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Developing Cross-Hedging Strategies Based on Lumber Price-Change Variation and Seasonality

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and
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NEW APPROACH

Seasonal price changes in lumber are a well-recognized fact, but not all lumber items show similar patterns of change, degrees of change, or responses to market influences. These dissimilarities can be attributed to two factors: 1) the localized effect of weather on production and consumption patterns, and 2) the suitability of lumber items for particular uses. For example, home building requires framing lumber and its consumption varies markedly according to regional weather patterns; these, in turn, affect both the supply of and demand for particular species. In contrast, 1 x 12 boards serve uses less influenced by weather than home building, although board production in northern areas can be affected by climatic factors.

Lumber price movements, which are generally volatile and variable, can have a large impact on businesses commercially involved with forest products. Typically, these price movements are entirely beyond the control of individual lumber producers, wholesalers, retailers, or large-volume users. Consequently, these businesses face substantial risks from adverse price changes; the firm's profitability, competitiveness, and long-range financial stability could be seriously reduced.

The lumber futures market offers a means to reduce the risks stemming from fluctuations in lumber prices. By initiating positions in the futures market that offset current or anticipated commitments in the product market, a firm can protect itself--hedge--against adverse price changes. How managers can best determine an appropriate futures position is the subject of this monograph.

We introduce an improved approach to developing optimal hedging strategies for non-deliverable (off-contract) lumber items. Our approach is based on new theoretical reasoning that employs recently developed statistical techniques to detect and evaluate the presence of seasonality in the basis and its consequent effects on hedging strategy. Although seasonal variation in lumber prices has been recognized for many years, analysts could not confirm its effect on the basis--the difference between a futures price and the product cash price of a particular lumber item--until a record of futures trading had accumulated over an extended period of time that included both rising and falling markets.

Previous studies of price trends generally tried to determine the possibilities for hedging against adverse price movements by employing statistical techniques that measure variation in price levels. More recently, a few investigators recognized that measuring price level variation is inconsistent with the fundamental objective of hedging, which is to reduce price change variation. Our approach incorporates this reorientation. Because our methodology thus recognizes seasonality and is based on sound theoretical reasoning, it is capable of producing more stable estimates of hedging opportunities than previous techniques.

HEDGING STRATEGY

Good hedging strategy dictates that a firm should only initiate a hedge when anticipated price change risk exceeds probable basis risk. Basis risk is inherent in hedging because the basis rarely remains constant; it fluctuates in response to product and futures price changes. When a firm hedges, it substitutes basis risk for price change risk. By definition, low hedge effectiveness denotes a large basis risk and limited hedge protection. This is unacceptable, because price changes in the contract lumber item are unlikely to be matched or mirrored by the nondeliverable item. In our study we did not make quantitative estimates of potential basis risks; however, their influence on hedging strategy can be qualitatively assessed. Remember that money will be lost on a short (sell) hedge when futures prices do not decline as fast or faster than product prices, or else rise faster than product prices. Similarly, a loss will occur on a long (buy) hedge when product prices rise faster than futures prices, or when product prices do not decline as fast as futures prices.

Arthur (1) states that a firm seeking to use the futures market as a business management tool must evaluate hedging strategies by the amount of risk reduction achieved in the firm's net position. The net position is the volume of lumber at risk because of adverse price changes. Therefore, to hedge correctly, a manager must be able to quantify the percentage reduction in net position risk that a hedge could accomplish.

The methodology we present here is based on studies by Johnson (2), Ederington (3), and Hill and Schneeweis (4, 5), which examined the relationship between product prices and their respective futures prices. However, we could not make a direct analysis of the cash-to-futures relationship because of the limited trading history under the Chicago Mercantile Exchange's (CME) revised lumber contract. In January 1981 the CME expanded deliverable species to include several others besides hem-fir (see Appendix A). Therefore, the focus of our analysis is on product-to-product relationships--the relation between the price of a particular lumber item and the price of the deliverable contract item. Of the deliverable species in the present CME contract, spruce-pine-fir (SPF) 2 x 4s have become the item most likely to be delivered. Thus, in order to evaluate the possibilities of cross-hedging (off-contract hedging), new, estimated price relationships were needed between SPF and other non-deliverable species, grades, and sizes.

Our work permits a more precise calculation of the appropriate futures position by utilizing two concepts: 1) hedge effectiveness, and 2) optimal hedge ratio. Hedge effectiveness can be defined as the percent reduction in variability of the non-deliverable item position that would be achieved by taking a futures position in the deliverable item. Hedge ratio is the size of the deliverable position in futures relative to the non-deliverable product position that is required to establish an effective hedge.

Kingslien and McMahon (6), in an earlier monograph of this series, reported relationships between price levels of the lumber contract item at that time (random length, inland hem-fir 2 x 4s) and 31 non-contract items for the period 1973-74. They presented tables to convert the price of the contract item into equivalent prices of the 31 non-contract items. In effect, they estimated hedge effectiveness indexes and optimal hedge ratios, although these terms were not used at that time. However, their technique produced results that appear invalid when judged by current statistical standards.

Hill and Schneeweis (4) revealed the logical fallacy of a statistical approach based on price <u>levels</u>; instead, they and Arthur (1) supported regression analyses based on price <u>changes</u>. Thus, in order to produce more valid statistics, we analyzed price changes between the likely delivered item (SPF) and the six arbitrarily chosen, non-contract items listed in Table 1.

Grammatikos and Saunders (7) showed that price relationships may change over time in response to changes in market conditions. We investigated whether this occurred in our lumber price series by making estimates for two time periods, 1973-74 and 1973-82. This permitted a direct comparison with the Kingslien and McMahon results, after substituting SPF for hem-fir as the independent variable. We found that the product-to-product relationships had deteriorated for the longer period (1973-82). However, the extent and significance of the deterioration were masked because of serious deficiencies in the statistical procedure of Kingslien and McMahon. It resulted in cross-hedging strategies that either did not reduce risks or improperly matched product-futures positions.

As an alternative statistical procedure, we compared the monthly price variation of SPF with each of the other lumber items by using Exploratory Data Analysis (EDA) techniques (8, 9). This analysis revealed substantial differences in seasonal effects. The seasonal tendencies in product prices, and particularly the differences in seasonal tendencies between the deliverable grade and each non-deliverable item, led us to estimate price relationships for each month of the year. With price changes in SPF as the independent variable, we derived estimates for each non-deliverable item and for each calendar month. By thus respecifying the underlying statistical model, we removed the effects of seasonal tendencies in the data for most of the lumber items. With these adjustments completed, we were finally in a position to develop hedging strategies based on theoretically sound reasoning.

ESTIMATING HEDGE EFFECTIVENESS

Potential hedge situations are revealed by studying seasonal tendencies for each lumber item and computing an associated index of hedge effectiveness. Earlier we defined hedge effectiveness as the percent reduction in the variability of the non-deliverable item position achieved by establishing a futures position in the deliverable item. Regression analysis of a price series of the two items yields a parameter (the coefficient of determination denoted by R^2) that is an index of hedge effectiveness.

In theory, the hedge effectiveness index should be higher in months that display price changes similar to SPF 2 x 4s than months when the change is divergent. We found, for example, that there is a pronounced tendency for inland hem-fir prices to rise more sharply than SPF prices from January into March. A long (buy) hedge against a hem-fir product position would incur a basis loss, while a short (sell) hedge would realize a basis gain. During April through July, the opposite occurs: the SPF price rises more sharply than inland hem-fir. Coast hem-fir 2 x 4s, fir and larch 2 x 10s, and green Douglas-fir 2 x 4s also showed substantial deviations from the SPF 2 x 4 seasonal pattern and, thus, correspondingly low indexes of hedge effectiveness; in some months, however, the seasonal patterns were similar (Table 1).

If we arbitrarily decide that some minimum value of the index, such as 0.30, denotes the lower limit for effective hedging, we can present a seasonal picture of effective and ineffective months for hedging our six lumber items (Table 1). An individual firm could calculate a similar table incorporating not only its hedge effectiveness index but also its own particular basis risk, price outlook, and risk exposure.

CALCULATING A WEIGHTED HEDGE POSITION

Once a feasible hedge situation is identified, the hedge ratio is used to match the values of the product and futures positions so as to minimize the risk from price changes, thereby establishing an optimal weighted hedge. Because the hedge ratio is defined as

$$HR = \frac{\text{size of futures position}}{\text{size of product position}},$$

a hedge ratio of 0.50 indicates that a 10% change in the product item price would result in a 5% change in the SPF price. Therefore, to offset the risk of product price changes, a SPF futures position would have to include twice the board foot volume of the exposed product position. Understood in this manner, the hedge ratio is simply another regression parameter, the slope of the regression of SPF prices (the dependent variable) on each of the product prices (the independent variable).

One consequence of weighting the size of the hedge by the hedge ratio is that the basis risk also must be evaluated in weighted terms. Depending on the current basis value, the basis risk could either be substantially increased or greatly reduced, because the change in the product-futures relationship will be amplified by the hedge ratio.

CONCLUSION

In this monograph on developing a cross-hedging strategy, we have only begun to suggest the usefulness of our new methodology for identifying hedging opportunities and evaluating strategic information. We have examined only six examples out of a vastly larger population of potentially hedgeable lumber items, and for each of the six we have demonstrated the presence of substantial seasonal effects in the basis. Most important of all, perhaps, our hedge effectiveness index identifies times during the year when hedging should not be attempted, because the adverse effects of seasonal factors preclude effective hedging.

Our recommendation is that managers should estimate the amount of price change their hedges are intended to offset; then they should determine an optional match between the respective sizes of their product and futures positions, as determined by the hedge ratio. This is contrary to the customary method of simply matching product volumes. We also recommend the use of weighted hedges, which requires skilled management under conditions of changing hedge effectiveness and basis risk. Thus, complex analyses are needed to achieve an effective hedge.

By showing the possibility of hedging non-deliverable lumber items with the SPF futures contract, we hope those who produce, distribute, or use non-contract items will appreciate that the CME contract has wider applicability and usefulness as a business management tool than many managers tend to assume.

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Appendix A

Random-Length Lumber (Excerpts from revised contract applicable against September 1981 and subsequent contracts).

COMMODITY SPECIFICATIONS

Each delivery unit shall consist of nominal 2 x 4s of random lengths from 8 feet to 20 feet. Each delivery unit shall consist of and be grade-stamped Construction and Standard, Standard and Better, or #1 and #2; however, in no case may the quantity of Standard grade or #2 grade exceed 50%. Each delivery unit shall be manufactured in California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, or Alberta or British Columbia, Canada, and contain lumber produced from and grade-stamped Alpine Fir, Englemann Spruce, Hem-Fir, Lodgepole Pine and/or Spruce-Pine-Fir (SPF).

FUTURES CALL

Trading Unit

The unit of trading shall be 130,000 board feet.

Price Increments

Minimum, price fluctuations shall be in multiples of $.10 per thousand board feet ($13 per contract).

Daily Price Limits

There shall be no trading at a price more than $5.00 per thousand board feet above or below the previous day's settlement price ($650 per contract).

Termination of Trading

Trading shall terminate on the business day immediately preceding the 16th calendar day of the contract month.

PAR DELIVERY

Par Delivery Unit

Delivery shall be made on track at the producing mill. The lumber shall be paper-wrapped and loaded on flat cars. Cars shall be packed as close to equal as possible.

Size

A delivery unit shall be 130,000 board feet of random-length 2 x 4s provided the tally is within the following limits:

Length	Percent of Total Board Feet Delivered
8'	3% to 10%
10'	5% to 12%
12'	10% to 20%
14'	10% to 24%
16'	35% to 60%
18'	0% to 15%
20'	0% to 15%
16' + 18' + 20'	45% to 60%

The lumber shall be double end trimmed, surfaced four sides, eased edge and of minimum dressed dimensions, as specified in Voluntary Product Standard 20-70, American Softwood Lumber Standard, published by the United States Department of Commerce (hereinafter referred to as PS 20-70).

The lumber shall be unitized; that is, steel banded. In addition, all units shall contain lumber of equal lengths, except 18-foot and 20-foot lengths which may be banded together. The units shall be individually paper-wrapped.

Quality

The lumber shall meet the requirements of PS 20-70 and shall comply with the requirements for inspection and reinspection of an agency recognized by the American Lumber Standards Committee and/or Canadian Lumber Standards Committee.

Variations in Quantity

Variations in quantity of the delivery unit between 120,000 and 140,000 board feet shall be permitted without penalty, but payment shall be made on the basis of the exact quantity delivered.

INSPECTION PROCEDURES AND STANDARDS

Inspection shall conform to PS 20-70 and any other requirements that may thereafter be promulgated under PS 20-70. Inspection service and compliance shall be subject to the customary lumber industry practice, as provided by PS 20-70.

In case of a claim on grade, moisture content, tally, or manufacture, the buyer shall demand reinspection through the Clearing House to an agency recognized by the American Lumber Standards Committee and/or Canadian Lumber Standards Committee as provided for under the rules of those organizations and PS 20-70. Findings of the reinspection shall be final and binding upon the buyer and seller.

Table 1. Effective and ineffective months for hedging six lumber items.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Inland hem-fir 2x4	X[a]	→	→	→[b]	X	→	→	→	→	→	→	X
Coast hem-fir 2x4	X	→	→	X	→	→	→	→	→	X	→	→
Coast hem-fir 2x10	X	→	X	→	X	→	→	→	→	→	→	→
Fir and larch 2x4	X	→	X	X	X	→	→	→	→	→	→	→
Fir and larch 2x10	X	→	X	X	→	→	→	→	→	→	→	X
Green Douglas-fir 2x4	X	X	X	X	X	→	→	→	→	→	→	X

[a] X indicates months when hedging would be ineffective.

[b] → indicates months when hedge effectiveness rating is greater than 0.30, denoting an effective hedging opportunity.

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