures (Figs. 101-105). Also, options open interest now exceeds futures open interest. The most likely explanation of this situation is that price volatility is attracting trading activity. It is unlikely that the increased trading activity has caused prices to rise.

Figure 100

Lumber Futures Trading and Prices of Spruce 2x4's
Delivered Boston, January 1992 – March 1993

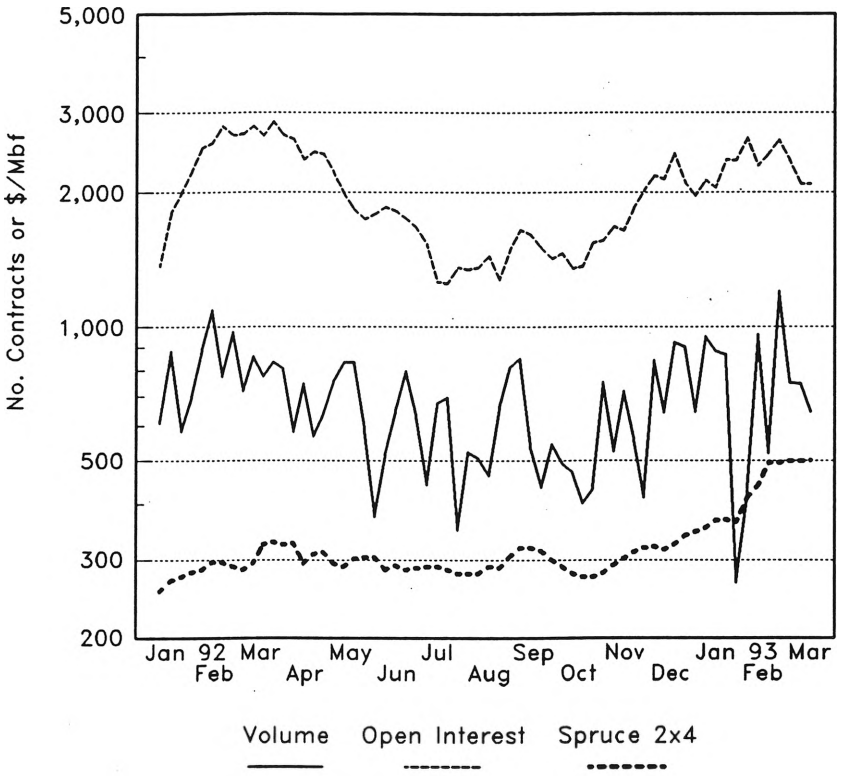
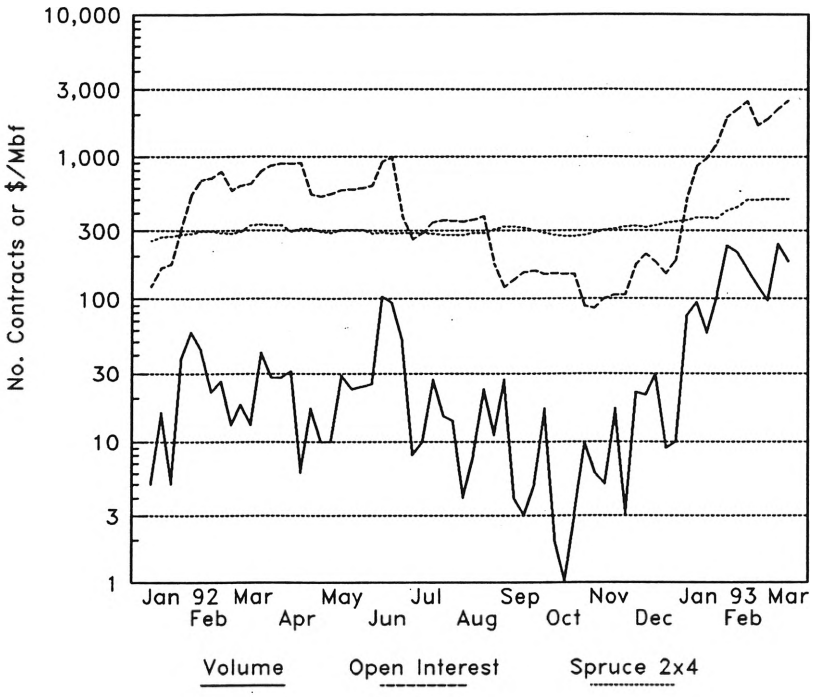


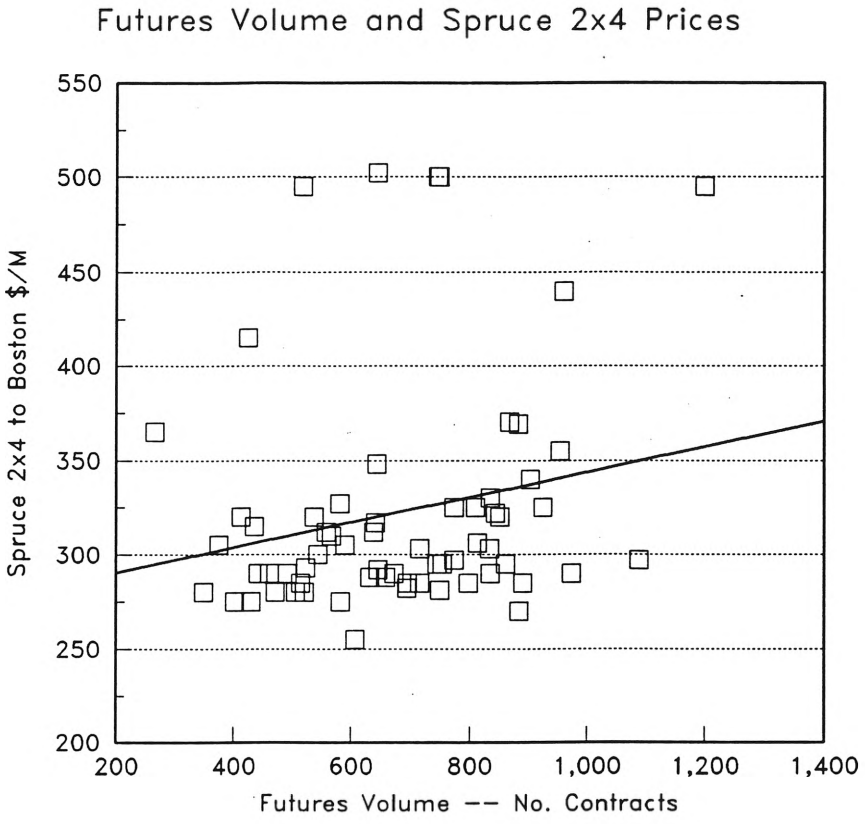
Figure 101

Lumber Options Trading and the Price of Spruce 2x4's
Delivered Boston, January 1992 – March 1993



Source: Chicago Mercantile Exchange and
Eastern Quotes & Comments.

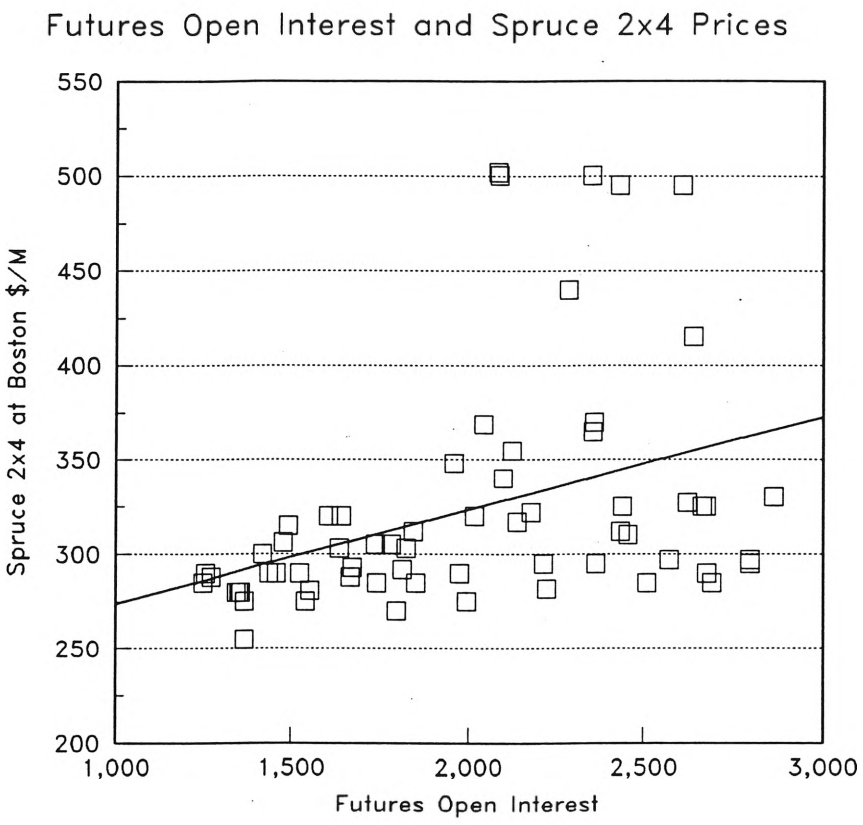
Figure 102



Regression Data

a	277.2
b	.0666
r	.0443

Figure 103

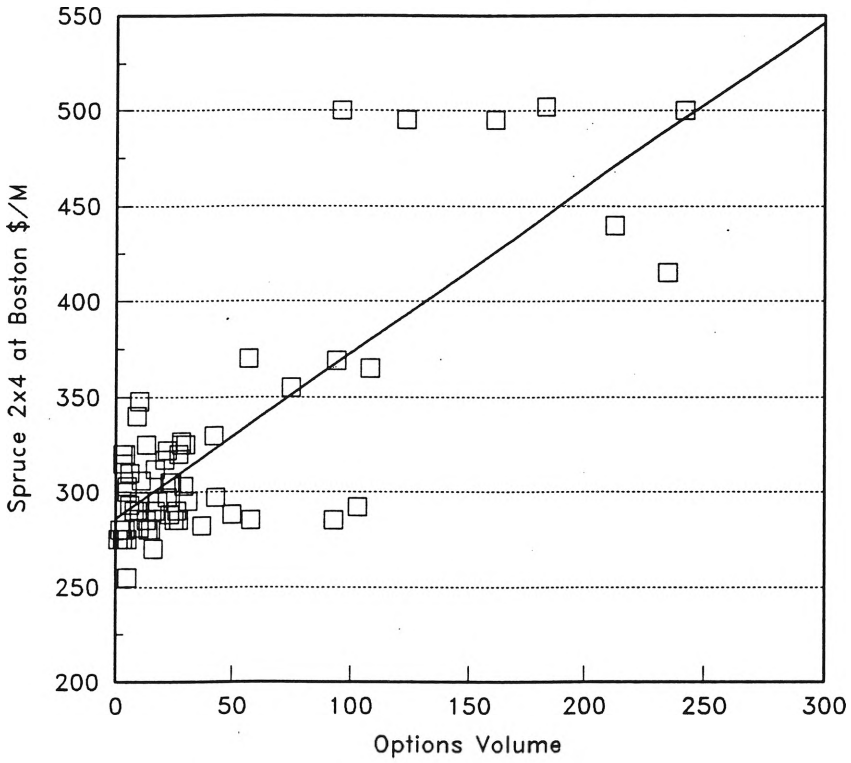


Regression Data

a	224.31
b	.0494
r	.15

Figure 104

Lumber Options Volume and Spruce 2x4 at Boston

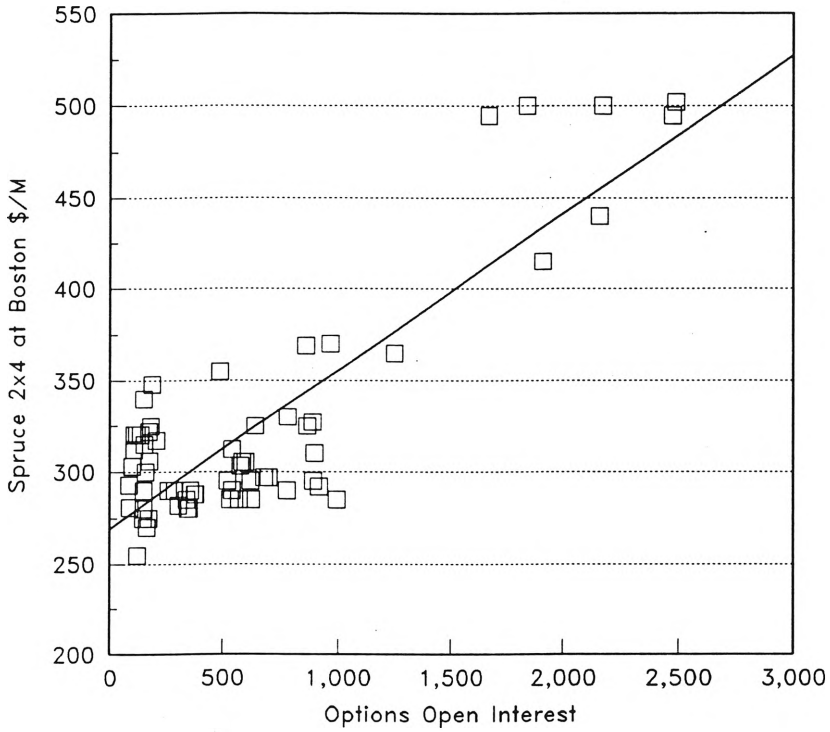


Regression Data

a 286.12
b .8674
r .6556

Figure 105

Lumber Options Open Interest and Spruce 2x4 Prices



Regression Data

a	286.12
b	.0859
r	.7264

2.5 ELASTICITIES OF DEMAND AND SUPPLY

2.5.1 General

Demand and supply elasticities are ways economists talk about supply and demand conditions to help them analyze how changes in the marketplace affect prices paid and quantities traded. An elasticity is a ratio between the relative (percentage) changes in two related variables. So a demand elasticity is the percent change in quantity purchased for every one percent change in price. Similarly, a supply elasticity is the percent change in quantity supplied for a one percent change in price. For ease of illustration, demand and supply curves are often drawn as straight lines. Along these lines the elasticities change, even though the slopes do not. For very small changes in quantity or price, the assumption that curves are linear, or that elasticities are constant, can be useful. A major difficulty, however, is that price and quantity changes seen in the softwood lumber market are often very large; for such large changes, elasticities cannot be assumed to be constant. In reports on econometric modelling studies, measured elasticities are normally reported as evaluated at the means of the variables. Also, elasticities may vary between species, grades, and regions, depending upon substitution opportunities available to end users.

2.5.2 Demand and Cross Elasticities

Measured elasticities of demand will be strongly affected by how data are aggregated across species, grades, and time. As might be expected, studies confirm that demand elasticities for individual species are much higher than for lumber as a whole.

Elasticities for the very short run (market period) of weeks or months are likely to be highly inelastic for the reasons described above. Elasticities measured over 3-5 year periods will be lower, reflecting more abundant substitution opportunities and the time that users have to make changes, which often requires persuading their customers to accept new materials. The few studies that have addressed this point find it confirmed empirically (Alexander and Greber 1991, Spelter 1985).

In analyzing substitution of other materials for lumber, cross elasticities are used. A cross-elasticity measures changes in quantity purchased of another product, compared to changes in price of a given product. For example, a cross-elasticity might measure how responsive the usage of aluminum siding is to small changes in the price of wood siding.

A few scattered measures of cross-elasticities have been made (Spelter 1985, McKillop, Stuart, and Geissler 1980). This distinction is important, because while weekly and monthly price behavior is probably controlled by own-price elasticities, the price behavior and quantity purchased over the years are likely to be determined increasingly by the cross-elasticities that describe substitution relationships. Cross-elasticities undoubtedly change over time, may respond to fashions in the marketplace, and may be very different at different price levels. Also, substitution trends are strongly affected by installed cost comparisons, in which differences in labor and equipment costs can often play a major role.

Surely, elasticities are not a static matter. Buyer behavior and choices of substitutes depend upon their expectations. If buyers in late 1979 had expected green fir 2x4's to stay at $320 for the decade of the 1980's, their attitude toward steel studs would have been one thing. While no one expected that this same item would stand in the $150 range just 3 years later, most market participants recognized that the $320 price would prove to be temporary as indeed it did.

Statistically measured elasticities are subject to the same difficulties as noted above. For this reason, the range covered by available estimates is wide. For example, in the ITC (1992, p. 42) countervailing duty investigation, commissioners accepted staff estimates that the elasticity of softwood lumber demand ranged from -0.3 to -0.9. With such a wide range, clear estimates of effects will be elusive.

Many of the experts and market participants interviewed for this project emphasized to us that the very structure of the market is changing. In their view, elasticities or other relationships measured with datasets ending in the mid 1980's will not depict the new market relationships that will exist in the 1990's. For this reason, we do not undertake any detailed calculations of the effects, for example, of the 15% countervailing duty.

2.5.3 Supply Elasticities

Supply elasticities measure how responsive quantity sold is to changes in prices. Supply elasticities are affected by imports, marketing system behavior, and other factors in addition to supply decision by mills. Supply elasticities as measured in econometric studies cover a wide range. (For a valiant effort at a worldwide application, see Cardellichio, et al. 1988).

Observers we have talked to believe that US and Canadian supply is becoming less elastic and more tightly constrained, largely by reductions in public timber supplies in the western US and in BC. These reductions are leading to several relevant effects:

-- reductions in industry manufacturing capacity;

-- increases in export log prices;

-- increases in prices of federal and private stumpage.

On the other hand, these same price increases will lead to improvements in productivity, increases in supply from competing overseas regions, increased economizing in end use markets both at home and abroad, and substitution of competing materials, including hardwoods and composite wood products. Further, they create the potential for improvements in longrun supplies due to more intensive management. These mitigating effects, however, will take years or decades to fully work themselves out.

2.5.4 Anticipated vs. Unanticipated Shocks

Shocks that affect a commodity market are of two kinds -- anticipated and unanticipated ones. Most, but not all, policy changes fall in the first category. Significant change in tax levels (Canadian GST), import tariffs, overseas tariffs or quotas, log export policies, or other major policies are likely to be debated or expected for months in advance (Table 30). The actual size or impact of the change may remain unknown until the policy is announced. As information changes, the markets will discount the expected impact in advance. This is why the January 1987 imposition of a 15% export levy on Canadian softwood shipments to the US did not cause an immediate 15% increase in delivered prices, or a decrease in FOB mill prices. The likelihood that a duty would be imposed was foreseen and already discounted into prices. Of course, market expectations about policy changes can be proven wrong, in which case prices will often adjust accordingly.

Table 30
Economic/Policy Events Affecting Lumber Prices
1980-1992

1980	June	Housing report sparks rally.
	Fall	Slower demand, election cools market.
1984		Election results/interest rate cut stimulates buying.
1985	Winter	Production cutbacks due to slow chip markets cause buying in so. pine.
1986	February	Rally sparked by housing news...short-lived.
1987	October	Stock market crash--prices fall after hitting yearly peak.
1989		Western stumpage prices rise.
1990	April	Thomas report recommends major reservations for Spotted Owl; markets rise
	June	Owl listed; no price response; news discounted in advance.
	August	Bill banning log exports and restricting exports for Oregon/Washington state lands signed Economy moving into recession
		Kuwait invaded; UN forces dispatched to Gulf.
1991	January	Housing starts fall to lowest monthly and annual level in decades.
	February	End of Gulf War restores consumer confidence.
	May	Dwyer injunction halting federal timber sales in PNW sparks major lumber rally.
		Prices peak in midsummer and then retreat.
1992	Spring	Owl litigation continues.
	October	Owl Plan thrown out by court, ensuring no quick restart of federal timber sales.
	November	Clinton elected, promising major infrastructure program. Economic news turns momentarily positive. President Clinton promises Timber Summit.

Source: Random Lengths Yearbooks, Chrono. Section.

It is the unanticipated shocks that are most likely to affect prices visibly, especially if they are large or of uncertain impact when they first appear (Table 31).

Combing over the Random Lengths Yearbooks and other sources for events of this kind yields a listing of situations in which prices were noticeably affected (Table 31). It appears that on one or two such events will occur in an average year; effects on prices are usually transitory.

Table 31
Weather, Fire, Strikes, Other Events Affecting Softwood Lumber Prices

1977	Winter	Weather depresses demand and prices.
1978	Winter	Car shortages; offset slow demand.
	October	Mild weather keeps construction busy and helps prop up prices.
1979		Low inventories/car shortages strengthen producers' positions.
	June	Labor problems tighten market. Fuel price protests disrupt trucking... sparks midsummer rally.
	August	Rally, followed by November slump.
1980	Winter	Mild weather maintains demand.
	May	Mt. St. Helens eruption creates momentary supply uncertainty.
1981	June	Strike threat in BC prompts insurance buying.
1982	June-July	Concern over production cutbacks prompts buying.
1983	January	Cold weather slows demand.
	Spring	Weather inhibits demand.
1984	Winter	Weather inhibits demand.
	February	Possible BC strike stimulates buying.
1985	Fall	Storms depress demand; Hurricane Kate soaks south; slows logging.
1986	June	Weyerhaeuser strike stimulates buying.
	Fall	Supplies tightened by prolonged BC strike; market weakens when strike resolved.
1987	Late Summer	Severe western fire season slows logging.
1988		Severe western fire weather slows logging (Yellowstone fire).
	Summer	Minor strikes.
1989	January	Strike at one company sends prices up.
	September	Hurricane Hugo hits South Carolina; prices rise.
	October	San Francisco earthquake; brief ripple in prices.
1992	Spring/Summer	Pulpmill strike in BC tightens supplies
	August	Hurricane Andrew causes panic buying in plywood and lumber.

Source: Random Lengths Yearbooks, Chrono. Section.

2.5.5 Attributing Price/Production Changes to Causes

In a fluctuating commodity market, attributing price changes to particular causes is extremely difficult. The first reason is data imperfections. It cannot be assumed that the data as published are a complete and fully accurate depiction of reality; those who produce and use the numbers acknowledge their imperfections. Price formation depends on a variety of perceptions and expectations held by traders that are affected by unexpected news, by trade rumors, and by many different economic events. Also, lumber production and inventory data, starts data, and other economic data arrive months after the fact and so can only affect prices if they cause traders to significantly revise their impressions about current market conditions.

The second reason is that market behavior is governed by expectations, which cannot be measured. Because expectations are so important, simple interpretations of supply-demand behavior are often wrong. For example, when prices fall, especially when they are falling rapidly, it does not always lead immediately to increased buying. In fact, if buyers expect the market to weaken, they will reduce their purchases hoping to buy at more favorable prices in a week or two.

The third reason is that multiple factors are always interacting on current market conditions and expectations, as we will outline in more detail below.

A fourth reason is the high level of volatility that is inherent in the month to month functioning of the industry, customers, and international traders. This amount of "noise" in the data may well obscure important underlying market forces.

A final reason is the occurrence of unanticipated disruptions to supply or demand that affect the market. Depending on their severity and other market circumstances, such shocks may or may not materially affect prices.

A useful example of the difficulty in attributing changes in prices and price levels to causes is found in the conflicting views of the ITC Commissioners in the lumber countervailing duty case (USITC 1992). In this case, the commissioners were divided as to whether: (a) Canadian resource pricing policies represented a significant subsidy; (b) whether rising lumber imports affected US prices; and (c) whether such effects "materially injured" US firms.

Occasionally, these shocks develop into extraordinary "bubbles" that push prices to

unheard of new levels before they settle back down to normal again. Through case reviews of these bubbles, we will later attempt to learn more about market behavior.

The rapid price increases of October 1992 to March 1993 prompted many suggestions that speculation was involved. Certainly any commercial market participant is motivated to consider expected future price direction in making inventory and selling decisions. Cumulatively, such decisions can augment upward or downward market pressures. At a time such as late 1992, when inventories were clearly low, anyone seeking to build inventories might be accused of speculation. Since we have no dependable and detailed data on inventories, anecdotes about the state of "the pipeline" cannot be checked.

The principal avenue in the market for pure speculation unrelated to an ultimate commercial use of the product is the futures and options market. Yet the level of activity in these markets is so small that it is difficult to imagine that they can divide the cash markets for long. In fact, the prime commercial purpose for futures markets is to reduce the risk of holding inventories. For whatever reasons, to data the futures/options markets have had little impact on this objective.

There is extensive literature in economics about the effects of speculation, primarily in securities and foreign exchange markets (Stiglitz 1990, Froot and Obstfeld 1991). There is no consensus that speculators alone can determine the direction of broad, deep cash markets such as those for lumber. But Choe (1990) suggested the possibility that speculation contributed to price bubbles in nickel in 1988. In a recent symposium (Stiglitz 1990) authors were generally skeptical of the importance of pure speculation even in famous bubbles of past history.

Between the multiplicity of interacting factors, and the importance of transitory supply and demand shocks, teasing out the individual effect of any one factor is virtually impossible. For example, the scatterplot of the monthly R/L framing lumber composite price index vs. housing starts displays a striking degree of looseness for a variable that dominates the seasonal and annual fluctuations in demand (Fig. 106).

The scatterplots suggest that prices are not related to individual important factors in any strong or simple way (Figs. 107-109). The plots show that significant shifts have occurred over time in the nature of these relationships, suggesting that changes in structure are in fact occurring. Considering for example Fig. 106, which plots the framing lumber composite against unadjusted monthly housing starts. Given the large consumption share

and the high variability of this sector, a strong association between its activity and lumber prices would be expected. Instead, the points are everywhere and the simple correlation is below 20%. Looking more closely, we see that the high starts of 1978-80 were associated with high prices (the "1's" in the plot). Also, the low starts of 1981-82 were associated with the lowest prices of these years. Looking at the "4's" in the plot takes us to the 1988-92 years. In this subperiod, we see the highest prices reached, but only at low to moderate levels of starts. Part of the explanation for this probably lies in shifting supply relationships, and part in the strong growth on non-housing uses of lumber.

Figure 106

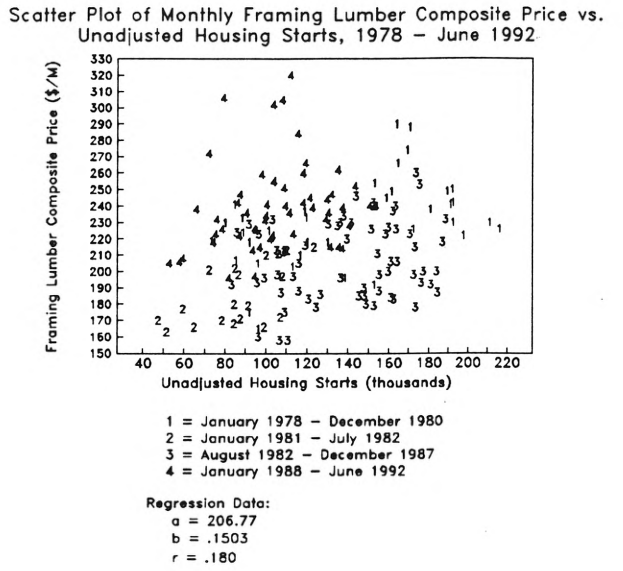


Figure 107

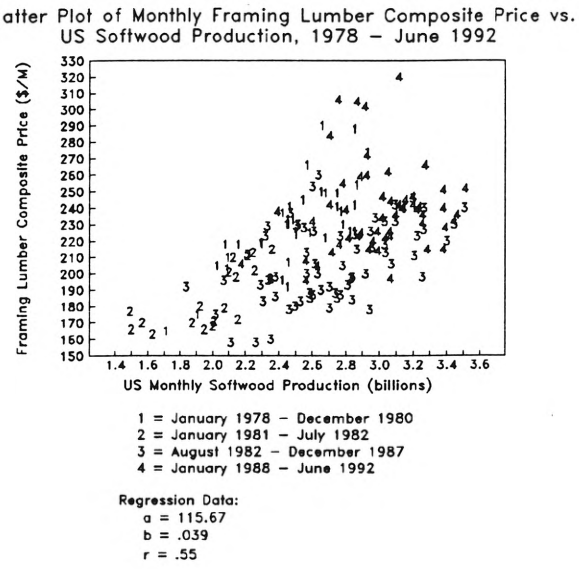


Figure 108

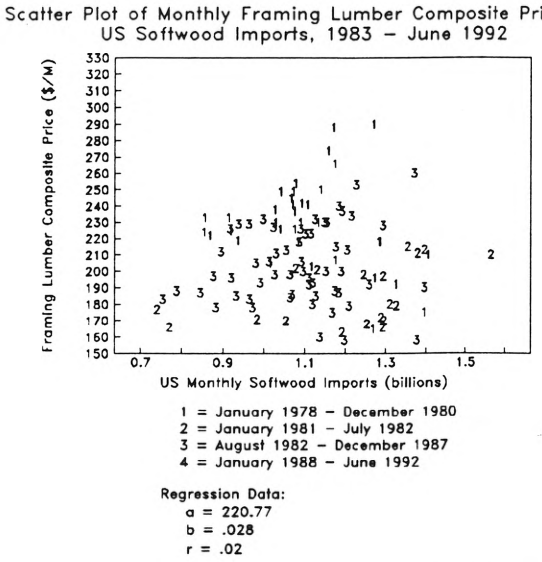
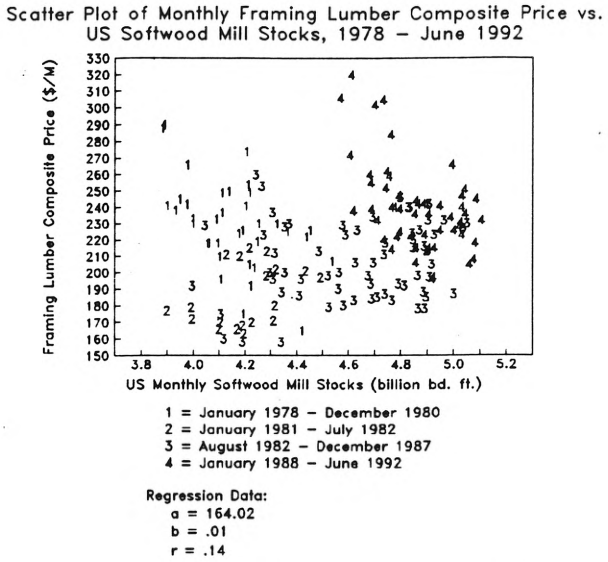


Figure 109



Now no one would expect that 2-variable scatterplots like these would yield crisply defined supply, demand, and inventory relationships. What the plots do show, however, is how multifaceted and complex the relationships are. The scatters suggest that there is a strong role being played by factors such as market sentiment, rumors, unexpected news, strikes, and other events that are difficult to quantify statistically. In an early statistical analysis of monthly data, Oliveira and Whitaker (1979) encountered similar results.

2.6 UNDERLYING FORCES AFFECTING THE US SOFTWOOD LUMBER MARKET SINCE THE LATE SEVENTIES

Shortrun price behavior is affected not only by week-to-week and month-to-month changes in supply, demand, and market expectations, but also by more slow-moving underlying forces. These forces may behave in unexpected ways and can at times change directions unexpectedly. Their effects on the market take time to fully work themselves out. Examples of such forces are considered in this section, including the exchange rate on the Canadian dollar, the export levy and countervailing duty on imported Canadian softwood, the log export trade, and the changing supply of federal timber.

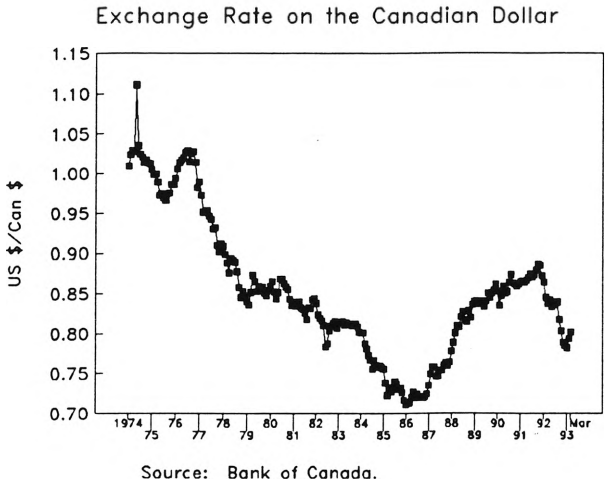
2.6.1 Canadian -- US Dollar Exchange Rate

One slow-moving force affecting US lumber supply and price levels is the exchange rate on the Canadian dollar. Given the multiplicity of influences on North American supplies and demands, it is difficult to isolate the effect of any one factor, as we note above. The methodological issue is to determine how to explore a counterfactual case...say, one in which the exchange rate remained at a given constant level over a period of time, and compare outcomes with those actually observed.

One reason why changes in exchange rates may have little immediate effect on prices or on volumes traded is that exporters may be able to absorb the effects of adverse rate fluctuations for a period of time. Likewise, when rates change favorably, the ability to expand supply may be limited by various constraints.

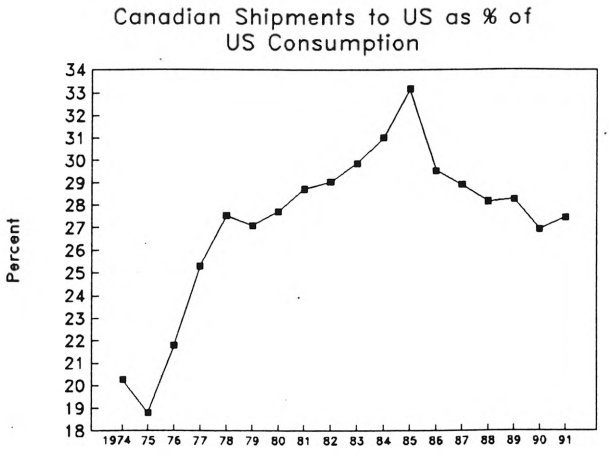
For example, the Canada-US exchange rate fell significantly during two periods of exceptionally strong US lumber demand --- the late 1970's, and the first part of the mid-eighties boom (Figs. 110 and 111). But after 1986, the rate turned decisively against Canadian producers. This was quickly reflected in declining Canadian industry profits and helped initiate a slow decline in the Canadian share of the US market. That share peaked in 1984 (at 32.5%) and slid to 26.2% by first quarter 1991. Well into the declining markets of the late 1980's and early 1990's, the rate continued to rise until a decline resumed once again in late 1991.

Figure 110



Source: Bank of Canada.

Figure 111



Source: USDA–FS PNW Res. Bull. 151.

An example illustrates the large leverage of changes in the exchange rate (Table 32). The example assumes a profit of $107.4/M at a 70 cent rate; break-even would be achieved at a one-for-one parity; no other changes occur. Several implications emerge. First, the effect increases with successive ten cent shifts in the rate. Further, the proportional impact on profits is far greater than on sales realizations as measured in Canadian currency. An analysis by Waggener (1991) reached a similar result. He argues that the changed revenues had to affect Canadian market share; Kaiser (1991, p. 4) agreed. Using this admittedly stylized example, the shift in the exchange rate that occurred from 1986 to early 1992 vaporized $79/Mbf of profits that had been realized at the 70 cent level. The BC softwood industry not only faced currency losses on this order of magnitude, but in addition saw its stumpage costs on Crown timber rise dramatically. Due to falling demand, after mid 1989 there was a deterioration in US dollar prices and in US and export sales volumes. Small wonder, then, that from the beginning of the period of a stronger Canadian dollar, which was partly engineered by the Bank of Canada, major Canadian export industries complained bitterly.

Table 32
Example: Canadian Lumber Profits as Affected by the Exchange Rate

Item (per Mbf lumber)	US Dollars per Canadian Dollar A: $1.00	B: $ .90	C: $ .80	D: $ .70	
Delivered logs	220	220	220	220	
Variable costs	60	60	60	60	
Chips	-30	-30	-30	-30	
Lumber price FOB (US)	250	250	250	250	
Realiz. $C	250.00	277.78	312.50	357.14	
Increm. Realiz. %		11.1%	12.5%	14.3%	read across
Profit	0.00	27.78	62.50	107.14	
Increm. Profit %			125.0%	71.4%	

Note: Effect not linear.

First 10 cents adds $28 to profit; second 10 cents adds $34.

Impact on profit larger than on realizations: a move in $C from .7 to .9 vaporizes $79 of profit.

While this example may exaggerate the magnitude of the effects of exchange rates on profits, it surely represents something that is real. It would be extraordinary indeed if changes in the exchange rate of the size actually experienced were to have no effect on pricing and on the Canadian market share. The changes in sales realizations can also be read from the table. While these are far smaller, they are not insignificant, and considered in light of likely inelastic supplies, they would be likely to evoke some supply response.

In the actual marketplace, exchange rate changes of this magnitude will affect bids for stumpage, will influence freight rates, and will cause other second-order adjustments that would render this stylized example a poor tool for predicting actual outcomes.

Econometric results on the impact of the exchange rate vary (Irland 1987, Buongiorno, et al. 1988, Jennings, et al. 1991). Some studies find a significant effect on prices and on Canadian shipments into the US. Others find that there is no statistically significant effect. The models in question use different functional forms and model specifications, different estimation methods, monthly, quarterly, or annual data, and different estimation periods. Significantly, some of them do not include the recent upswing in the Canadian dollar in their estimation period. Looking at the chart, it is easy to see how a model estimated with

data ending in 1986 could conclude that there is no effect from the exchange rate. The time trend in the exchange rate would probably be picked up by another trend variable, with resulting biases in both coefficients.

2.6.2 Effect of the Countervailing Duty on Canadian Lumber[1]

The effects of the export levy/countervailing duties on lumber prices in the North American market ought to be easy to analyze and measure. During January 1987 - October 1991, the Canadian government collected an export levy on softwood shipments to the United States, under a last minute Memorandum of Understanding agreed to in the waning hours of 1986. The full rate was in effect with full coverage, for about 9 months (Table 33). The levy was eliminated for the Maritimes in summer 1987 due to the agreement of the two governments that those provinces should be exempt. It was eliminated for British Columbia at the same time in recognition of the substantial increases in Provincial stumpage charges. Later, the rate for Quebec was reduced. By summer 1991, the effective rate on all Canadian lumber was less than 2%. After Canada terminated the MOU, bonds at the 14.48% rate were required for a time during early 1992, and the final duty was imposed at a 6.51% rate in late spring.

[1] The Irland Group performed certain consulting services for the US Coalition for Fair Softwood Lumber Imports during the 1991-92 countervailing duty proceeding. For further background, see Smyth (1987).

Table 33
Chronology of Export Levy and Countervailing Duty on Canadian Softwood Lumber Entering the US

1982-83		US Industry files unsuccessfully for countervailing duty.
	March	Trading slowed by concerns over possible countervailing duty announcement.
1986	May	US industry files again for duty (27%).
	October	Trade agencies propose 15% duty. Causes trading to slow down.
1987	January 1	Canadian government initiates 15% export levy.
	Late 1987	Maritimes and BC exempted from duty, BC on basis of increased stumpage revenues.
	October	Canada terminates the 1986 MOU on lumber export levies.
	October 31	Dept. of Commerce Self-Initiates countervailing duty proceeding.
1992	March	Commerce Dept. announces determination of 14.48% subsidy rate and Customs begins requiring a bond at this rate.
	May	Final duty rate determined to be 6.51%.

The imposition of the export levy for the first 9 months of 1987 would seem to provide an excellent natural experiment. It covered about 32% of the softwood lumber used in the US (probably a larger share of dimension used in construction), and was levied at a 15% rate, a large enough amount to be noticeable. Demand and production were near cyclical peaks. Yet, there seems to have been no published ex post econometric examination of this "experiment."

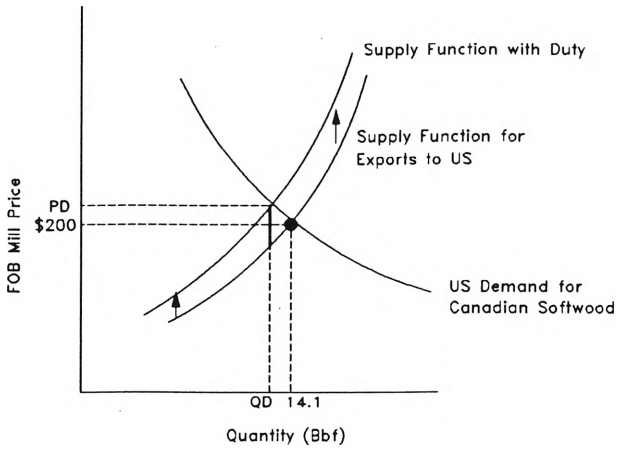
As clear as the situation appears to be, there is high normal variability in prices and shipments. There were other changes underway, as demand began to peak, as BC producers anticipated large increases in their stumpage costs, and as the Canadian dollar bottomed out relative to the US dollar. Given that the markets had time to discount the likely imposition of the export levy ahead of the actual announcement, it is not surprising that there was no obvious spike in prices at that time.

On theoretical grounds, the incidence of a duty depends on the relevant supply and demand elasticities. While this can be conceptualized in a more complete manner (see, e.g. Boyd & Krutilla 1987), the chart illustrates the essential point. The elasticities would

be those applicable to the US demand for Canadian imports and the supply of those imports to the US market. For convenience, the chart uses rough annual quantity and price levels applicable for 1986. Given the wide ranges in the available elasticity estimates, we attempt no formal calculation here. But a schematic analysis shown in Fig. 112 suggests that the duty would fall on both producers and consumers, the exact split in the short run depending on the elasticities.

Figure 112

Schematic: Incidence of a 15% Export Levy
on Canadian Softwood Lumber



Our conversations at the time with lumber market participants elicited divided opinions as to the 1987 levy's impact on prices. Some asserted that it was being passed on to customers; others that the mills were absorbing it. Still others declared that they couldn't really tell.

To illustrate the complexity of market response to the duty we excerpted market comment from three weekly market newsletters that provide price quotations and comment on softwood lumber markets. The week-by-week observations of market commentators indicate that market responses to policy changes such as the imposition of tariffs is a confusing process and is anything but straight forward to analyze.

Random Lengths is a leading national lumber and panel products newsletter. Coded (R) in excerpts.

Pribec is published in French with English summary, by the Quebec Lumber Manufacturers Association. Coded (P).

Eastern Quotes & Comments[2] is a regional newsletter serving producers and wholesalers in the eastern US and Canada. Coded (E).

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Aug. 30 - Sept. 5, 1991

The Canadian Govt. announced that on Sept. 3 Canada has retired from the Memorandum of Understanding and will not pay a 15% export tax on softwood lumber shipments to the US. The US industry is opposed to the decision and retaliation measures could be undertaken by the US Government. The importance of this decision brought confusion into the market with Ontarian producers, who are exposed to the 15% export tax, virtually off the market and intended to dry a maximum of lumber. (P)

Sept. 27 - Oct. 3, 1991

With all of these rumors buyers and sellers are taking defensive positions to avoid bad surprises. This created the number of transactions to be limited and the prices to move sideways. (P)

October 4, 1991

The Bush Administration has imposed provisional duties on Canadian lumber entering the US...

US markets for Canadian lumber went into a holding pattern immediately following the announcement....(R)

February 7, 1992

The potential for a countervailing duty resulted in a new set of selling strategies by some Canadian mills. However, rumors outnumbered facts. (R)

February 14, 1992

SPF traders wrestle with CVD questions--Canadian lumber producers are struggling to sustain the market's early-year momentum a crucial date in the countervailing duty investigation nears. They also want to avoid a repeat of the sharp, erratic price swings that characterized the previous countervailing duty case in 1986.

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[2] Eastern Quotes & Comments is published by The Irland Group.

Wholesalers and dealers turned away when most producers began quoting "duty for customer account" on shipments that would cross the border after March 6. A few mills quoted "duty for mill account," but most were unwilling to take that risk.

During the 1986 investigation, western SPF prices fell prior to the preliminary and final rulings...(R)

February 21, 1992

Order files are certainly being kept in check as the market awaits the US Commerce Department's March 5 announcement on the countervailing duty. (E)

February 28, 1992

Order files have retreated significantly to two weeks and less. (E)

...traders are asking a familiar question: "Who would really pay a duty?"

This is a question no one can answer, at least in the near-term. Lumber prices are not set by producers. They are established by the collective decisions of retailers out in the marketplace. Ultimately, prices are set by the balance between the volume mills are making, and the demand. If the total of dealers' individual buying decisions is less than the volume mills want to sell, prices fall; if it's more, prices rise. The market doesn't "care" about mills' costs, whether they include a duty or not.

This is not to say that a duty wouldn't have an effect on markets, but its impact would be subtle, hard to track, and long-term. The added cost for Canadian producers would ultimately affect the volumes supplied to the US by Canada, and that in turn would put upward pressure on the prices dealers pay. (R)

March 6, 1992

Dry dimension sales in Boston were strong...Mill inventories are low, but there are reports of significant amounts of wood being held by wholesalers on the US side of the border. (E)

Many producers are staying out of the market until they know what is ahead. (P)

March 13, 1992

The US Government has imposed a 14.48% countervailing duty...Canadian markets moved sideways and demand is flat...(P)

...considerable confusion accompanied the early stages of the duty, and trading in many Canadian items slowed to a trickle...both the quality and quantity of the price information we gather have temporarily suffered on Canadian items.

The situation is doubly complicated in western red cedar, where many items are produced in both Canada and the US. Canadian cedar mills raised prices to reflect the duty and quoted prices with the duty in. Most US mills took the opportunity to also raise prices. (R)

Western red cedar traders spent much of their time assessing the impact of the interim countervailing duty. Canadian producers raised their prices by the amount of the duty, while US producers responded with increases ranging from 5-10% or went off the market to see how the issue would shake out.

Trading in western red cedar was in turmoil due to the potential countervailing duty on shipments from Canada. The issue preoccupied traders, many of whom criticized the potential tariff as counterproductive and draconian. Most buyers approached the market cautiously, buying Canadian wood only if it could ship in advance of March 6...(R)

March 20, 1992

Duty placed helped push the composite price to its new record. (R)

Sales...Engelmann...sporadic as traders continued to assess the impact of the countervailing duty. (R)

Canada...On the orders booked, were able to pass most or all of the duty on the buyers. (R)

March 27, 1992

...misconception that the court's ruling would open up northwest forests for harvesting led to rumors...prompted secondaries to dump some stock at prices well below replacement costs. (R)

April 3, 1992

Producers saw a generally low level of activity as heavy shipments that preceded the countervailing duty worked through the system. (R)

If US customers are reluctant to pay higher prices they must insure some stocks regarding the time of year. So shipments have been consistent despite the fact that buyers limited purchases for immediate needs. (P)

April 10, 1992

...Cedar trading remained clouded...Reluctance to buy was due in large

part to the prospect that the interim duty might be reduced or eliminated...Buyers aggressively countered Canadian producers. Inventories at mills in Canada started to build. (R)

April 17, 1992
Confusion over the application of the countervailing duty disrupted trading in Canadian items. (R)

April 24, 1992
Buyers stuck to "must-have" purchases...(R)

****

These excerpts display the significance of several factors that determine immediate market responses to tariff imposition or changes:

a) efforts by producers to pass the tariff forward;

b) efforts by buyers to stockpile in advance of an anticipated duty;

c) confusion over specific details of computing and paying the duty;

d) attempts to try all possible options to avoid or reduce the impact of the duty;

e) efforts to avoid making any commitments until the price impact becomes clear.

All of these forms of strategic behavior by market participants can affect how prices respond. On balance, the view expressed in Random Lengths Feb. 28, 1992 (above) seems a judicious estimate.

In the case of the countervailing duty imposed by the US in 1992, there was general agreement that the duty did affect the US market; some observers referred to the later winter rally in prices as the "countervailing duty rally". A further description of this rally is provided in the section below analyzing the various price bubbles.

In summary, there is no clear consensus on how the Canadian export levy of 1987-91 and the US countervailing duties of 1992 have affected prices in the softwood lumber market. Waggener (1991) argued that the duty was important, but that by the late 1980's it was overshadowed by the large exchange rate shift discussed above. Kaiser (1991), argued that the export levies "appear to be effective in reducing imports from Canada" (p. 2). It seems certain that they did have some effect on prices, though the size of the effects

has changed with the varying levels charged, and the varying coverage of Canadian production. Given that the shortrun supply elasticities in the market appear to be changing toward becoming more inelastic, the price effects and their incidence may also change. On related points, see Harrison (1991).

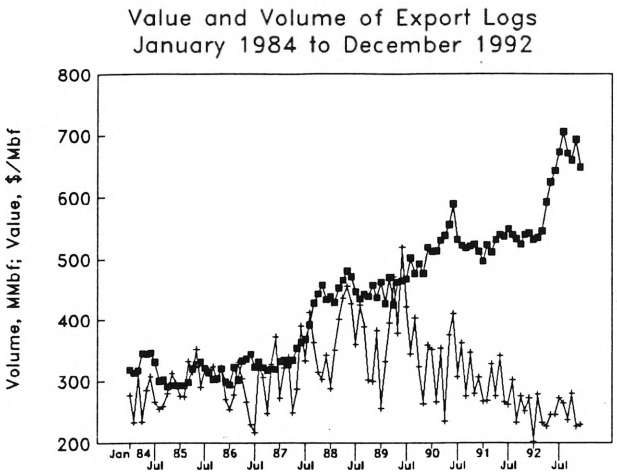
2.6.3 Log Exports

Softwood log exports have a significant effect on the US industry in the Pacific Northwest, where large volumes of logs are exported. Other areas such as Maine, northern New England and New York, are affected by log exports at times but because of the small volume of production in these areas, the national market impact is small.

The effect of the log export market on the Pacific Coast's stumpage market and lumber industry is complex (see, e.g. Flora and McGinnis 1992). It has to be seen in context of a trans-Pacific chip market that gives a strong boost to sawmill chip revenues. Also, embargoes on logs from Federal lands may partially protect the industry from the full force of foreign competition for raw material. This may lead to higher prices for logs from private lands. Whether high export log prices spill over into federal stumpage prices is difficult to say. Also, the export market tends to concentrate on species that are less valuable on the domestic market, but this does not mean that other log prices are unaffected. Finally, export log volumes and prices depend on economic conditions in Japan and on the yen-dollar exchange rate. To untangle all of these complex interrelationships is not within the scope of this study. Simple interpretations are likely to be misleading. Some observers argue that higher demand for export logs causes higher local stumpage and lumber prices. On the other hand, domestic supply and demand changes certainly affect export log prices as well. There is no single answer. For a review from a coastwide perspective, see Irland Group (1991), Appendix.

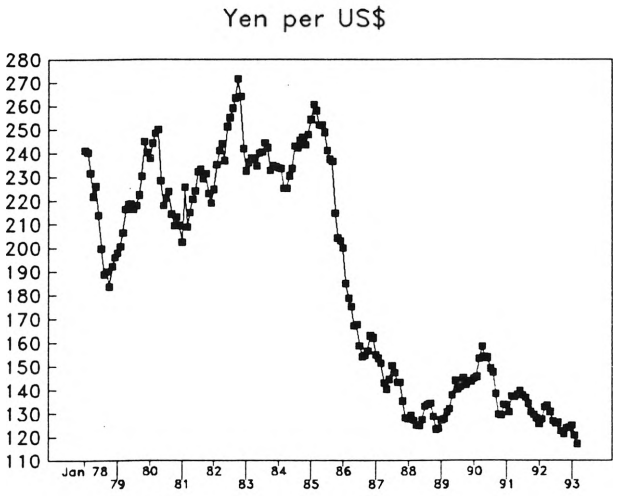
What is clear is that since 1989, despite weak economic conditions in Japan and a significant decline in export log volumes, export log prices have risen significantly. Interestingly, they did not react strongly to the spring 1991 Dwyer injunction price bubble in the US lumber market, but began a strong upward move early in 1992 (Figs. 113 and 114).

Figure 113



Source: Prudential Securities.

Figure 114



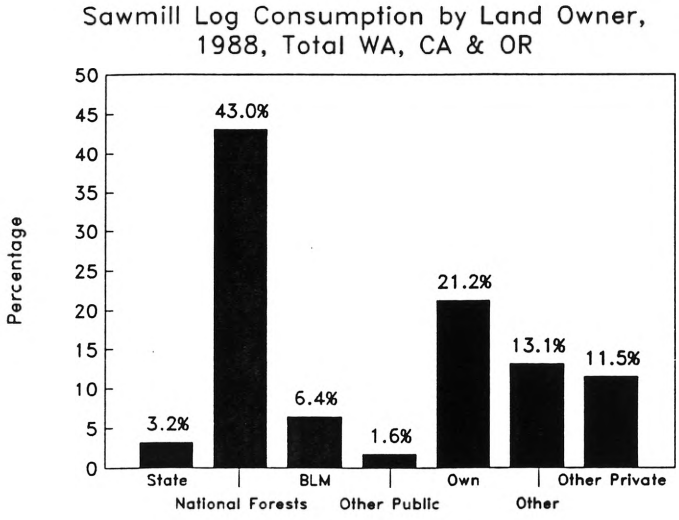
Source: Joel Popkin & Co.

2.6.4 Timber Supply

A number of forces have slowly changed the timber supply conditions facing the sawmill industry. In the South, for example, it has become clear that in local areas the harvest is reaching the maximum level that can be sustained by future growth. In Maine, and parts of Quebec and the Maritimes, damage caused by recent spruce budworm

outbreak yielded a surge of salvaging but has depressed growth and caused extensive mortality, depressing near-term harvest potential. In parts of the west, insect and disease outbreaks, while depressing growth rates, may lead to localized pulses of increased supply while salvage is completed. In British Columbia and other parts of Canada, long-term allowable cuts have been exceeded and land management goals are changing, so that declines in timber supplies are likely there also. Yet the most significant and fast-changing force affecting supply is surely the expected 1993 harvest level on federal lands. In the three states accounting for 43% of US softwood production in 1990, the sawmills obtained 49% of their log supplies from federal (USFS and BLM) lands in 1988 (Fig. 115).

Figure 115



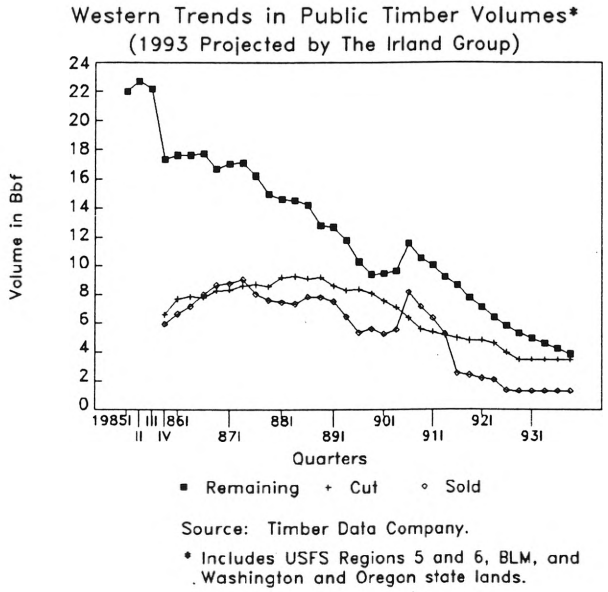
Source: USFS, State of Washington.

As management priorities have shifted on the National Forests and the BLM lands, timber sale levels have changed. By the early 1970's, it was clear to many that an increase in federal timber harvests could not be expected. By the early to mid 1980's, new Forest Plans were programming reductions in future cutting, and major statewide wilderness bills and roadless area reservations were beginning to have an effect. Improvements in resource inventories led some National Forests to conclude that long-term sustained yields had previously been overestimated, and suitability determinations played a significant role. Also, many Forests discovered in the late 1980's that analyses underlying their Forest

Plans had underestimated the cumulative effects that Standards and Guidelines would have in reducing allowable cut potential. So long as these changes were gradual, and as Canadian supplies continued to respond to peak US demands, the markets adjusted to these changes.

But in 1989-92 the situation changed dramatically. A variety of forces continued to constrain the ability of the National Forests to offer new timber sales, so the uncut volume under contract, declining since the early 1980's, could not be replenished. Then, litigation over the spotted owl led to a virtual standstill on new sales in mid 1991. Uncut volumes now stand at historic lows (Figs. 116 and 117).

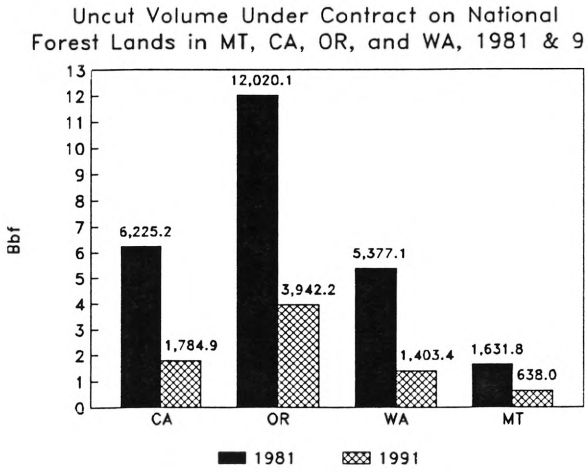
Figure 116



Source: Timber Data Company.

* Includes USFS Regions 5 and 6, BLM, and Washington and Oregon state lands.

Figure 117



Source: Warren, PNW-RGB-193, Sept. 1992.

Aided by the reduction in demand, by the remaining uncut volume, and by overcutting on private lands and some salvage sales on public lands, the western industry was able to susbtantially maintain production during 1992, as demand recovered from Gulf War lows; the West suffered only a mild decline in production. At present, many western mills are declining to add shifts, as they normally would do to benefit from historically high prices. Instead, they are holding production steady to conserve their remaining uncut volumes under contract. The result is that a significant portion of the industry no longer has an ability to expand supply to meet increasing demand.

Moreover, similar forces are at work in British Columbia and Quebec, the leading Canadian producers. As a result, the industry's ability to expand output is shrinking, just at a moment when consumption is growing. This has been reflected in measures of US lumber production capacity. As estimated by Evadna Lynn of Dean Witter (Lynn 1992) US capacity fell by 3.5 Bbf/yr. from 1988-89 to 1992. According to consultant Paul Ehinger (1992), sawmills producing about 4.5 Bbf annually were permanently closed in Washington, Oregon, Idaho, and California.

How this reduction in supply, and in the responsiveness of supply to price, will affect short-term stumpage price behavior remains to be seen. What is clear, however, is that stumpage prices have been reacting to the tightening supply (Figs. 118 and 119).

Figure 118

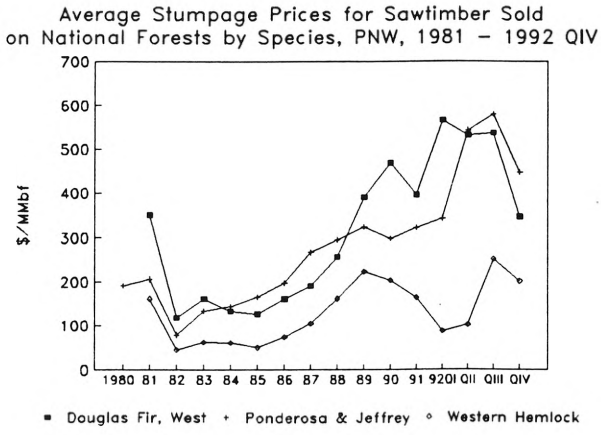
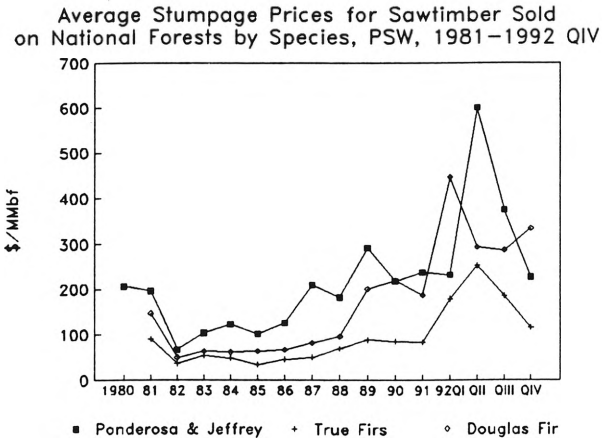


Figure 119



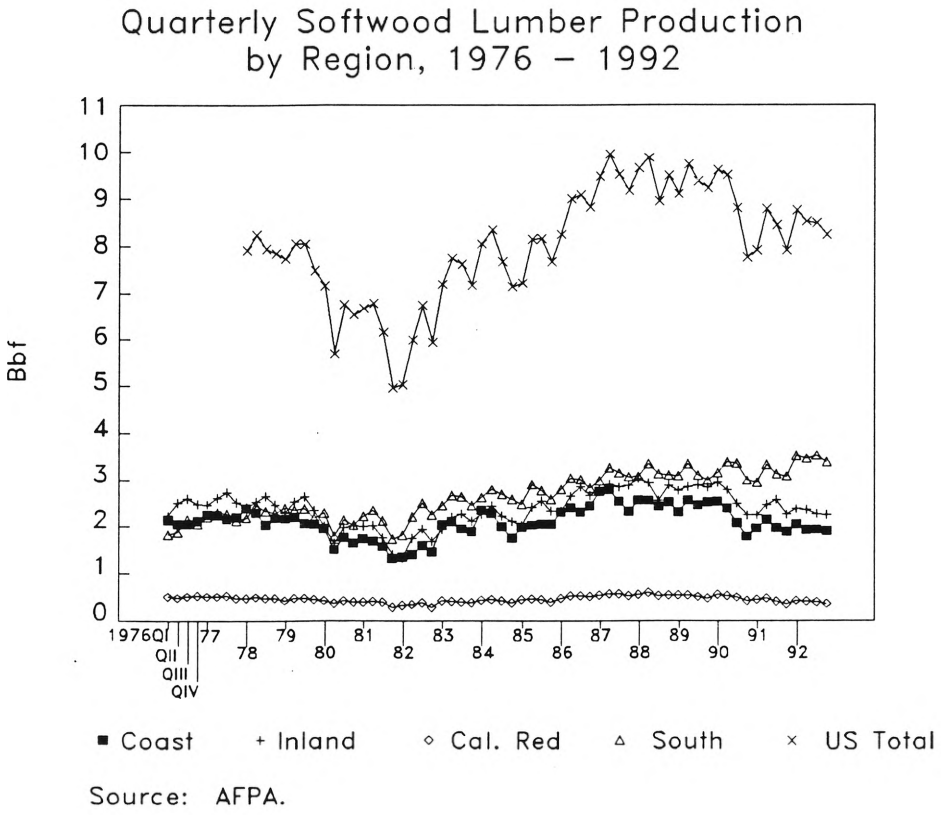
From the viewpoint of an individual mill, stumpage prices are an important and uncontrollable cost factor affecting their profitability. Yet mills cannot simply pass costs forward. Mills that cannot restructure or cut costs to remain profitable are closed.

But from the viewpoint of the market as a whole, the price of stumpage is jointly determined by demand and supply. In the past, stumpage prices in the intermediate and longrun have been determined by lumber prices, and not the other way around. The present reductions in timber quantity sold in the west and in BC are so large, however, that resulting changes in lumber production are likely to affect price levels in the lumber market (see case below on Christmas 1992 price bubble). This introduces a new level of complexity into the task of assessing the future outlook.

2.6.5 Regional Production Shifts

Responding to a host of factors, regional shares of US production have slowly shifted (Sec. 1.4.2). Since the late 1970's, those shifts were marked by the relative stability of output in the Coast, by a rising import share until about 1987-88, and by the emergence of the South as the leading US production region (Fig. 120). Compared to the 1950's and 1960's, then, the US industry's prospects for meeting rising lumber demands depend increasingly on the supply levels and elasticities for imports and for southern production.

Figure 120



Source: AFPA.

2.6.6 Supply Responsiveness

In the past, supplies have quickly responded to increased demand, especially early in recoveries when the industry was operating well below capacity. Comparing price and production changes for several two-year periods strongly suggests that industry supply

relationships are changing (Table 34). The extraordinary price increases of the late 1970's were caused by a new peak in US consumption and brought forth an especially large Canadian production increase. In 1982-84 and 1985-87, much smaller price increases still brought forth large domestic production increases, leading to an all-time consumption peak in 1987. Yet in 1990-92, a 23% increase in prices was accompanied by a decline in US production and a Canadian production increase half as large as occurred in 1985-87. This was despite the fact that total US consumption was below the 1987 peak (as it will be in 1993). In past cyclical contractions, minor reductions in estimated capacity have occurred as marginal mills closed. This is the first contraction in which a large reduction in capacity has occurred. (Unfortunately, the capacity estimates published by the Federal Reserve Board fail to properly reflect what is actually happening.) In 1993, then, there exists no idle mill capacity to serve increased demands. The markets seem to have realized this. There have been elements of "panic buying" in the marketplace, but there is no evidence of speculative withholding of stocks by wholesalers or speculative holdbacks in output by mills.

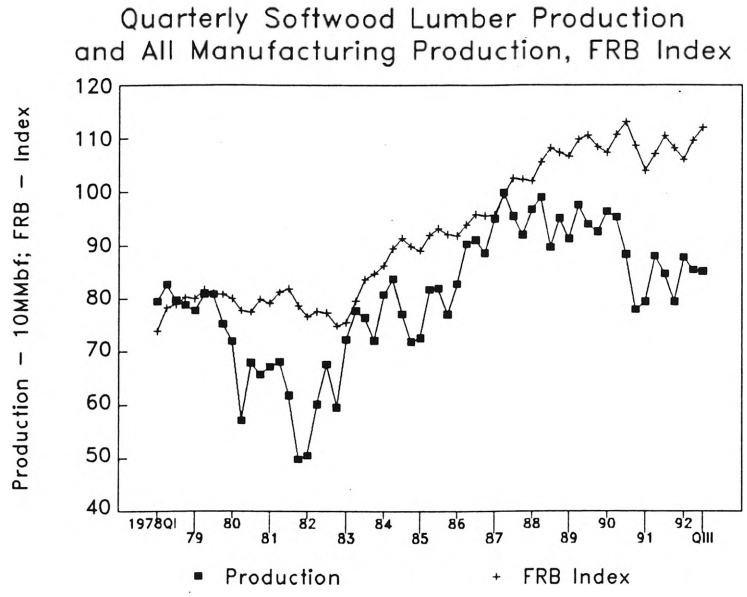
Table 34
Price and Production Responses, 1975-92

	Percent Increases			
Period	R/L Framing Lumber Composite	US Softwood Production	Canada Softwood Production	End of Period Consumption Level
1975-77	+50-60%*	+20%	+54%	All time high to date
1982-84	+18%	+31%	+33%	Equal to 1977
1985-87	+18%	+22%	+10%	New all time high
1990-92	+23%	-5%	+9%	5 Bbf below 1987 peak

* Composite not published in these years. Estimate based on prices of western SPF, Douglas-fir, and southern pine.

Lumber production since 1987 has diverged strongly from all industrial production (Fig. 121). Up to 1990, this was due to demand declines. But during 1992, industrial output climbed, while lumber output declined, leading credence to the view that timber supply was a constraint on output.

Figure 121



2.7 THE PRICE BUBBLES: COMPARATIVE REVIEW

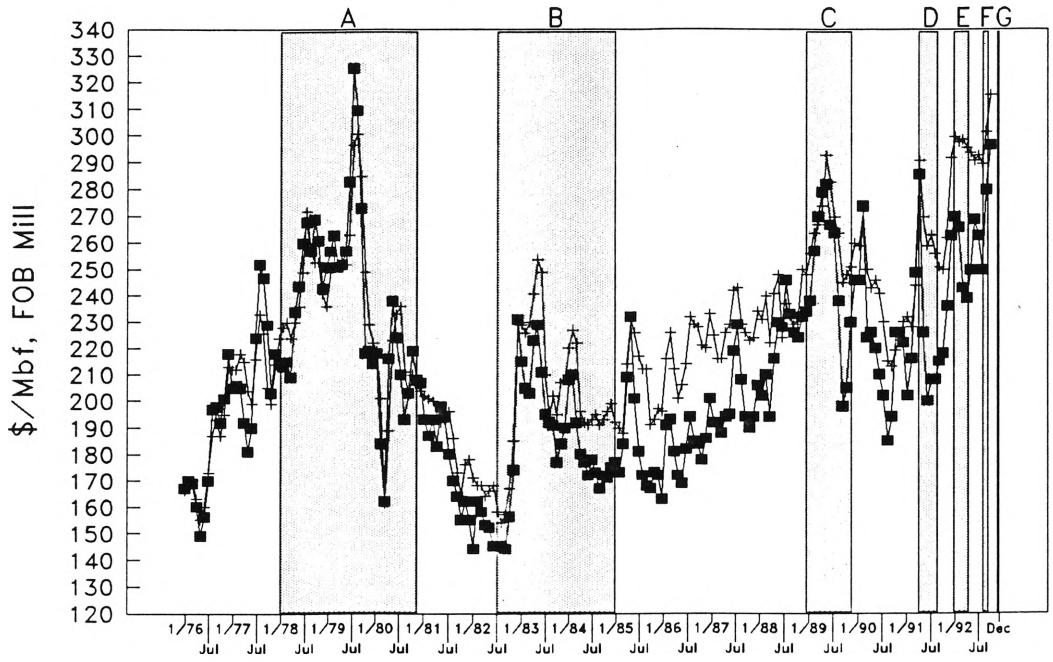
Recognizing that the various lumber items displayed differing price behavior over the period, we can discern a few prominent examples of price rises that can be thought of as "bubbles" in the sense that one or another unusual combination of events drove prices to extreme levels that attracted wide public attention (Table 35 and Figs. 122 and 123). In most instances, prices quickly receded to levels at or below where they had previously stood. A comparative study of prices, production, imports, demand, and unanticipated factors during these bubbles will yield some useful generalizations.

Table 35
Price Bubbles in Softwood Lumber, 1978-92

A. Jan. 78-Dec. 80	Housing boom/oil shock commodity boom
B. July 82-Jan. 85	Post-recession housing recovery
C. Jan. 89-Dec. 89	Production peak
D. May - Aug. 91	Dwyer injunction bubble
E. Jan. - May 92	Countervailing Duty Rally
F. Aug. - Sep. 92	Hurricane Andrew Rally
G. Late Dec. 92 - ?	1992 Holiday Rally

Figure 122

Douglas Fir Dimension Prices and the Price Bubbles, 1976–92



■ Douglas Fir, Green, 2x4, Std&Btr, Random

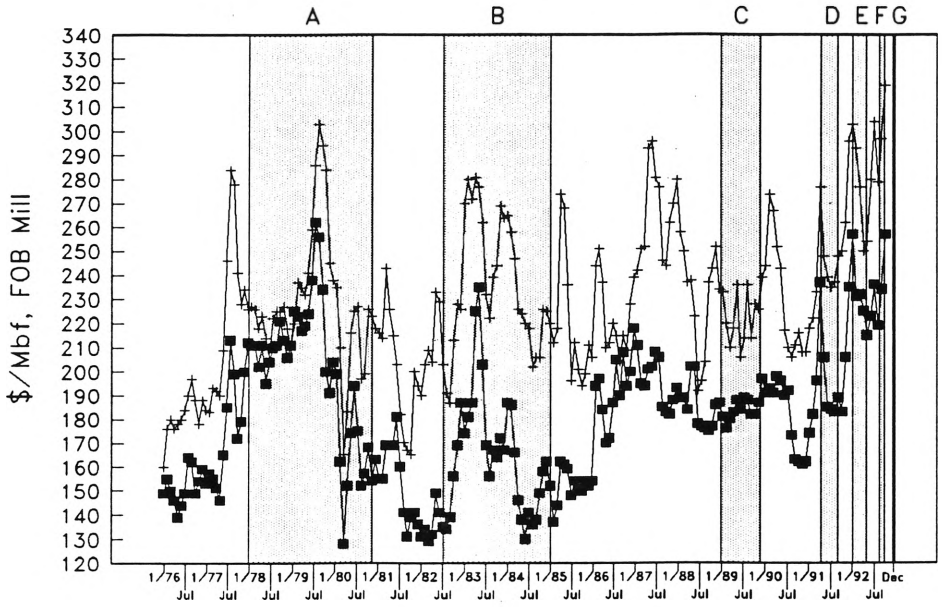
\+ Douglas Fir, Kiln Dried, 2x4, Std&Btr, Random

A = January 1978 – December 1980
B = July 1982 – January 1985
C = January – December 1989
D = May 1991 – August 1991, Dwyer Bubble
E = January 1992 – May 1992, Duty Rally
F = August – September 1992, Andrew Rally
G = Late December 1992, Holiday Rally

Source: Random Lengths Yearbook.

Figure 123

Western SPF and Southern Pine Dimension Prices and the Price Bubbles, 1976–92



◇ SPF Western, Kiln Dried, 2x4, Std&Btr, Random

■ Southern Pine (Westside), Kiln Dried, 2x4, #2 Random 8/20'

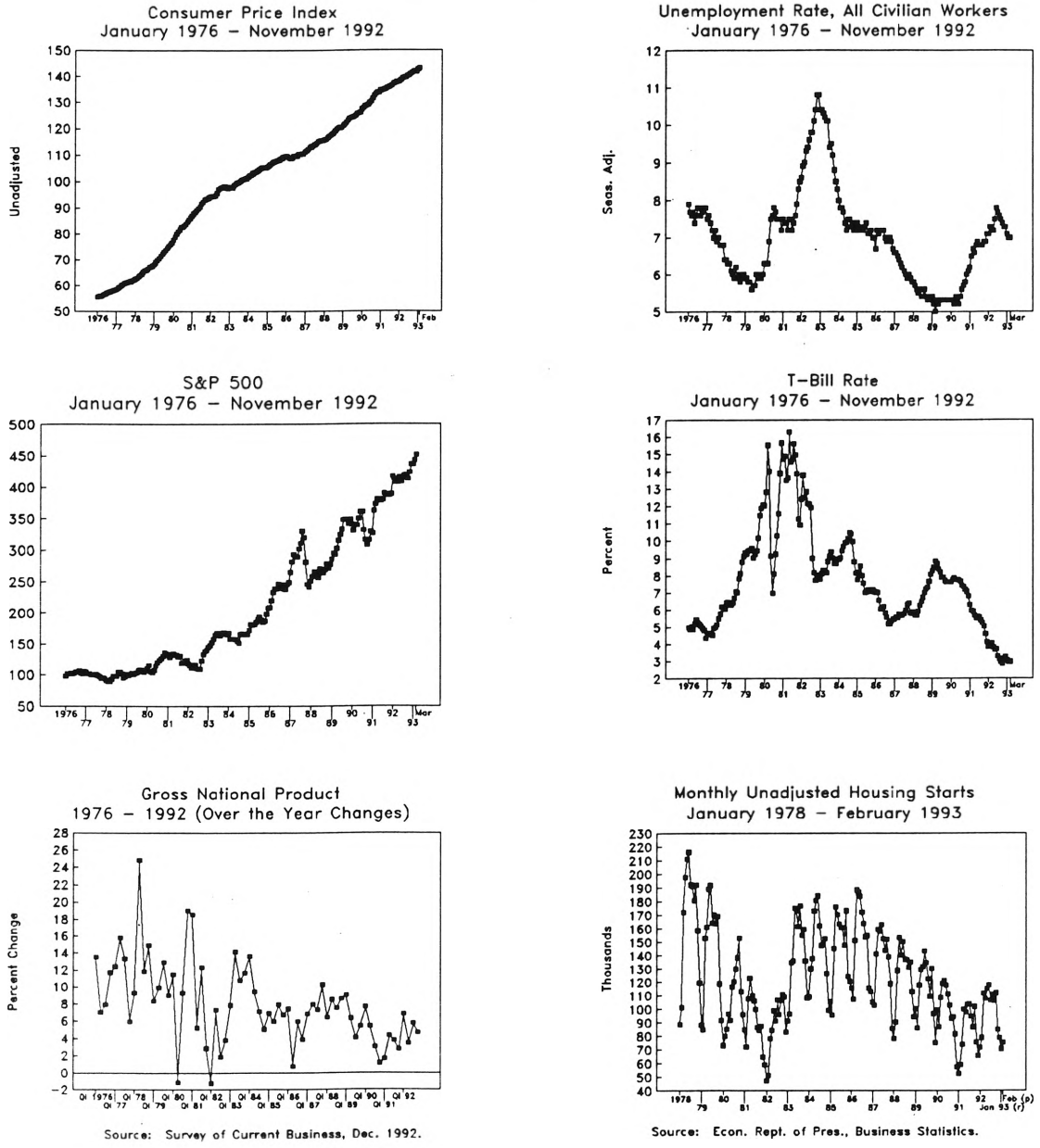
A = January 1978 – December 1980
B = July 1982 – January 1985
C = January – December 1989
D = May 1991 – August 1991, Dwyer Bubble
E = January 1992 – May 1992, Duty Rally
F = August – September 1992, Andrew Rally
G = Late December 1992, Holiday Rally

Source: Random Lengths Yearbook.

Considering the amount of rough judgment that went into defining these bubbles, it might be going too far to attribute a great deal of importance to the apparent increase in their frequency, but the trend may be telling us something about the rigidity of supply in the face of unexpected demand shifts. To enable a comparison with broad economic trends over the period, Fig. 124 presents the indicators that will be used in the individual cases. The sources for all data are the Economic Report of the President, Joint Economic Committee, Economic Indicators, and Business Statistics, except as noted.

In interpreting these relationships, we need to recall that the data as displayed here were not known to traders at the time these particular price and quantity levels were being established. We use the data as an imperfect clue to market perceptions at the time. A full econometric approach would employ a variety of lags and expectations-formation processes to account for this.

Figure 124
January 1976 - December 1992



To review the individual bubbles and try to tease out lessons and implications, we have assembled a set of charts showing key lumber market variables and key economic trends within those periods. This information, together with other information on events

that have affected the markets, will be used to develop a descriptive understanding of what happened in each instance. These cases must be viewed as tentative and subject to debate, as they are only of an initial exploratory nature.

For manageable data handling, we have used monthly price data from Random Lengths for four key dimension items. In the later years we can also take advantage of weekly data from Eastern Quotes and Comments' files. Economic data are monthly, except for GNP, which is quarterly. Data in this form are adequate to examine these bubbles in an exploratory way.

2.7.1 January 1978 - December 1980: Housing Boom/Oil Shock Commodity Boom

A strong increase in housing starts up to 1978 brought US lumber consumption to new highs and brought capacity utilization to 100% or more. Prices moved broadly upward, in nominal and real terms.

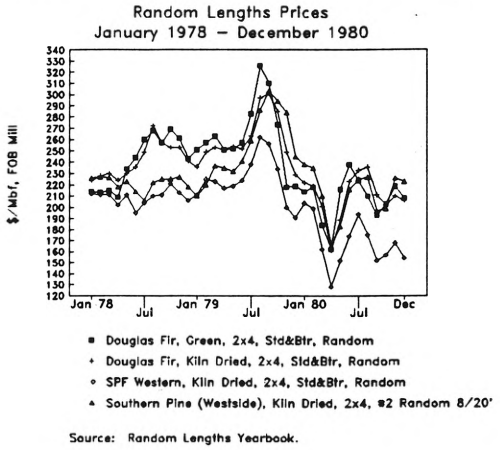
During summer 1979, softwood lumber prices experienced a significant peak that lasted several months before prices slid to levels far below early-year levels as demand collapsed following the peaking of the housing boom (Fig. 125). Demand could not have been responsible for this bubble, since unadjusted housing starts in summer 1979 were lower than they had been the previous summer. Production, on the other hand, in summer 1979 slightly exceeded the 1978 level. Imports experienced a strong rebound from winter seasonal lows and seemed to respond strongly to the higher prices before they too receded in response to declining demand later in 1979. Lumber inventories were not drawn down significantly below the low of summer 1978. They later soared to levels far higher than the previous years' peak, as mills accumulated unwanted inventories as demand declined. Those inventory accumulations peaked just as prices hit bottom in early 1980. Further, the accumulations occurred despite dramatic cutbacks in production.

The price bubble of 1978-80 occurred during a time of a peaking economy that featured a distinct low in unemployment in early 1979, and an actual decline in GNP in 1980. Over the period, interest rates were rising, right up to the early months of the recession in 1980. Due to the Iranian Oil Shock, energy prices rose by 35% in 1979 and 49% in 1980 (as measured by the PPI component for Finished energy goods). Other industrial and food commodities experienced price booms, though not as sharp as lumber and energy, during these years.

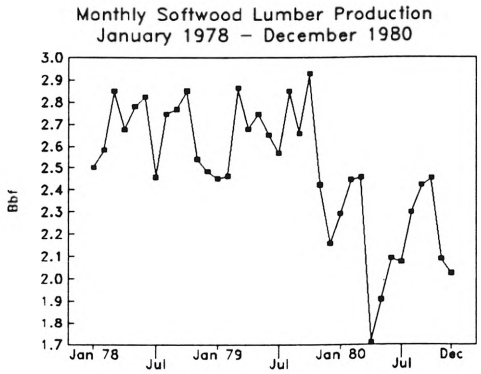
The explanation for the price peak of 1979 does not seem to involve demand increases or supply shortfalls. Rather, it seems to have had its origin in a number of temporary and unexpected market disruptions (Table 33 above) that affected the market at a time of strong economic activity and peak capacity utilization when many traders were probably optimistic about the economy. These disruptions included a car shortage in winter/spring of 1979, labor problems at a few mills, and serious trucking problems caused by truckers demonstrating against rising fuel prices. As these matters settled back to normal, the rally faltered. It was followed by prices falling to new lows before rebounding in late winter

1980. The increase in production in response to the higher prices was modest, so overproduction was probably not responsible for the subsequent decline in prices. Indeed, the mild response of production may have been due either to capacity limitations, or to a belief by manufacturers that the rally would be short lived, as it did indeed turn out to be.

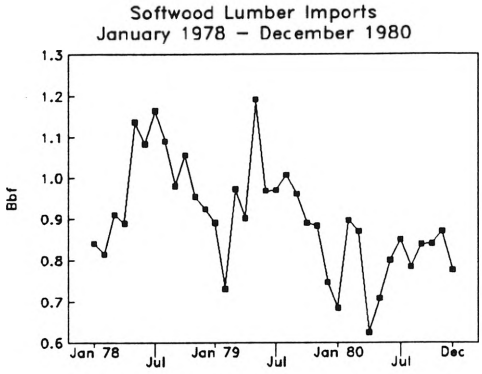
Figure 125
January 1978 - December 1980



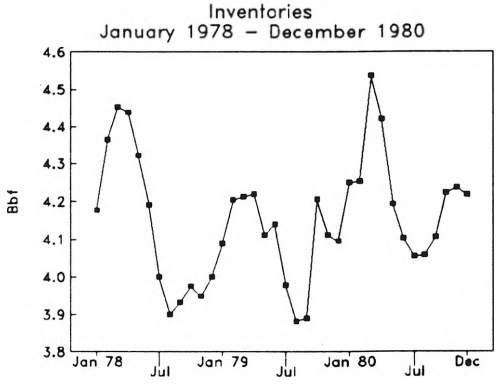
Source: Random Lengths Yearbook.



Source: AFPA.

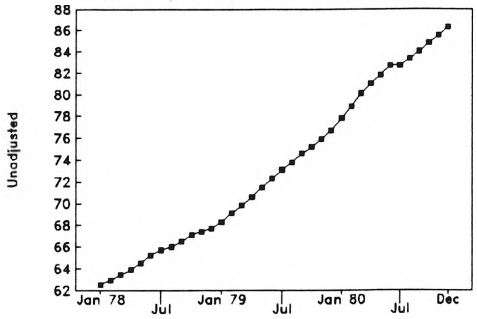


Source: AFPA.

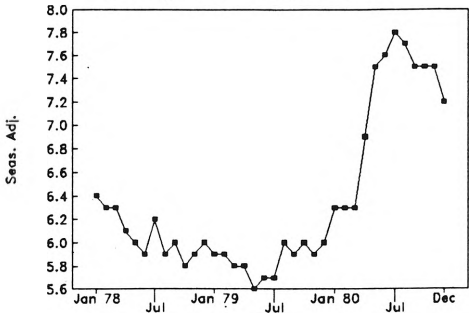


Source: AFPA.

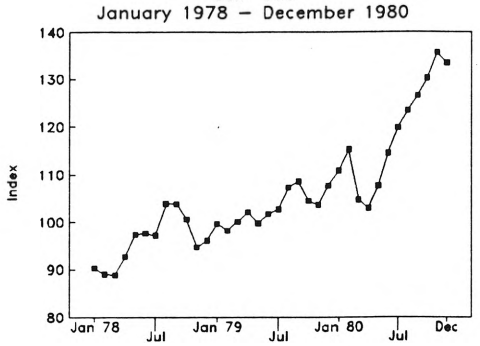
Consumer Price Index
January 1978 – December 1980



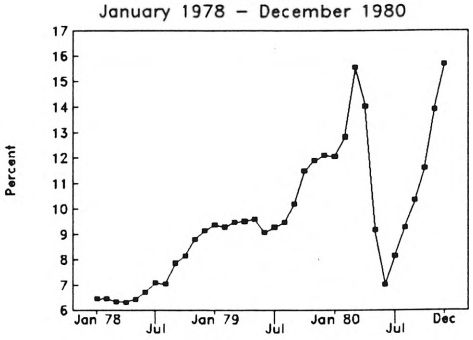
Unemployment Rate, All Civilian Workers
January 1978 – December 1980



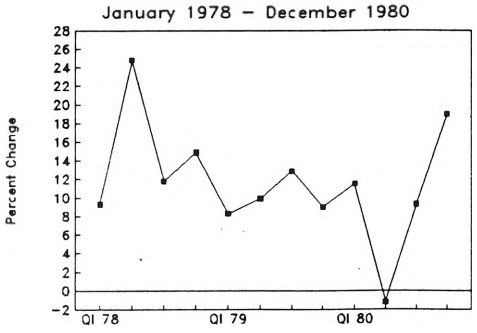
S&P 500
January 1978 – December 1980



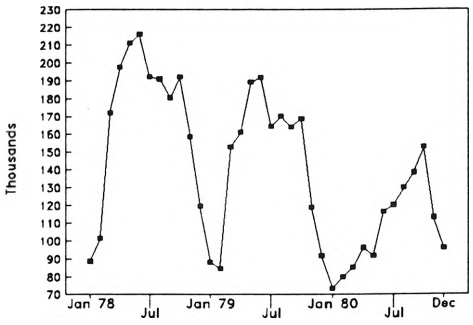
T-Bill Rate
January 1978 – December 1980



Nominal Gross National Product
January 1978 – December 1980



Unadjusted Housing Starts
January 1978 – December 1980



2.7.2 July 1982 - January 1985: Post-Recession Housing Recovery

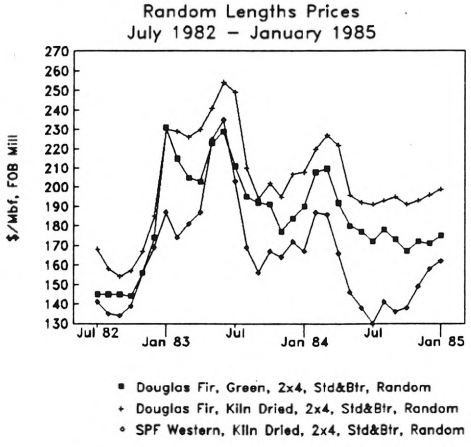
The next significant bubble occurred during the post-recession recovery of mid 1982 to January 1985. While the recession low was officially dated at November 1981, the economy climbed out of it only slowly -- not until mid 1984 did unemployment reach the 7.5% level again. Consumer price pressures moderated toward the end of the period, and interest rates fell sharply in late summer of 1982 before edging upward as the economy recovered. A strong upward move in the stock market accompanied the recovery, but peaked in mid 1983. GNP growth was robust until early 1984.

Lumber prices responded dramatically to the resumption of economic growth, rising by about $80/M for green fir between late summer 1982 and the following summer. Production rose in response, with winter seasonal interruptions, as did imports. Inventories rose throughout the period, probably to support expected higher levels of demand and in anticipation of further gains in prices.

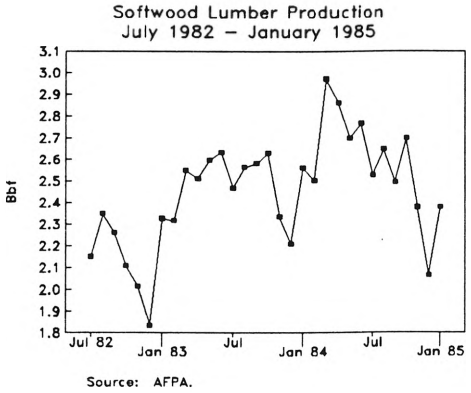
From summer 1982 to summer 1983, housing starts rose dramatically. They stayed in the 106-110,000 range in late summer and autumn 1982, but rose to exceed 170,000 per month in summer 1983. Still higher levels were reached in 1984.

Uncertainty about supply was probably caused by ongoing debates about federal timber policies and by the rapid decline in production in both the US and Canada that had occurred in the previous 2 years. Traders may have been unconvinced that supply would be able to respond to rising demand. The steep rise in prices that occurred late in 1982 would seem to have been caused at least in part by traders anticipating future tight supplies, and bidding up prices more rapidly than current demand conditions alone might have warranted. This is suggested by the fact that prices moderated significantly for the summer 1983 building season. A strong midwinter "buy" was prompted by hopes for a good housing year in 1984, which did materialize. The significant pullback in prices during that year is not readily explained. Imports peaked in late summer at a higher level than 1983; the declining Canadian dollar may have been placing downward pressure on prices. In any case, imports did correct sharply in line with their normal seasonal patterns.

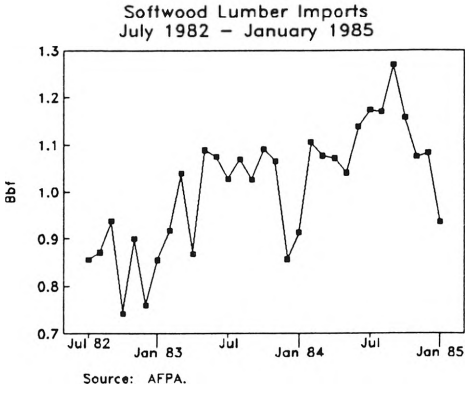
Figure 126
July 1982 - January 1985



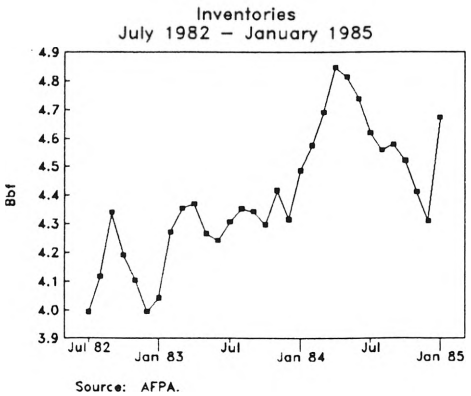
Source: Random Lengths Yearbook.



Source: AFPA.

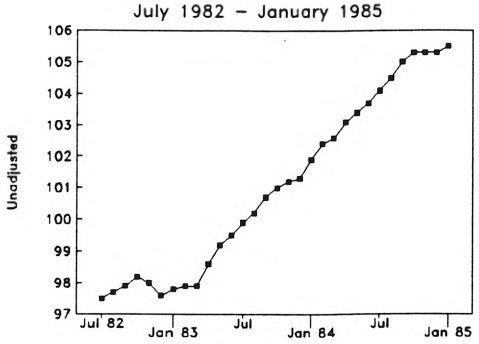


Source: AFPA.

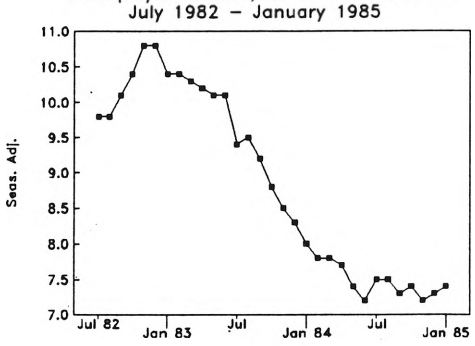


Source: AFPA.

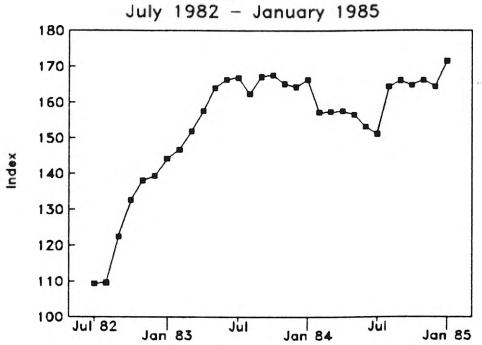
Consumer Price Index
July 1982 – January 1985



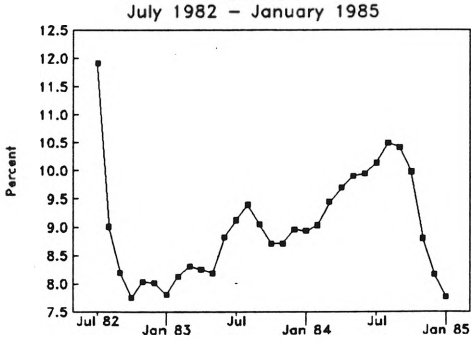
Unemployment Rate, All Civilian Workers
July 1982 – January 1985



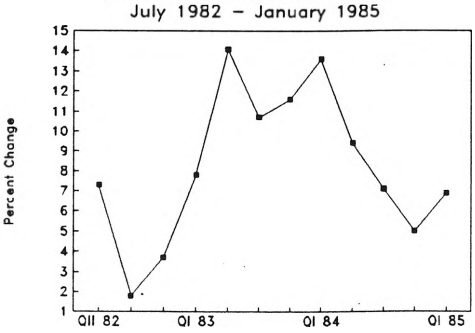
S&P 500
July 1982 – January 1985



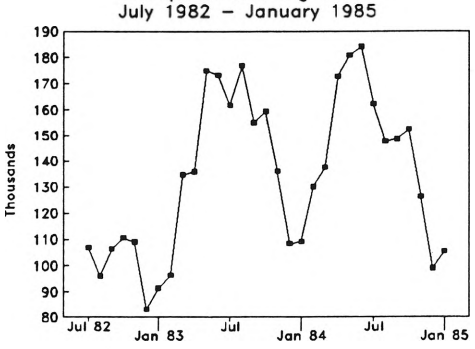
T–Bill Rate
July 1982 – January 1985



Nominal Gross National Product
July 1982 – January 1985



Unadjusted Housing Starts
July 1982 – January 1985



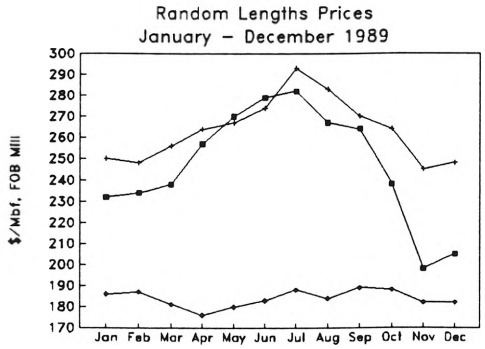
2.7.3 January 1989 - December 1989: Production Peak

During 1989, demand and production reached their peak for the 1980's, and prices displayed a broad plateau, perhaps not quite a bubble, in response. High production levels were reached in spring and fall. Imports peaked in August, helping to take pressure off the market. Concurrently, the stock market plateaued following a long upward run in its recovery from the late 1987 plunge of Black Monday. Interest rates fell significantly after March, and unemployment jumped but stabilized after midsummer. GNP growth slowed during the year.

During this episode, inventories were drawn down but only by a very small amount compared to the changes in consumption and imports. Mills were clearly unwilling to draw inventories down very far, perhaps because they hoped that prices would remain strong during 1989, brief ripples in prices were caused by a brief strike early in the year, and by the effects of Hurricane Hugo and the San Francisco earthquake. These effects are visible in the weekly data for eastern SPF.

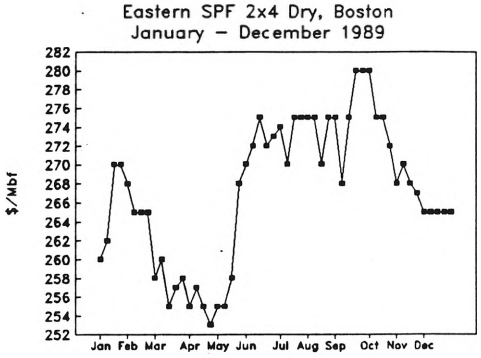
This episode displays evidence of both normal workings of supply and demand and the temporary influence of dramatic events, in this case natural disasters.

Figure 127
January 1989 - December 1989

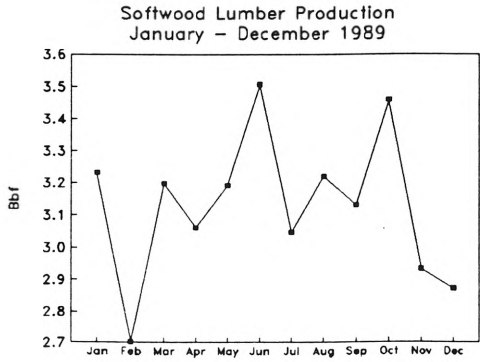


▪ Douglas Fir, Green, 2x4, Std&Btr, Random
+ Douglas Fir, Kiln Dried, 2x4, Std&Btr, Random
◦ SPF Western, Kiln Dried, 2x4, Std&Btr, Random

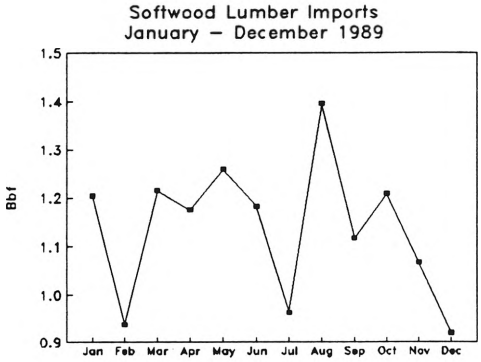
Source: Random Lengths Yearbook.



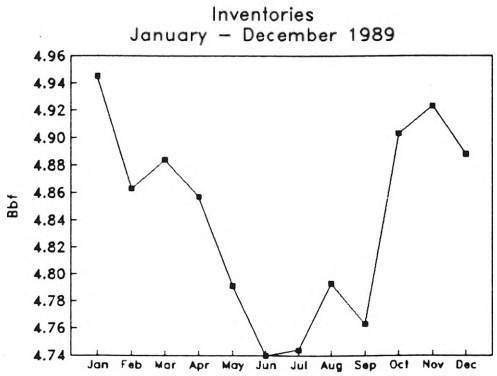
Source: Eastern Quotes & Comments.



Source: AFPA.

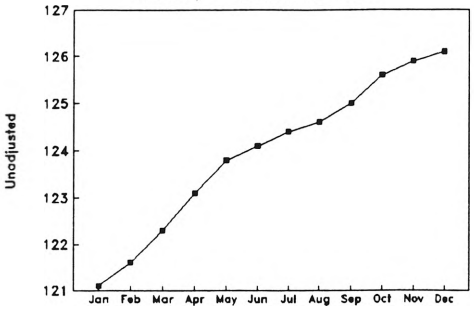


Source: AFPA.

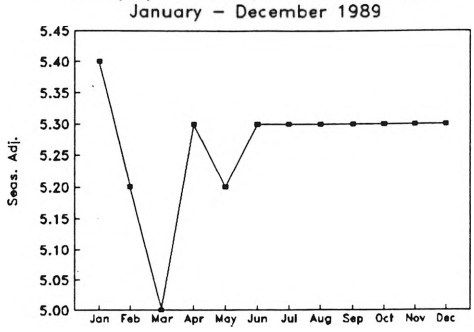


Source: AFPA.

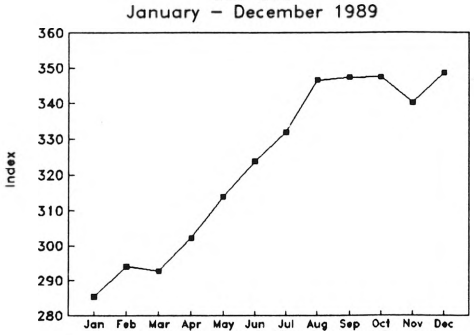
Consumer Price Index
January – December 1989



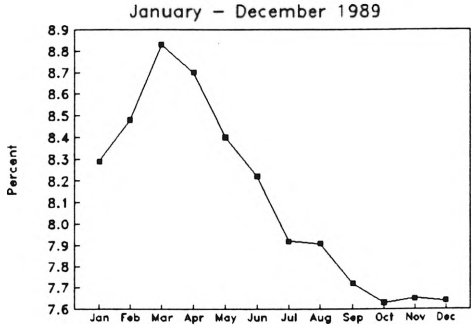
Unemployment Rate, All Civilian Workers
January – December 1989



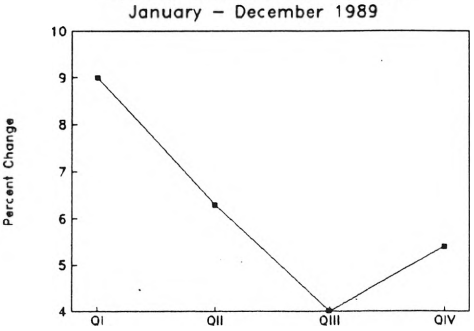
S&P 500
January – December 1989



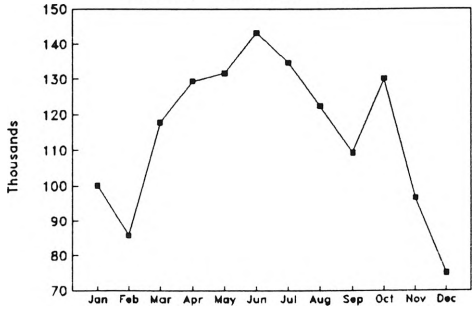
T-Bill Rate
January – December 1989



Nominal Gross National Product
January – December 1989



Unadjusted Housing Starts
January – December 1989



2.7.4 May - August 1991: Dwyer Injunction Bubble

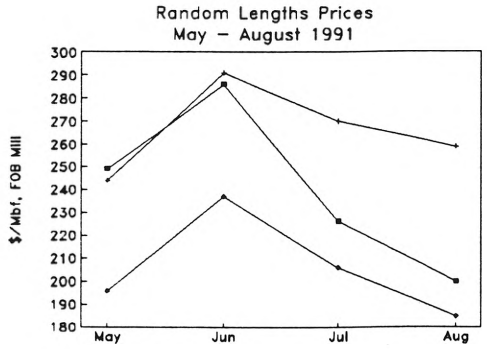
In May 1991, an injunction was issued which dramatically curtailed new timber sales on Federal lands in Oregon, Washington, and California. Lumber marketers affectionately named the resulting price action after the judge hearing the case.

Demand fundamentals could hardly have caused this rally. The economy was in a slow growth phase, not visibly emerging from the recession, though the stock market rallied late in the summer. Housing starts reached a seasonal peak noticeably below the previous year, and there was excess capacity in the lumber industry.

In the 5 to 6 weeks, prices surged, for example, by $40/M for SPF at Boston, a large amount and important at a time when many mills were losing money. Yet the rally was short-lived, reflecting its origins in fear and uncertainty as to the injunction's impact on production. Prices peaked in mid June, and drifted to levels below those of early May in just a few weeks.

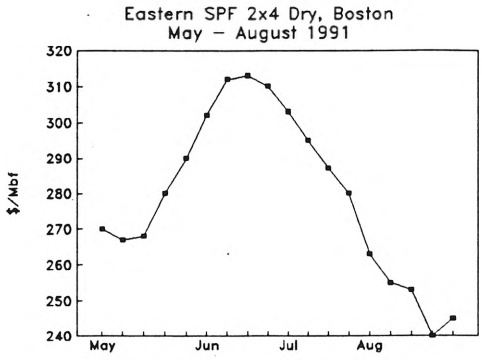
One likely interpretation of the strength of this rally, however brief, is that the market knew something would be done about the Spotted Owl but had not expected the court to order so dramatic a remedy.

Figure 128
May - August, 1991

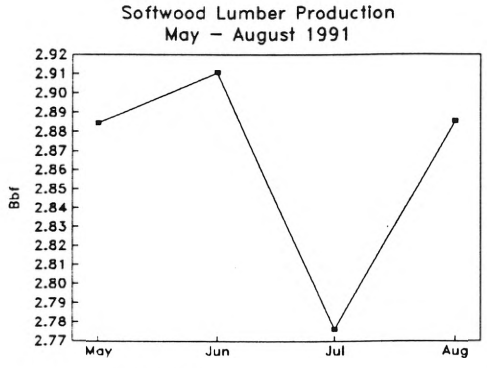


▪ Douglas Fir, Green, 2x4, Std&Btr, Random
+ Douglas Fir, Kiln Dried, 2x4, Std&Btr, Random
◦ SPF Western, Kiln Dried, 2x4, Std&Btr, Random

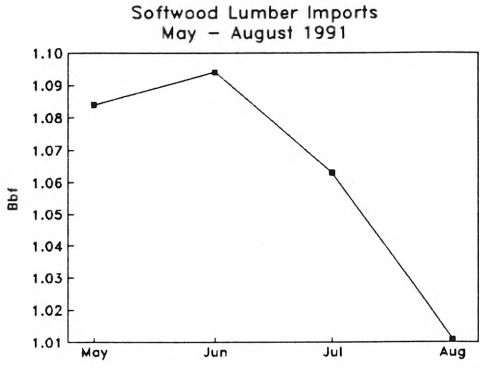
Source: Random Lengths Yearbook.



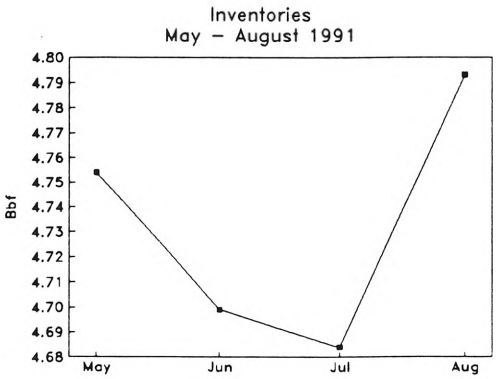
Source: Eastern Quotes & Comments.



Source: AFPA.

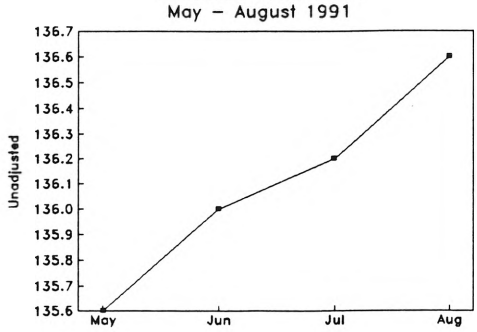


Source: AFPA.

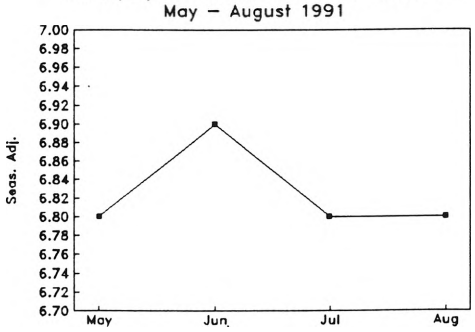


Source: AFPA.

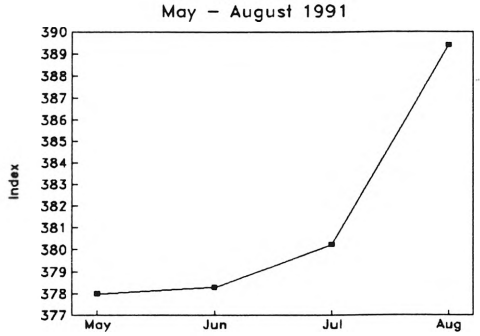
Consumer Price Index
May – August 1991



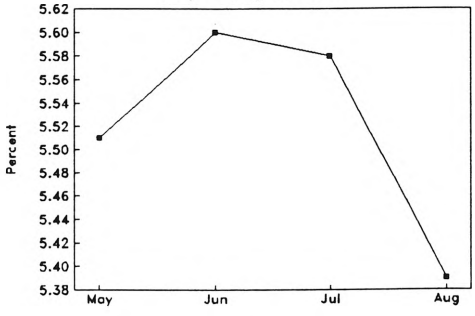
Unemployment Rate, All Civilian Workers
May – August 1991



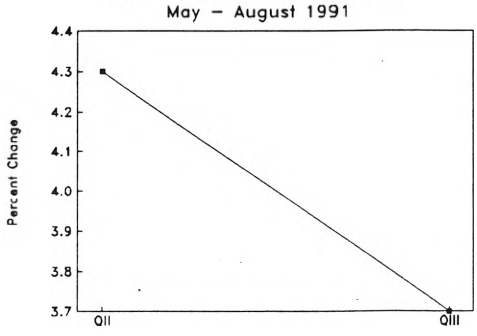
S&P 500
May – August 1991



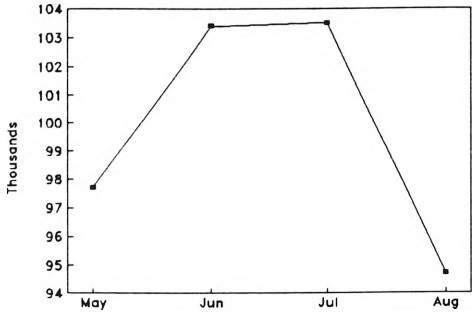
T–Bill Rate
May – August 1991



Nominal Gross National Product
May – August 1991



Unadjusted Housing Starts
May – August 1991



2.7.5 Countervailing Duty, Hurricane Andrew, and Holiday Rallies of 1992

Data to permit a full analysis of the 1992 bubbles are not yet available. Price patterns are displayed most clearly in the weekly data. They show a significant but transitory response to the imposition of the countervailing duty, and to the record-breaking destruction of Hurricane Andrew.

The duty rally reflected the market's sense of the duty's potential effects, arriving just as the industry was confidently looking forward to a significantly improved building season.

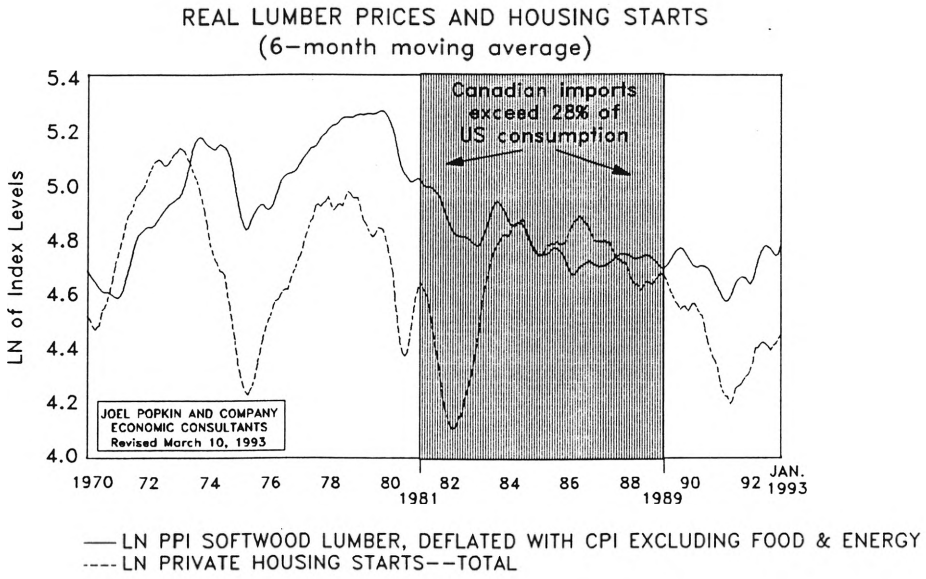
The Andrew bubble represented a mix of effects. First, it illustrated how extremely urgent needs for significant volumes of wood can move the national market even though those volumes are small in the context of monthly continentwide nationwide output. The key was the extreme urgency with which the wood was required. But this bubble also illustrated how buying panics can arise when tight inventories and indications of shrinking supply are met with urgent, temporary demand surges.

These rallies were accompanied by a slowly emerging impression that the economy was slowly improving, though unemployment remained high and lumber demand conditions compared most unfavorably with the previous cyclical peak, especially in real estate markets. Interest rates fell dramatically over the year, and consumer price pressures moderated. But these events failed to trigger the boom in new construction that had been hoped for. But new housing starts did bounce back from depressed 1991 levels. Export demand for US lumber was slow throughout the period.

2.8 SOFTWOOD LUMBER PRICE SITUATION, FALL 1992 - WINTER 1993

Softwood lumber prices trended down in real terms from 1980 to 1991, generally following cyclical trends in the economy (Fig. 129). Expanding Canadian supplies, available at declining prices due to a falling Canadian dollar exchange rate, helped real prices fall even as consumption reached its all time peak in 1987-88.

Figure 129



LN = Natural logarithm.

The decline in demand in the 1990-91 recession placed further downward pressure on prices. As a result, current dollar prices in October 1992 were little different from their levels at the major demand peak of 1978-79. Total lumber consumption had risen significantly, however, though housing starts were well below 1978-79 (Table 36).

Table 36
Softwood Lumber Prices and Demand Measures

	R/L Composite $/Mbf*	Softwood Consumption (Bbf)	Housing Starts (SAAR)
1978-79	244	41.9	1,882
First ten months, 1992	278	45.6**	1,198
Jan.-Feb. 1993	404	N/A	1,192 (Jan.)

* Random Lengths Framing Lumber Composite Index.

** Annualized.

Sources: Random Lengths; Economic Report of the President; AFPA.

After October 1992, softwood lumber prices began an unprecedented upswing that astounded forecasters, trade participants, manufacturers, and builders. While all observers had foreseen upward price pressures in 1993, the magnitude of the increase was surprising (Figs. 130-133). In just five months, the widely followed Random Lengths composite index[3] rose by $245/Mbf, the price of ponderosa pine boards jumped $119, southern pine rose $156, and spruce 2x4's delivered to Boston rose $240. This was at a time of modest inflation as measured by the Producer Price Index (Fig. 134).

[3] The Random Lengths framing lumber composite is a weighted average price of six leading framing lumber species.

Figure 130

Price History: Random Lengths Framing Lumber Composite Price Index

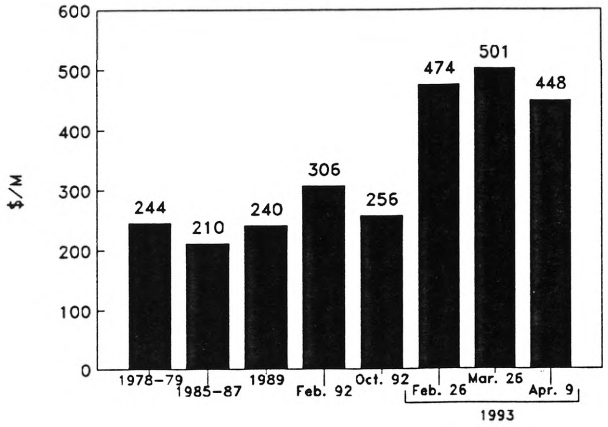


Figure 131

Price History: Southern Pine (Westside) Kiln Dried, 2x4 #2 Random

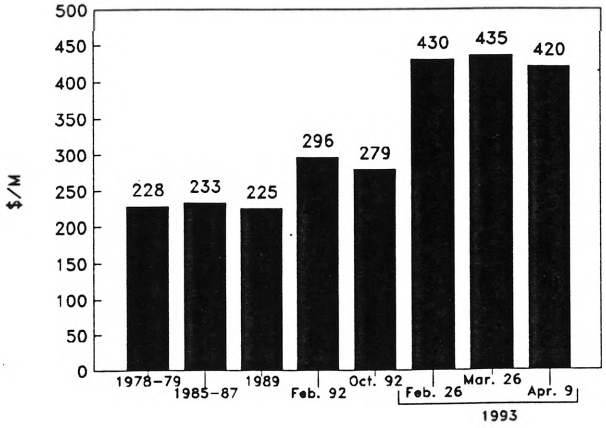
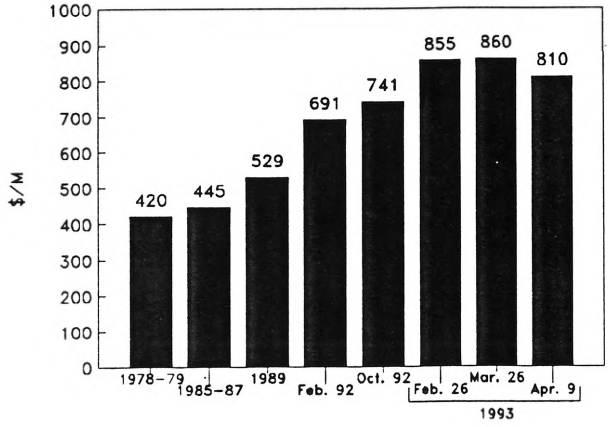


Figure 132

Price History: Ponderosa Pine 1x12 #2 and Better Boards



Source: Random Lengths

1978 – 79	Represents general high level of prices in major building boom.
1985 – 87	Represents high level of prices gained at mid 80's residential construction peak
1989	Peak before recent recession.
Feb. 92	Year ago price level.
Oct. 92	Price level prior to recent market move.
Apr. 9, 1993	Latest quote.

Figure 133

Price History: Spruce–Pine–Fir 2x4
(Eastern) Kiln Dried, Del. Boston

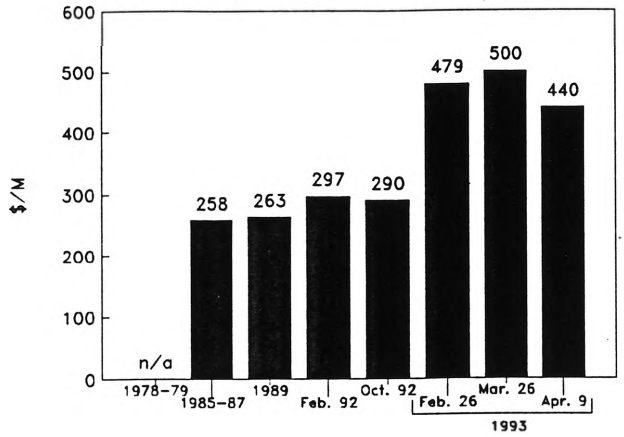
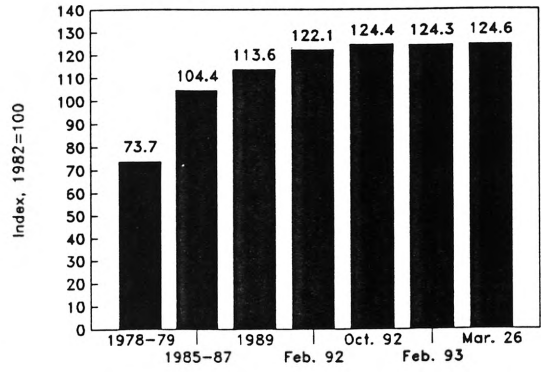


Figure 134

Price History: Producer Price Index
All Finished Goods (Unadjusted)



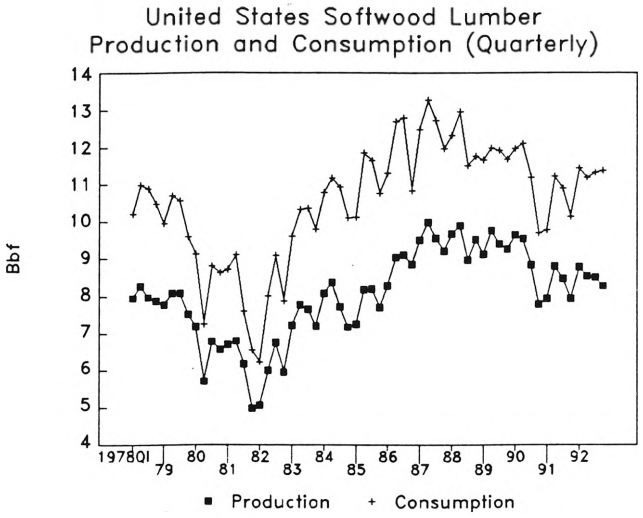
1978 – 79	Represents general high level of prices in major building boom.
1985 – 87	Represents high level of prices gained at mid 80's residential construction peak
1989	Peak before recent recession.
Feb. 92	Year ago price level.
Oct. 92	Price level prior to recent market move.
Feb. 93	Recent quote.

2.9 LUMBER MARKET CONDITIONS 1990-1992

There is no single cause for the extraordinary upswing in prices since October 1992. Since production and consumption data are available with a three-month lag, and we have almost no data on the current status of inventories in the marketing chain, final judgments will have to wait. Yet it is clear that the following forces have played important roles:

-- Demand for softwood lumber steadily rose following the housing trough of January 1991 (Figs. 135 and 136). Reflecting tighter supplies, unfilled orders rose as mill stocks declined.

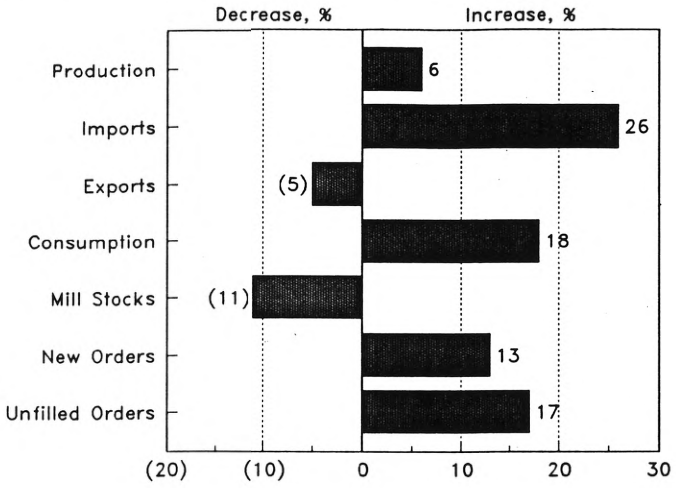
Figure 135



Source: AFPA data as summarized by Prudential Securities.

Figure 136

Measures of Softwood Lumber
Supply and Demand Changes, QIV 1990 to QIV 1992



Source: Calculated by The Irland Group from
AFPA data as summarized by Prudential Securities

While US consumption grew by 18% from QIV 1990 to QIV 1992 (Fig. 136), this was a modest increase compared to previous housing recoveries. (The housing trough occurred in January 1991; the business cycle trough occurred in March.) Also, 1992 consumption was still 10%, or 5 Bbf below the 1987 cyclical peak. Exports declined due to weak economic conditions in Japan and Western Europe. Canadian production was much better able to respond to this demand increase than was US production, so that imports grew by 26%. In 1992, Canadian consumption increased 10%.

-- By late 1992, Mill and Commercial inventories were too low to support expected summer 1993 consumption (Table 37). The estimated shortfall at year-end 1992 was not large, but it was part of a tightening supply-demand balance that caused the level of unfilled orders to rise and a shortage psychology to develop as economic expectations rose following the November elections. Retailers and wholesalers scrambled to restock inventories, touching off a bidding war for wood.

Table 37
Measures of Inventory Levels vs. Normal Level for 1993

Date	Wholesale Inventories	Gross Mill Stocks MMbf	US Consumption MMbf
QIV 1988	N/A	4,977	11,774
QIV 1990	65 days*	4,824	9,678
QIV 1992	48 days*	4,276 } "shortfall"	11,390
1993 (proj.)**	N/A	4,750 } 500 MMbf	12,500

* December 31.

** 1991 (proj.) mill stocks based on consumption/stocks ratios prevailing in earlier years.

It does not seem likely that lumber futures and options markets have been a significant factor in the recent price increases. The volume of lumber represented by the futures contracts outstanding (open interest) is a small fraction of the gross mill stocks or monthly production. Through much of the period of rapidly rising prices, futures prices were constrained by daily trading limits. Further, futures prices continue to trade at a discount to cash market prices. In March 1993, open interest in futures was lower than it had been the previous year, even though prices were far higher. While options trading has increased, it remains far too small to affect prices.

The US obtains about 80% of its softwood lumber from four areas: the South, the Inland West, the Coast Region (west of the Cascades in Washington and Oregon), and British Columbia (Fig. 137). Supply limitations have become increasingly evident in all of them:

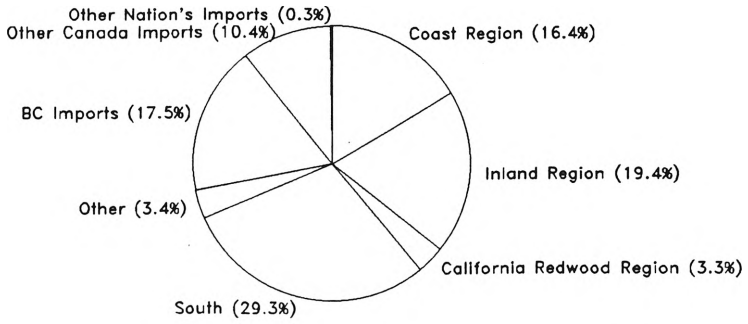
-- Mill capacity and production on the Coast and in the Inland West are shrinking as federal timber sales are unable to replenish the uncut volume under contract, even at current reduced cutting levels. By one estimate, timber supply reductions eliminated 3.5 Bbf of US sawmill capacity from 1988-89 to 1992 (E. Lynn, 1992). Also,

Paul Ehinger (1992, p. 3-6) estimates that in four western states from 1988-92 sawmills producing 4.5 Bbf of lumber per year were permanently closed. Reduced log supply, and expectations of further reductions, were a primary cause in most instances.

-- Harvest levels are being cut back on Crown lands in British Columbia, a major supplier of imports to the US. The outlook for 1993 production is highly uncertain. Some observers expect no increases over 1992, while others expect some increase. In 1992, BC lumber output increased 6.2%, while log production grew only 0.4% (COFI, pers. comm.)

Figure 137

Where Our Softwood Lumber Supply Comes From
(Production plus Imports)



	MMbf 1992	1991–92 % Ch.
Coast Region	7,778	−1.6%
Inland Region	9,224	−3.0
California Redwood Region	1,568	−5.4
South	13,924	+11.3
Other	1,624	+2.8
Imports	13,380	+14.0
BC Imports	8,300	+13.0
Other Canada Imports	4,939	+13.8
Other Nation's Imports	121	+41.3
Total New Supply	47,498	+5.8

Source: AFPA and COFI.

-- Expanding production in the South will be difficult due to mill capacity being reached and weather-related log supply problems. The South has expanded output significantly, continuing to set production records after the 1987 nationwide peak. But in 1990-92, growth in the South was not enough to offset declines in other regions.

Other building materials have not seen significant increase in prices, though they serve the same markets as does lumber. The PPI component for materials and components for construction showed a major increase in the 1978-79 housing peak, and outpaced all finished goods by twofold from 1982-89. From Sept. 1992 to Jan. 1993, representative PPI index components changed as follows:

Materials and components for construction	1.8%
All crude nonfood materials	-3.0
Softwood lumber	16.3
All finished goods	0.5

The rapid increase in lumber during this period strongly suggests that some unique factor is at work, probably on the supply side.

2.10 WHY ARE PRICES SO HIGH?

One possible scenario for interpreting these developments is shown in Fig. 138. What needs to be emphasized is the role of expected supply uncertainties, combined with a demand to restock inventories. These combined forces are likely more important than an increase in end-user demand which is expected to amount to only 2-6%.

The lumber trade is aware that the 1993 peak of consumption has not yet arrived, that further declines in western production are likely later this year, and that supply responsiveness from Canada and the South are uncertain. The best working hypothesis for the current price behavior, then, would be that the price effects of this summer's anticipated supply/demand conditions are being recognized in today's prices, perhaps with some premium caused by the unusual level of uncertainty.

The current price situation seems to be caused by three inventory shortages -- one in the distribution system, one at the mills, and an expected decline in log inventories available for conversion to lumber in the western US. These three inventory shortages are occurring at a time of rising demand and when other major supply sources are plainly stretched to capacity. If our understanding of present market conditions is correct, prices would have increased from 1992 to early 1993, even if demand had remained unchanged.

On the basis of what we now know, to attempt a final apportionment of the price increase among these causes would be unsuccessful. Yet the owl litigation would likely merit a prominent place in the list, since it is causing the largest and fastest change in short-run supply potential.

Figure 138

ILLUSTRATIVE SOFTWOOD LUMBER MARKET SCENARIOS

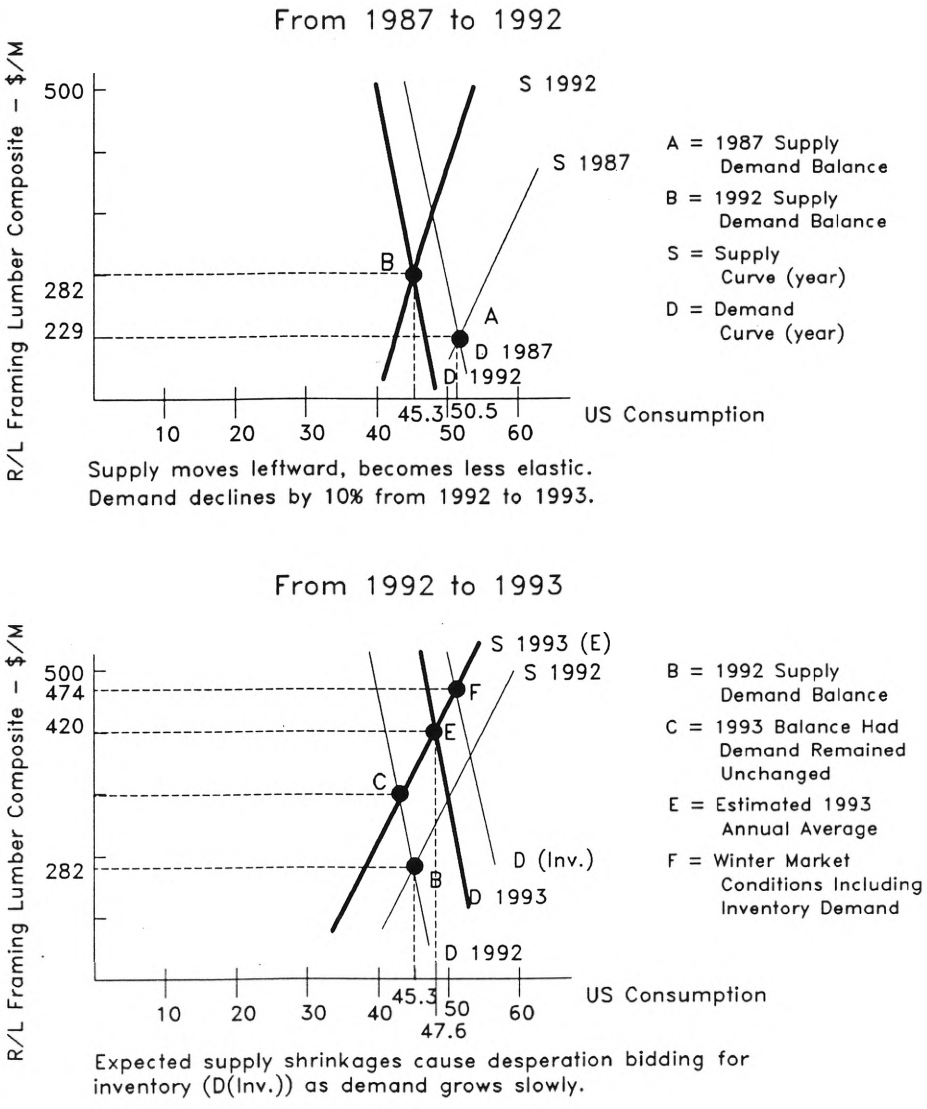
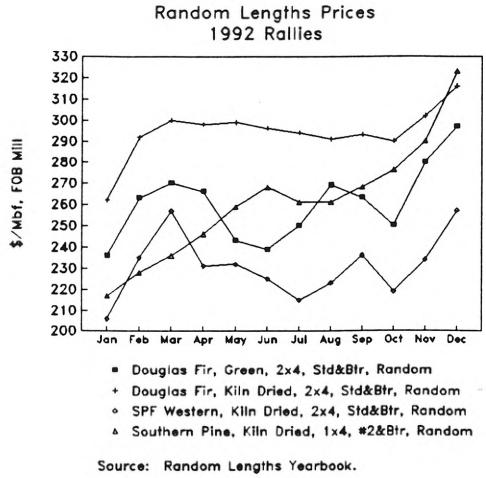
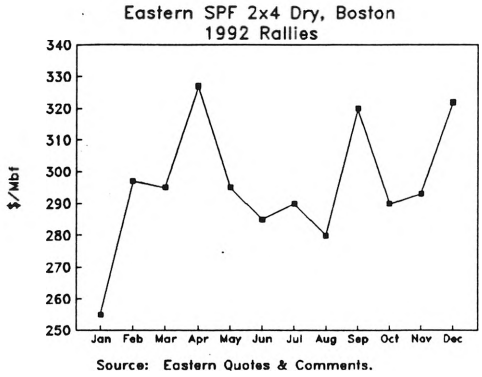


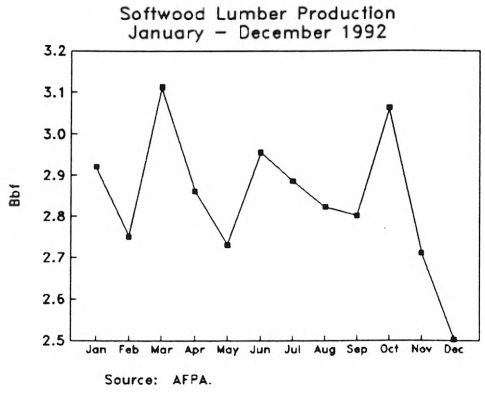
Figure 139
1992 Rallies



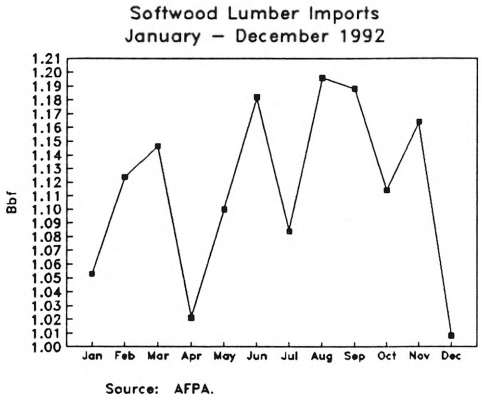
Source: Random Lengths Yearbook.



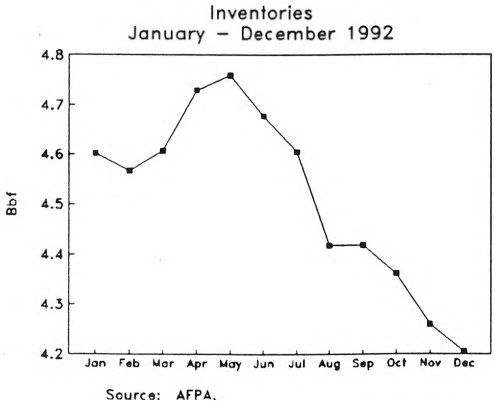
Source: Eastern Quotes & Comments.



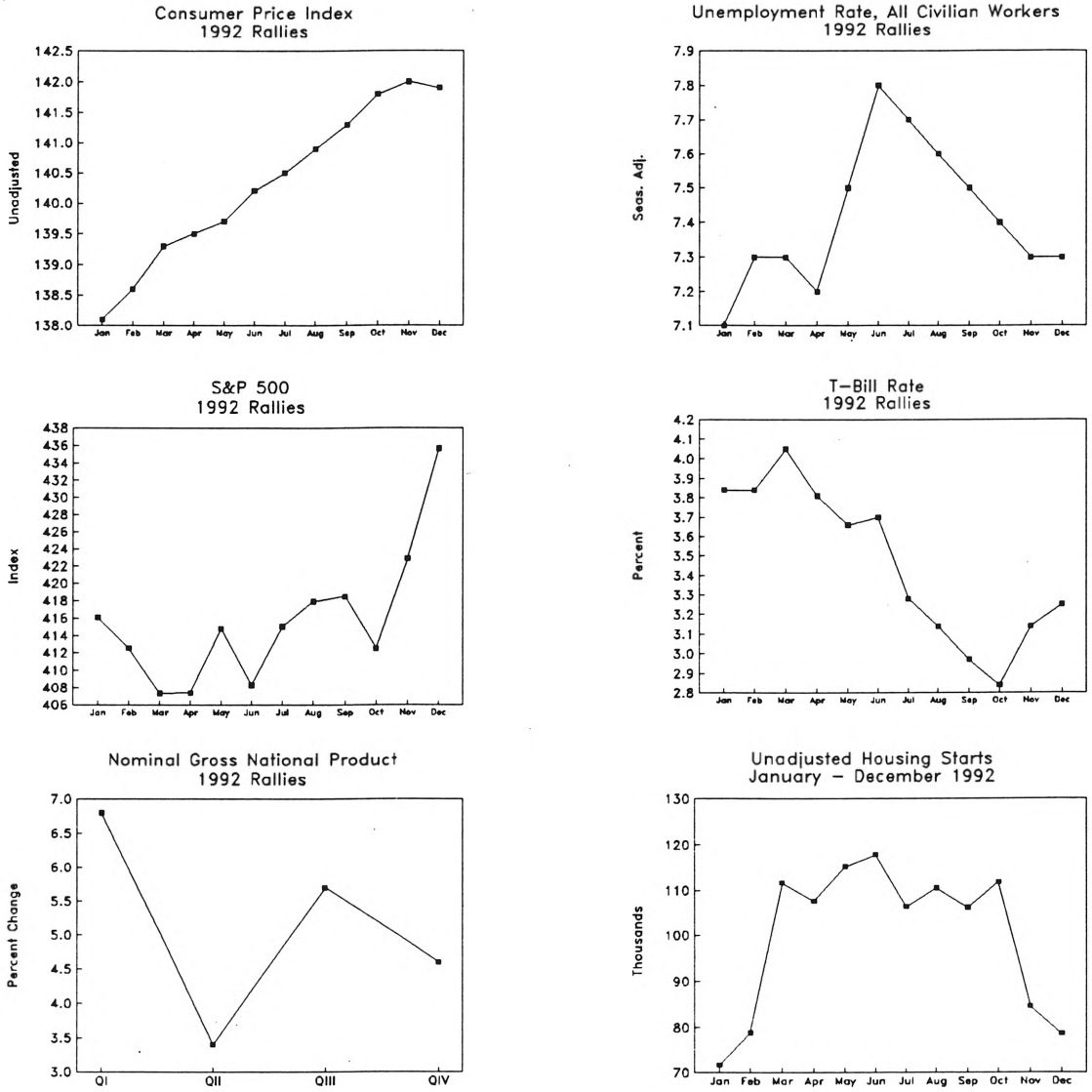
Source: AFPA.



Source: AFPA.



Source: AFPA.



As this is written, the rally persists, having driven some prices and indexes to record levels. The market is now trying to sort out the question:

> *Is this just another bubble, or a step to a new high plateau of prices such as we saw in the early 1970's?*

The best judgment at present is that the market is moving to a new price level based on changed supply conditions. Though interpreting market forces in these conditions is difficult, and production and consumption data are not current, an initial interpretation of

events must be made; this is the purpose of this section. Very likely, more complete information available in the future may result in a revision of significant parts of this interpretation.

2.10.1 The Bubbles: A Stylized Overview

Lumber is sold in a decentralized auction market in which data on the fundamentals are lacking or only available with long lags. As might be expected in such a market, lumber prices seem to overreact to changes in demand and supply fundamentals. Why this should be so is a complex question. It certainly appears that on a monthly basis, demand and supply are not only both inelastic, but are also subject to significant unanticipated variability.

A consistent tendency appears, regardless of the bubbles apparent cause, for prices to overcorrect and touch lows well below pre-bubble levels.

Three of the bubbles examined were primarily driven by upsurges in demand: 1978-80, 1982-85 (really 83-84), and the market peak of 1989.

Two bubbles were driven by policy (Dwyer; Duty), and one (Andrew) was a pure unanticipated demand shock. The massive upswing of October 1992 to March 1993 seems to have been caused by a number of factors coming together at one time. Clearly critical ones were the inventory shortage, slow supply shrinkage in major regions, and the market's anticipation of a severe supply-demand crunch in summer 1993 due to the effects of the spotted owl litigation.

One important conclusion does emerge from common features of these examples. This is that price behavior such as these cases exhibit could hardly be characteristic of a highly concentrated industry or of an industry possessing market power. If the softwood lumber industry, or its marketing system, possessed market power, it would be hard to understand why in so many instances, price increases due to strong demand fundamentals or to momentary market shocks are so promptly reversed, and in fact, often lead to overcorrections.

An impressionistic tabular overview of these experiences is shown in Table 38.

Table 38
Factors in Price Bubbles, 1978-92
Relative Importance - High, Medium, Low

	1978-80	1982-85	1989	Spring 1991	1992 Bubbles	1992-93 Upsurge
Supply Constraints on Logs, Capacity		M			M	M-H
Anticipated Supply Constraints				H		H
Inventories					L	H
Transportation	M					
Supply Shocks				H		
Demand Shocks					H	
Market Overreactions	M	H		H	H	H
Lumber Demand Fundamentals	H	H	M	L	M	M
Overall Economy	M		M		M	M

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VIEWS OF SECURITIES ANALYSTS AND LUMBER MARKET OBSERVERS ON LUMBER PRICES AND CAUSES OF RECENT INCREASES

The Irland Group, Augusta, Maine

April, 1993

We have collected securities analysts' reports from 11 major financial firms. We excerpted sections of their reports that deal with lumber prices, the outlook for 1993, and causes of the increases. We also add excerpts from reports of two leading price reporting services, a congressional analyst, and a widely quoted industry consultant. A few key points emerged:

1. Analysts attribute the price increases in softwood lumber to trends in both supply and demand, but with a strong emphasis on supply. Not one analyst attributes the price increases solely to demand increases, though one securities analyst (Rogers) is now arguing that demand will be more important than supply over coming years, and the congressional analyst also emphasizes demand (Gorte 1993).

2. Recognizing that securities analysts must be conservative in making earnings estimates, it is clear that they -- as well as other experts and market participants -- did not predict the extreme price pressures that emerged in January through March 1993.

3. The analysts agree that increased supplies from other regions will not outbalance western production cutbacks in 1993 and 1994.

4. The analysts foresee a strong boost to the use of substitute species and engineered wood products using more abundant species of wood.

5. Several analysts point to the relatively low level of demand at present compared to previous lumber price peaks, arguing that pricing fundamentals are radically changing.

Relevant excerpts follow:

George B. Adler and James Brucculeri, Smith Barney Paper and Forest Products, February/March 1993

Even if there were some easing up, it would take the U.S. Forest Service and other government agencies a considerable period of time to ready timber for auction, which probably would not happen until sometime in 1994. This now has caused the tremendous speculative rise in product prices.

While housing starts have picked up modestly and the repair and remodeling market is growing, the speculative fever in wood products prices is anticipatory. We recently talked to major home builders who have no problems getting supplies. We suspect that some inventory accumulation has occurred at all levels, from the distributors to the lumberyards to the builders. Thus, with housing starts likely to rise only moderately in 1993, we would expect prices to come down from their recent peak (p. 57).

Thomas P. Clephane, Morgan Stanley, US Investment Research, December 9, 1992

Severe environmental restrictions on government timber sales in the Northwest have led to sharp production declines for western lumber and plywood in recent years. Prices rose by an average of 20-25% in 1992, with substantial volatility in spite of a subdued housing recovery of 1.2 million housing starts. We expect a tighter market for lumber than for plywood because of regional supply and substitution patterns. Thus, we project a 7-10% price increase in 1993, with 1.32 million housing starts, and a further 5-6% rise in 1994, with 1.35 million starts. We find the roughly 15% rise in wood product prices over the past five weeks encouraging -- especially since seasonal demand and prices are usually weak at this time: This indicates that dealer inventories are lower than normal...

The West is a more important source for lumber than plywood: This region will likely furnish 38% of the estimated 1992 lumber supply compared to 43% in 1987; production is down 22% from 1987 to 1992. The South has increased its supply ratio from 25% in 1987 to 31%. Imports from Canada have risen modestly from 29%

of total demand in 1987 to almost 30% in 1992, but environmental pressures are also rising in British Columbia, which supplies 63% of the Canadian lumber exports to the US. Unlike the situation in panels, engineered lumber is only now making an appearance; it represents a mere 1% of lumber output. We expect that the estimated 3.5% rise in 1993 lumber demand will have a greater effect on lumber prices than an increase in demand will have on prices in the panel segment; this is because US and Canadian lumber suppliers cannot increase production as easily as panel suppliers. What's more, panel prices appear to have received a stronger 3Q92 price benefit from Hurricane Andrew (p. 6).

Steven E. Dietrich, Jensen Securities Co., Northwest Forest Products Report, November 5, 1992

Most Northwest building products manufacturers reported very strong 3Q92 margins and earnings despite high domestic log prices. Timber shortages combined with lower product inventories are setting the stage for higher lumber, plywood and oriented strand board (OSB) prices in 1993. Canadian lumber and panel imports, boosted by a weaker Canadian dollar, should only partially limit prices increases (p. 1)...

We continue to believe the combination of lower capacity, increased housing starts and continued timber shortages will drive log and building material products prices well above their 1992 highs. Pulp and paper pricing will continue to be plagued by weak demand relative to new capacity levels (p. 8).

Sherman Chao, First VP and Richard S. Palm, CFA, Merrill Lynch, Paper and Forest Products, December 8, 1992

We continue to hold the most confidence that further profit gains are to come in the forest products business in 1993 on top of spectacular gains in 1992. The supply/demand dynamics next year should be similar to 1992 in which timber supply is constrained at a time of improving demand. These forces led to above a 20% gain in wood product prices this year (about 17% for lumber and 22% for wood panels) and we expect wood product prices

to again rise faster than inflation in 1993. To be conservative, we have assumed only 5% higher wood product prices in our earnings forecasts (p. 1).

Mark S. Rogers, CFA, Prudential Securities, Paper & Forest Products Industry Update, February 5, 1993

Although the rise during the last two-to-three months has been much sharper than we earlier expected, we believe the story's basic plot remains the same as we have been suggesting for quite some time -- namely, that the demand for wood products will catch up to available supply by the summer of 1993, driving wood products prices sharply higher and far above the depressed levels that investors had been used to seeing for the last 15 years, when wood products were in continual oversupply (p. 1).

Mark S. Rogers, CFA, Prudential Securities, Wood Products Industry Update, March 12, 1993

...we continue to believe that the chances are exceedingly high that the approximate 5% reduction in industrywide lumber and plywood capacity that we are expecting as a result of reduced governmental timber sales is a very safe assumption. As a matter of fact, we continue to believe our projected 5% reduction is the low end of a realistic reduction range of 5%-10%.

Although the reduction in capacity brought about by environmental constraints tends to garner the majority of the headlines, the economic reality is that the rise in demand, brought about by the improvement in the economy and the rise in housing starts, is far more important in bringing about the tight supply/demand balance that we now believe is near.

- Specifically, we believe that wood products demand will be 20% higher this year than in the trough year of 1991
- We believe it is likely that demand will rise by at least another 5% next year and maybe by as much as 10%
- The reduction in supply from the spotted owl will total only 5%-10%.

Accordingly, while the 5% reduction in supply plays a part in the 100% operating rate that we expect to be the norm in this business during the next few years, the rise in demand is far more important. The spotted owl is not single-handedly bringing about a return to industry profitability, nor will any likely change in policy toward the owl effectively alter the tight supply/demand balance we expect during the next few years (p. 2-3).

Evadna S. Lynn, CFA, <u>Dean Witter Equity Research, Forest Products Industry</u>, September 18, 1992

Investment Opinion: Forest products stocks should outperform the market. Wood products are one of the few commodities experiencing a major contraction in supply, resulting in sharp price gains even in a slow-growth and noninflationary economic environment (p. 1)...

The cost-push and supply restrictions are resulting in sharply higher prices. During 1992 prices are likely to rise about 17% or $40 per MBF (or MSF). That is a much greater increase than we had anticipated, given the lackluster increase in demand...

We expect another 10-20% surge in prices in 1993. Given the lower timber availability expected next year, the continuing cost pressures in the West, and the rise in operating rates as demand improves modestly, we believe that prices for sawtimber-based products will move up sharply next year. The question is how much. The minimum we expect is about $25 per MBF (or MSF), which is incorporated in our earnings estimates for 1993. There appears an increasing likelihood, however, that the move could be in a $40-50 per MBF range, comparable to the increase experienced this year.

Since there has been no precedent for the supply squeeze now being experienced, there is no real method of anticipating the magnitude of price increase. For example, operating rates would suggest that lumber prices, and particularly western lumber prices, should have seen the sharpest increases this year...

It is of interest to note that lumber and plywood prices

finally surpassed their old 1978-79 peaks in 1992, despite a 32% lower rate of housing starts (only 1.185 million units compared to 1.745 million units in 1979). That is a key signal that the pricing fundamentals have changed (p. 12).

Evadna S. Lynn, CFA, Dean Witter Equity Research, Forest Products Industry, January 13, 1993

For 1993, we continue to expect the forest products stocks to lead the way, reflecting the further tightening of western government timber supply in the face of continuing improvement in lumber and plywood demand. Wood products prices may not repeat the 20-26% rise of 1992, but they should jump at least 10% and possibly 15-20% in 1993 (p. 1).

Matthew K. Berler, VP and Seema R. Hingorani, Donaldson, Lufkin & Jenrette, Paper & Forest Products, February 1, 1993

While we attribute much of the recent strength in lumber and plywood prices to continued supply constraints in the Pacific Northwest due to protection of the Northern Spotted Owl and other environmental pressures, demand appears to have held up in the last few months of 1992. Housing starts for December reached 1.302 million units annualized, up 5.5% month-over-month and 16.5% year-over-year, and starts are expected to rise further in 1993. In addition, demand will accelerate in the South in the first half of 1993 due to Hurricane Andrew-related rebuilding...

In the Pacific Northwest, timber sales from National Forests in Oregon and Washington totaled 4.9 billion board feet in 1990. In 1992, timber sales from the same forests totaled only 389 million board feet, a mere 8% of the 1990 total. Over the last three years, this abrupt reduction in log supplies has forced sawmills and plywood plants in the Pacific Northwest to either shut down or work down their existing timber inventory. As sawmills hit the bottom of their inventory, competition for shrinking supplies of private, state and dwindling amounts of public timber escalates furiously. As a result, log prices will

continue to spiral upward (p. 31)...

The beauty of the wood business for investors, however, is that each new set of regulations that restricts harvest rights results in reduced supply, which translates into higher prices. Even if President Clinton holds a timber summit (as he promised in his campaign) to strike a compromise between the timber industry and environmentalists, there will be very little new supply of federal timber ready for harvest in 1993...

Wood substitutes are gaining more and more attention from producers as the timber supply outlook worsens (p. 36).

Larry Katz, <u>Pacific Crest Securities, Portland/Seattle</u>, December 21 thru 24, 1992

As 1993 approaches, we are looking for an increase in demand for all building products next year as the volume of home building increases. With available timber supplies and production capacity shrinking, prices have nowhere to go but up. The new capacity under construction in other areas such as Canada and the US Southeast cannot replace what is being lost in the Pacific Northwest (p. 8).

Raymond J. Kilroy, CFA, <u>NESBIT Research, Forest Products Industry</u>, October, 1992

A whole host of environmental pressures primarily on public timberlands continued to drive both log and finished prices upwards...

Through June Canadian lumber shipments gained 5.7% to 28.13 million m^3. Shipments from BC, where the imposition of the countervailing duty had a bigger impact, were up 3% and those from the rest of Canada by 10%...

US and Canadian housing starts should recover in 1992 as the economy and consumer confidence improves. Our estimates are 1.35 mm in the US and 187,000 in Canada...

Lumber prices should continue to improve as improving demand

and a shrinking supply will lead to a tighter supply/demand balance. We expect prices to increase by about 5% to 10% (p. 22).

C. A. Dillon, III, CFA, United States Equity Research, Salomon Bros., Paper and Forest Products, October 5, 1992

Wood (or forest) products represent the strongest product area in the entire industry. Harvest restrictions on government lands in the Pacific Northwest effectively have removed about 25% of the industry's wood raw material supply. However, we believe that cyclically peak earnings will be achieved in 1993 -- when we expect supply to be at its nadir...

During the 1980s, prices never returned to the heady levels of the late 1970s because timber supplies were ample enough throughout the decade to meet the demand. In the late 1980s, however, timber supplies from government sources in the Pacific Northwest began to drop as preservationist pressures took hold. Today, basically no wood flows from government lands in the Northwest. Although demand has been lackluster this year, prices for lumber and panels have soared to record highs. Any growth in demand next year likely will cause prices to rise further. However, we believe that prices will flatten in 1994 and 1995 as new capacity begins to start up in the South. Beyond 1995, we expect that the currently tremendous returns derived in this commodity business will drop as either additional new capacity and/or engineered or substitute products become available (p. 17).

John Chrysikopolous, Goldman Sachs, August 11, 1992

Over the past several years, federal timber supply in Oregon, Washington, and California has declined dramatically. On average, federal forest lands provided approximately 40% of the total timber harvest in these three states in fiscal 1986-1990 with an annual volume of 7.5 billion board feet (Scribner scale). In fiscal 1991, only 3.5 billion BF were sold, which included more than 1 billion BF sold in fiscal

1991. During the first half of fiscal 1992, only 0.6 billion BF have been sold from these lands.

The aforementioned declines in timber sale programs have caused lumber prices to increase and have made many western mills much more aggressive in bidding for private timber and logs, driving up the price for certain species. As a result, many logs that would have been exported, especially to China and Korea, have instead been diverted to domestic mills (p. 6-7).

Tom Martin, <u>Martin's Lumber Forecast</u>, January 28, 1993

It appears this rally is for real and we will see Forest Products - wood fiber - trade at much higher levels for some time to come. Analysts have been predicting this rally and much higher trading levels for at least the past three years, but a series of circumstances have kept the real potential well hidden. In fact, anyone who bet on a sustained rally and much higher prices on a continuing basis during the past three years has been a loser.

This is brought out by the fact that the Producer Associations have been reporting lower Production and an even lower Order rate during the past seven months. (Remember we were told during the Presidential Campaign that we were in a more severe Recession than we experienced during the early 1930's.) This drop in total Orders reduced pipe-line inventories, as Demand for new construction has increased by approximately one third over the past 18 months.

For the past thirty three years Production has always quickly overwhelmed Demand during any rally as Producers were able to rapidly increase supply. Now -SURPRISE - the "OWL EFFECT" is kicking in. Actual Federal timber sales in Washington and Oregon in 1992 were down more than 92% compared to just two years ago. As most Producers plan for their log supply two to three years ahead, they are now finding they do not have the timber - logs - to increase supply, at a time that Demand for new homes is rapidly increasing. And at a time when the pipe-line inventories are very low because no one believed it could happen (p. 1).

Doug Smyth, Research Director, IWA - Canada, Madison's Canadian Lumber Reporter, February 26, 1993

During the week of February 19, 1993 U.S. lumber prices continued to soar to astronomical highs. The price of Western Spruce-Pine-Fir (SPF) 2x4's reached $445 (U.S.) per thousand board feet -- a jump of $140 over the record one month earlier and $210 greater than the year-ago level. Although some of those increases can be attributed to temporary factors, including the constraints imposed by inclement winter weather on logging activity in all major producing regions in North America, most of the explanation lies in the severe shortfall in timber supplies which has developed in the U.S. Pacific Northwest. Until December, 1992 the growing crisis was generally hidden from view by the depressed market that began during 1990. And during the early months of 1992 a temporary softening in log export markets permitted West Coast sawmills to enjoy greater access to log supplies.

> *...the projected increase in U.S. consumption of 2.6 billion board feet between 1992 and 1993 will leave an enormous shortfall of at least 1.2 billion board feet during the coming year.*

During 1993, however, the long-term fundamentals of declining Pacific Northwest timber supplies will finally come into direct conflict with rising levels of U.S. demand for softwood lumber (p. 1).

Joe Heitz, Random Lengths Yard Stick, Dec. 1992

Tightening raw material supplies in the U.S. West and Canada, and higher log costs everywhere, are changing the buyer-seller dynamics that prevailed in the wood products industry during the 1980s. The upward trend in lumber and panel prices, driven by log shortages, flat production, and increasing consumption, has put mills firmly in the driver's seat. While admitting that prices will still have their ups and downs during the rest of the 1990s, producers expect to have a much firmer hand in dealing with buyers than they had during the previous decade.

This constitutes a fundamental shift in the give-and-take of normal market activity. During the 1980s, wood products were relatively abundant, and significant price increases usually were followed by declines of equal intensity as mills cranked up production. Now, with logs scarce in the western U.S. and selling at higher prices virtually everywhere, many producers are unable or unwilling to boost production in response to price hikes as they traditionally have. The resulting supply shortages have given mills the upper had during the spectacular price surge that began last October (p. 1).

Paul F. Ehinger Associates, <u>Forest Products Industry Report on Mill Closures, Operations, and Other Related Information</u>, September 1992

Today we have an all-time high in plywood prices and a similar, but not as dramatic, situation in lumber prices. Plywood prices were in a steep climb in the week preceding Hurricane Andrew, and simply proceeded to break through the roof with this additional pressure on an already short supply.

The plywood industry as a whole has operated in recent weeks at 85 percent of capacity. In the North and South, it has held at 95 percent, but in the West, the industry has only been able to operate at 61 percent of production capacity in a peak market. The mills cannot obtain the necessary timber to improve this pattern of operation.

Southern lumber has operated throughout this year at approximately 100 percent of capacity when compared to 1991. Canadian imports are up a similar amount, but the Western States' lumber product has been at only 97 percent of 1991 levels during a period of the highest market prices ever experienced by the industry.

The Forest Products industry nationwide has a long history of being able to respond to the changing demand for its products in a timely manner and at reasonable prices. <u>It can no longer do so</u> (p. 1-4).

Ross W. Gorte, Memorandum on Lumber Prices, Congressional Research Service, March 10, 1993

Conclusions and Implications. Lumber prices have risen by 70 percent in the past few months. February 1993 prices reached historic highs, although after adjusting for inflation, the prices are still substantially below real lumber prices of the late 1970's. Many factors have contributed to the recent price rise, but the economic recovery is probably the most significant cause, because lumber prices rose by more than 30 percent in the previous two recoveries, in 1983 and in 1976. Seasonal lumber demand also contributes about a 10 percent rise in prices. The recent 6.51 percent countervailing duty on Canadian lumber and the possible Japanese economic recovery may also be contributing to the recent rises in US lumber prices. Finally, spotted owl protection on Federal lands is likely to raise prices by about 10 percent; this price rise could be considerably more in the short run, until the Forest Service and BLM have completed land management plans and environmental impact statements that the courts determine have adequately reflected the threatened status of spotted owls.

Some interests have warned that substantial lumber price rises might choke off the US economic recovery. They argue that homebuilding is typically a major factor in an economic recovery, and that price rises for homebuilding supplies could dampen the demand for housing, and thus cause a recovery to falter. However, examining this possibility from two different angles suggests that this result is unlikely. First, history suggests that rising lumber prices are unlikely to constrain housing starts. Lumber prices rose by 73 percent between 1975 and 1978, while housing starts rose by 74 percent (from 1.16 million starts in 1975 to 2.02 million in 1978). Similarly, lumber prices rose by 31 percent between 1982 and 1983, while housing starts rose by 60 percent (from 1.06 million starts in 1982 to 1.70 million in 1983). Thus, rising lumber appear not to have, historically, dampened homebuilding activity.

The second angle is the likely effect of rising lumber prices

on housing prices. According to the National Association of Homebuilders, construction wood -- lumber, plywood, trusses, interior trim, etc. -- accounted for less than 5 percent of the price of a house. Thus doubling the price of lumber raises the price of a house by only 5 percent -- $5,000 on a $100,000 house. On a 30-year mortgage for a $100,000 house with a fixed interest rate of 9 percent, doubling the price of lumber increases mortgage payments by less than $40 per month. This increase is less than the impact of a 1-percentage point increase in the interest rate; increasing the interest rate from 9 percent to 10 percent, in this example, would increase the mortgage payments by slightly more than $40 per month. Since small changes in mortgage rates have a greater effect on home buyers than doubling lumber prices, it seems unlikely that changes in lumber prices can have a significant effect on housing demand (p. 6-7).

Note: This work was conducted as part of a joint project with Joel Popkin and Co. for the American Forest and Paper Association.