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The Seasonal Fluctuation of the Forest Products Price (II)

—The Relationship between Price Indicator and Quantitative Indicator—

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Introduction

In the previous paper[10], we have showed the seasonal indexes of log and lumber price movements in Japan, mainly after 1973. And we referred the characteristics of seasonal index of timber price. A couple of results can be observed, and the main of the couple is that the pattern of seasonal indexes of price movement is not equal. More important, the pattern is changeable within the same price series. These results are similarly for the amplitude of the seasonal indexes. The seasonal index of wood, lumber and related products price index (estimated by the Bank of Japan[1,2]) is similar in the peak and the bottom month to that of construction materials price, but the amplitude of the former is obviously bigger than that of the latter.

We have discussed the seasonal indexes of only timber price in the previous paper. The contents of this paper are as follows: Firstly, we calculate the seasonal index of the quantitative indexes assumed to be related to the timber price movement. Next, the characteristics of seasonality of these quantitative indexes are going to be discussed by using the same methods adopted in the previous paper. Next, similarly in case of price, we try to type these seasonal indexes by using cluster analysis. Last, we shall be able to discuss the relationship between the price series and the quantitative series.

Data and Methods

Mori[17], Kishine[5], Yukutake[19,20] and Matsushita[7,8,11] have calculated the seasonal index of quantitative variables on timber price movement. Such indicators are widely divided into the demand-side index and the supply-side index. The most important field of the demand-side of log and lumber is construction movement[15,16], especially wooden one. As the supply-side index, the import quantity (customs clearance) estimated by the Customs Bureau, Ministry of Finance is important, because the proportion of domestic timber for all the timber supply in Japan has been decreasing since the freeing of timber trade. The proportion of domestic timber is 26.4% in 1990[13]. "Lumber statistics"[12] surveyed by Statistics and Information Department, Economic Affairs Bureau, Ministry of Agriculture, Forestry and Fisheries, is also an important source. All the indexes used in this paper are listed in Table 1. This table includes the variables used in the previous paper, too.

There are several technical methods used for the time-series-analysis[4,18]. To separate a seasonal factor from the original data series, we use the same analysis as the one used in the previous paper. Namely, we use EPA method as time-series-analysis, which was fixed by the Economic Planning Agency[3,4] in Japan in 1963. The brief summary[3] of the method was shown in

Table 1. The list of variables used in this paper

	Statistics name	Contents		Variable number	Period of analysis
Price statistics	Wholesale price index*1	All commodities*4		P11	1952–1990
		Wood, lumber and related products*4		P12	1952–1990
		Construction materials*5		P13	1973–1990
	Import price index*2	Wood, lumber and related products*4		P14	1967–1990
	Survey of log and lumber price*3	Log	Japanese cedar*6	P21	1973–1990
			Japanese cypress*6	P22	1973–1990
			U.S.A. Hemlock*7	P23	1973–1990
			South sea timber (Lauan)*8	P24	1973–1990
			U.S.S.R. Yezo Spruce*9	P25	1973–1990
		Lumber	Japanese cedar, squares*10	P31	1973–1990
			Japanese cypress, squares*10	P32	1973–1990
			U.S.A. Hemlock, squares*10	P33	1973–1990
			U.S.S.R. Yezo Spruce, strips*11	P34	1973–1990
Quantity statistics	Construction work started*12	Building construction started (all)		Q41	1969–1990
		Building construction started (wooden)		Q42	1969–1990
	Import quantity (Customs clearance)*13	Log and lumber from	U.S.A. & Canada	Q51	1969–1990
			U.S.S.R.	Q52	1969–1990
			South sea countries	Q53	1969–1990
	Lumber statistics*13	Sawlogs	supply to sawmill (domestic log)	Q61	1969–1990
			supply to sawmill (foreign log)	Q62	1969–1990
			consumption in sawmill	Q63	1969–1990
		Lumber	production	Q64	1969–1990
		Domestic lumber stock		Q65	1969–1990

*1 1934–1936 average = 100.
*2 1985 average = 100, Yen basis.
*3 Unit: Yen per m^3.
*4 Indexes for groups.
*5 Indexes for use.
*6 Diameter 14–22 cm, length 3.65–4 m; mixed.
*7 Diameter 30 cm and over, length 6 m and over; grade No. 3.
*8 Diameter 60 cm and over, length 4 m and over; for plywood.
*9 Diameter 20–28 cm, length 3.8 m and over; mixed.
*10 Thickness 10.5 cm, width 10.5 cm, length 3 m; grade No. 1.
*11 Thickness 1.3–1.5 cm, width 15 cm, length 3.65–4 m; grade No. 1.
*12 Total floor area, unit: 1,000 m^2.
*13 Volume, unit: 1,000 m^3.

the previous paper. Alike in case of the previous paper, T means trend factor, C means cyclical one, S means seasonal one and I means irregular one. We can also use these four signs by combining adequately, for example, TC means trend-cyclical factor. In accordance with the definition of time-series-analysis, TCSI means the original series.

Results

1. Statistical summary of time-series-analysis

We calculate the seasonal index of the quantitative variables listed in Table 1. In this paper, we often use the variable number listed in this table instead of the variable name. The statistical summary of the EPA method is shown in Table 2. We can point out several characteristics from

Table 2. Summary of statistical analysis*1

		Q41	Q42	Q51	Q52	Q53	Q61	Q62	Q63	Q64	Q65
Ave. percentage change*2	TCSI	9.6	13.1	15.0	12.6	10.8	6.0	5.4	4.3	4.3	2.6
	TCI	3.7	4.3	12.2	9.0	6.5	2.5	2.9	1.2	1.1	1.4
	I	3.3	3.7	10.9	8.2	5.8	2.2	2.7	1.1	1.0	0.8
	TC	1.2	1.3	2.5	2.0	1.7	0.7	0.8	0.4	0.4	1.0
	S	8.4	12.2	8.1	7.6	7.8	5.5	4.3	4.0	4.0	2.1
Related measures*3	I/TC	2.8	2.8	4.3	4.2	3.3	3.3	3.4	2.5	2.4	0.8
	I/S	0.4	0.3	1.4	1.1	0.7	0.4	0.6	0.3	0.3	0.4
	S/TC	7.1	9.2	3.2	3.9	4.5	8.1	5.5	9.5	9.3	2.1
	I/TCSI	0.3	0.3	0.7	0.7	0.5	0.4	0.5	0.2	0.2	0.3
	TC/TCSI	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.4
	S/TCSI	0.9	0.9	0.5	0.6	0.7	0.9	0.8	0.9	0.9	0.8
I/TC ratio*4	1	2.8	2.8	4.3	4.2	3.3	3.3	3.4	2.5	2.4	0.8
	2	1.7	1.9	2.5	2.2	1.8	1.6	1.9	1.4	1.3	0.6
	3	1.1	1.3	1.8	1.6	1.3	1.1	1.3	0.9	0.8	0.4
	4	0.9	0.9	1.4	1.2	1.0	0.9	1.0	0.7	0.7	0.3
	5	0.6	0.7	1.1	1.0	0.7	0.7	0.7	0.5	0.5	0.2
	6	0.6	0.7	0.9	0.9	0.7	0.6	0.6	0.4	0.4	0.2
	MCD span*5	3	3	5	4	4	3	3	2	2	0
Ave. duration of run*6	TCI	1.8	1.9	1.7	1.5	1.6	1.6	1.6	1.8	1.8	3.1
	TC	6.6	5.7	4.1	3.9	5.6	5.4	5.4	7.1	6.8	9.1
	I	1.6	1.7	1.5	1.5	1.5	1.5	1.6	1.5	1.5	2.1

*1 The period of analysis of all variables is from January, 1969 to December, 1990 (264 months).

*2 In case of TCSI, the month-to-month per cent change is defined as follows:

$d_i = ((TCSI)_i - (TCSI)_{i-1}) / (TCSI)_{i-1} \times 100$

i: period (i=1...n), n: the number of the data period

Average of d: $(\sum_{i=2}^{n} |d_i|)/(n-1)$

By comparing the mean of TCSI and that of TCI, we can judge the effectiveness of seasonal adjustment. If the latter is bigger than the former, this series is not well adjusted by EPA method. Though only the seasonal factor is discussed in this paper, irregular factor is also important from the view point of short-term fluctuation. The mean of the month-to-month per cent change of I is a useful index to know the degree of the irregular factor.

*3 As indexes have another scales or units each other, relativized index is required.

*4 The ratio of average percent change of I to that of TC according to month spans.

*5 Month for cyclical dominace (MCD) is defined as the first month when I/TC ratio is smaller than one.

*6 This index means how many months the same direction-change in the series continues on the average.

this table, which are quite comparable to the results in case of price index.
(1) The average percentage of change in quantitative index is considerably bigger than that in case of the price index. For example, the percentage of the original series (TCSI) of the wooden construction started (Q42) is 13.1%. The figures in case of the import quantity are over 10%. The figures of variables related to the lumber statistics, that is, Q61–Q65, are smaller than that of the import quantity, being almost bigger than that of the price series. As discussed in the previous paper, the change of price series is almost less than 3%.
(2) As comparing the average percentage change of TCSI to that of TCI, the effect of seasonal adjustment is remarkably important. Especially, in case of the wooden construction started (Q42), the average percentage of change in TCSI and TCI is 13.1% and 4.3%, respectively. The lumber consumption in sawmills (Q63) and the lumber production (Q64) are also the series that show the effectiveness in this seasonal adjustment method.
(3) The average percentage of seasonal factor (S) listed in this table is also quite bigger than that of the price series. The value of S/TCSI is 0.8 or 0.9 in case of the construction started (Q41, Q42) and the lumber statistics (Q61–Q65). This value is also higher than that of the price statistics. For the variables on the import quantity, the value is around 0.6, that is almost equal to or little higher than that of the price index.
(4) The irregular factor is not negligible, especially in case of the import quantity. The average percentage of change in I of the import quantity, that is, Q51, Q52 and Q53, is 10.9%, 8.2% and 5.8%, respectively. I/TC of the above variables is over 0.5. Thus, MCD span of Q51, Q52 and Q53 is 5 months, 4 months and 3 months, respectively.

2. Construction activities

As shown in the previous paper, the price indexes of wood, lumber and related products price have almost the same peak and bottom months as those of the construction materials price. As a result, it is supposed that the construction movement reflects the price movement also in terms of seasonal period. It is needless to say that this is obvious in terms of long-run. At first, we analyze the movement of construction started, especially wooden construction. The result is shown in Fig. 1. The peak months are 'April' and 'July'. 'July' has been one of the peak months through the whole researching periods, and 'April' has been the peak month since late 1970's. The peak season has become comparatively earlier than as before. As 'July' is a rainy season in Japan, they say that the construction activities show a decreasing tendency a little, but the result is

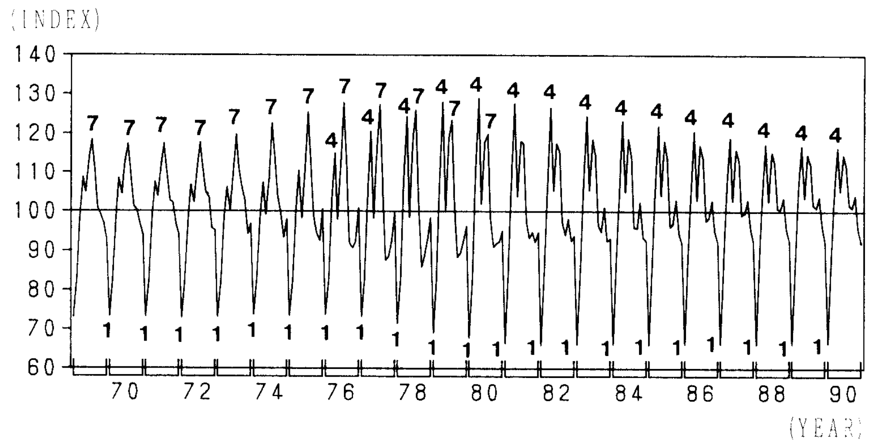

Fig. 1. Seasonal index of wooden building construction started (Q42).

almost the reverse. The bottom months have been 'January' through the whole researching periods. The amplitude is almost within 30%. This seasonal pattern is almost fixed, comparing to the seasonal index of the price series.

When we use "construction statistics", we have to pay attention to the method how to survey this statistics. With the enforcement of the Building Standard Law in 1950, the new construction of building with a floor area of more than 10 square meters is required to be notified by the owner-to-be prior to the start of the construction work[6]. So, this seasonal index is not always equal to the construction activities themselves. Probably, the "real" month of peak and bottom may be several months after the observed one. By the construction statistics in 1989, the construction period in case of the wooden one is as follows: under 3 months is 12%, from 3 months to 5 months is 75%, from 5 months to 8 months is 11%, and over 8 months is 2% in floor area basis.

3. Log and lumber import

The result of seasonal index of import quantity is shown in Fig. 2, Fig. 3 and Fig. 4. The seasonal movements of these three important foreign timbers are different.

Firstly, in case of the import quantity from U.S.A. & Canada, the peak months are almost 'June' or 'July', and the bottom months are 'January' or 'February'. The bottom months have been 'August' before 1971, and 'November' during the period 1979–1982. During the period 1983–1985, the seasonality is not so clear. As shown in the previous paper, the peak and the bottom months of the price of log or lumber from U.S.A. & Canada are not fixed. The relationship between the price variables and the quantitative variables is not clear, but let's pay attention to the position in 'June' or 'July'. 'June' and 'July' have been the bottom months during the period 1973–1975 and 1984–1988 (variable number P 23, Fig. 5 in the previous paper[10]). However, these two months have been the peak months during the period 1978–1981. The relationship does not seem to be constant during this researching period.

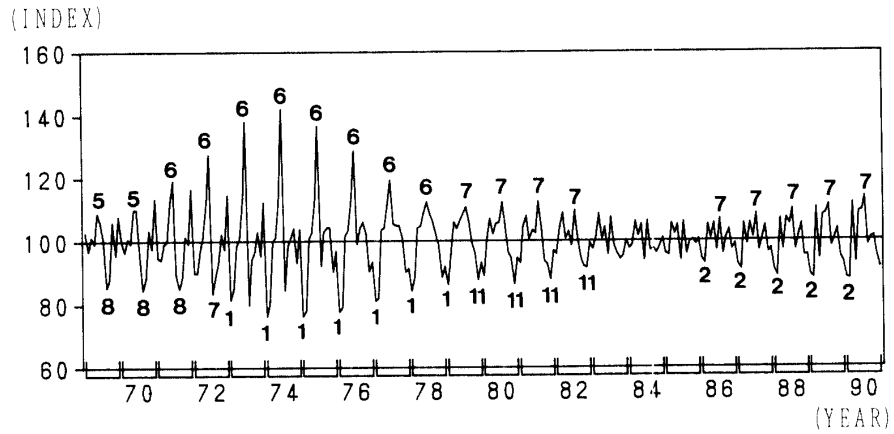

Fig. 2. Seasonal index of timber import quantity from U.S.A. and Canada (Q51).

Next is the case of import from U.S.S.R. The result is shown in Fig. 3. The peak months have been 'June' or 'July', and the bottom months have been from 'November' to 'January'. This pattern is common during the researching period. The amplitude is around 20%. Supply area of timber for export to Japan in U.S.S.R. is the eastern part of Siberia, so the climatic conditions influence the timber export. From winter to summer is the best season to transport log from

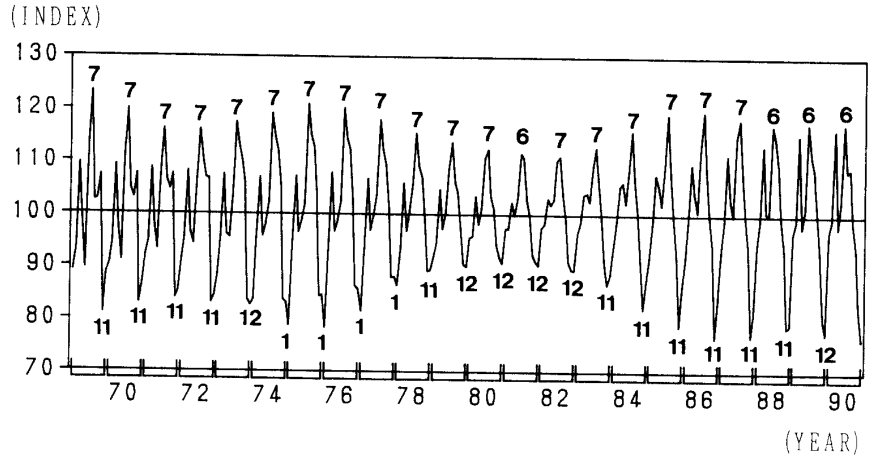

Fig. 3. Seasonal index of timber import quantity from U.S.S.R. (Q52).

forest land and to make use of ports. As discussed in the previous paper, during the period 1982–1987, the seasonal index of the price of Yezo Spruce strips (P34) shows the pattern in which the peaks have been 'January' and the bottoms have been 'July'. This pattern is almost the reverse one shown in Fig. 3. The amplitude of the seasonal index of timber import from U.S.S.R. (Q52) in late 1980's is greater than that in early 1980's. In spite of this spread, the amplitude of the price of Yezo Spruce strips price (P34) is very small, as shown in the previous paper.

The result of Lauan is shown in Fig. 4. The peak months are 'October' or 'December'. In addition, as in partially, 'May' or 'June' shows the second peak. The bottom months have been 'March' or 'April' since 1972. The weakness of the import of Lauan in winter is partially due to the rainy season in the supply area. The amplitude is within 10–20%. In spite of these fixed seasonalities observed in the import quantity, the seasonal pattern of Lauan log price (P24) is not stable, as shown in the previous paper. In comparing directly the month of the peak and the bottom in Fig. 4 with that of Lauan log price, the reverse result can be found partly. During the period of 1973-1976, the peak months of the price have been in winter, a season showing low value in quantity basis. During the period of 1978–1981, the bottom months of the price have been in winter, a season showing high value in quantity basis. But, recently both patterns have been similar.

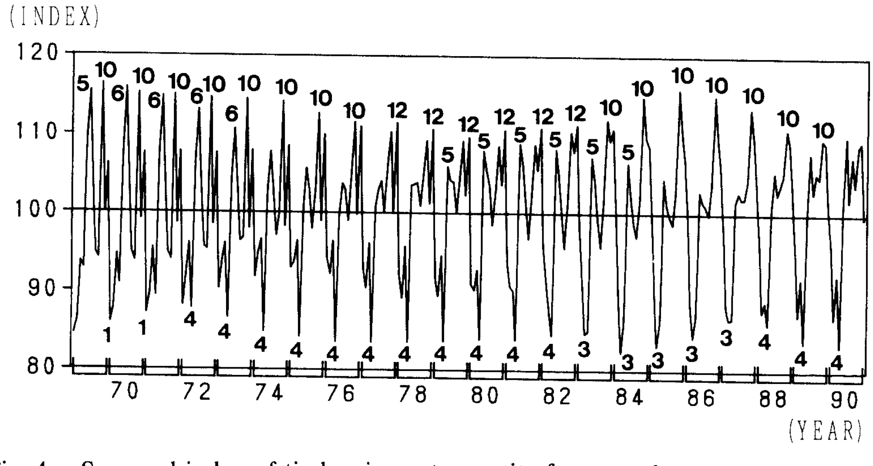

Fig. 4. Seasonal index of timber import quantity from south sea countries (Q53).

4. Lumber statistics

(1) Sawlogs supplied to sawmill

(a) Domestic log

The seasonal index of domestic sawlogs supplied to sawmill is shown in Fig. 5. The seasonal pattern is clear. The peak months have been 'March' and 'December'. The seasonal index of 'December' is bigger than that of 'March'. The bottom months have been from 'April' to 'June' before 1976, and 'August' since 1977. The amplitude is almost 10%.

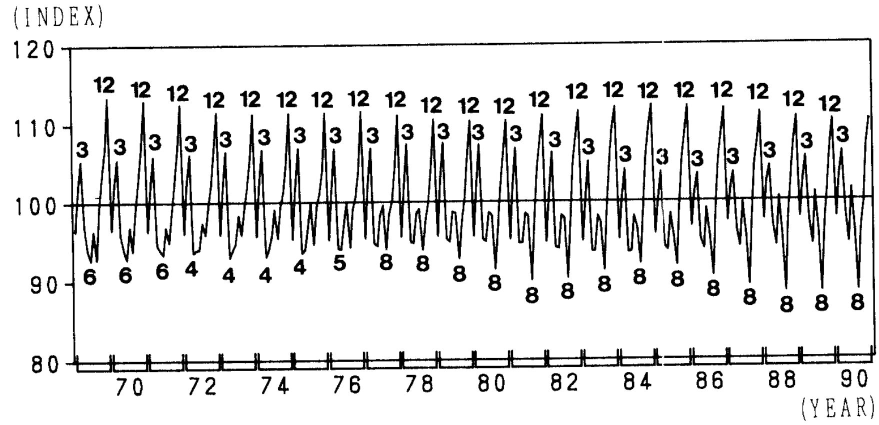

Fig. 5. Seasonal index of domestic sawlogs quantity supplied to sawmill (Q61).

'June' is a rainy season in Japan, so the quantity of the supply has a tendency to decrease. And, as 'August' contains the summer vacation, the rate of operation of sawmill is probably less than the other months.

(b) Foreign log

The seasonal index of foreign sawlogs supplied to sawmill is shown in Fig. 6. The bottom months have been 'January'. 'August' is the bottom month around 1970 and 1980. The peak months have been 'November' and 'December' before 1975 and during the period of 1978–1984. In most of the other periods, the peak months have been 'June' or 'July'. The peak is not so clear as the bottom.

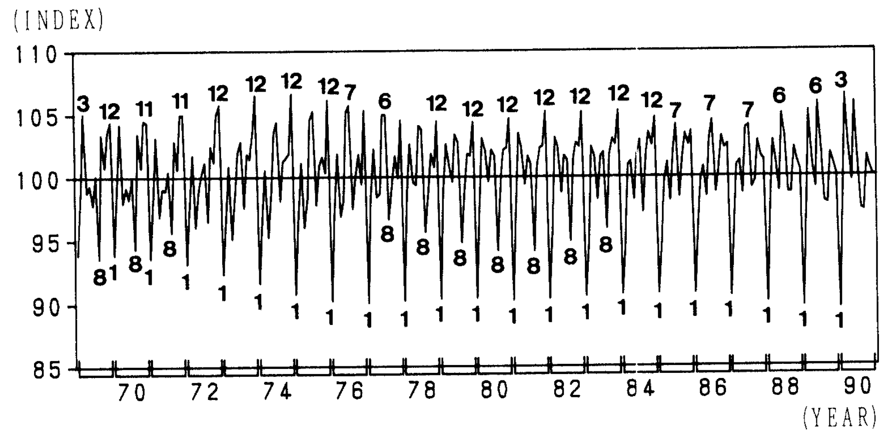

Fig. 6. Seasonal index of foreign sawlogs quantity supplied to sawmill (Q62).

(c) Sawlogs consumption

Next, let's consider about the sawlogs consumption in sawmill. The seasonal index of the

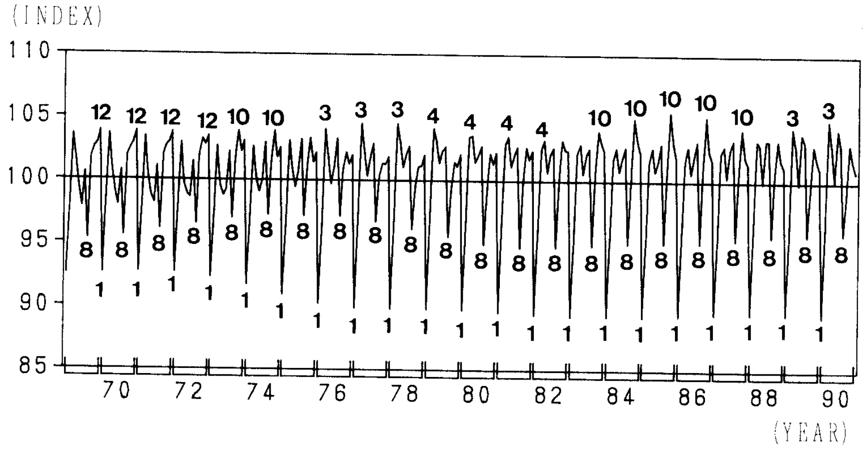

Fig. 7. Seasonal index of sawlogs consumption in sawmill (Q63).

consumption is shown in Fig. 7. The bottom months have been 'January' and 'August' through the whole researching periods. The peak months have been 'October' or 'December' before 1974 and during the period of 1983–1987, and have been 'March' or 'April' in the other periods. As similar to Fig. 6, the peak is not so clear as the bottom. The ratio of operation of sawmill in both months is supposed to be low because of the vacations in summer and winter. There are twice high-demand periods in a year, which are called "demand-in-spring" and "demand-in-autumn", respectively. Two types of peak are almost wholly reflected by these demand seasons.

(2) Lumber production and stock

(a) Lumber production

The seasonality of lumber production in sawmill is very much alike to that of the lumber consumption in sawmill as shown in Fig. 7. This may mean that the stock level of log in sawmill is not so high.

(b) Lumber stock

The seasonal index of the lumber stock has been almost constant during the researching periods as shown in Fig. 8. The peak months have been 'March', excepting 1989, and the bottom months have been from 'September' to 'December'. Varying in an expression, the inventory-building occurs from autumn to spring, and the inventory-cutting occurs from spring to autumn. The recent amplitude is half the percentage of that of before 1986.

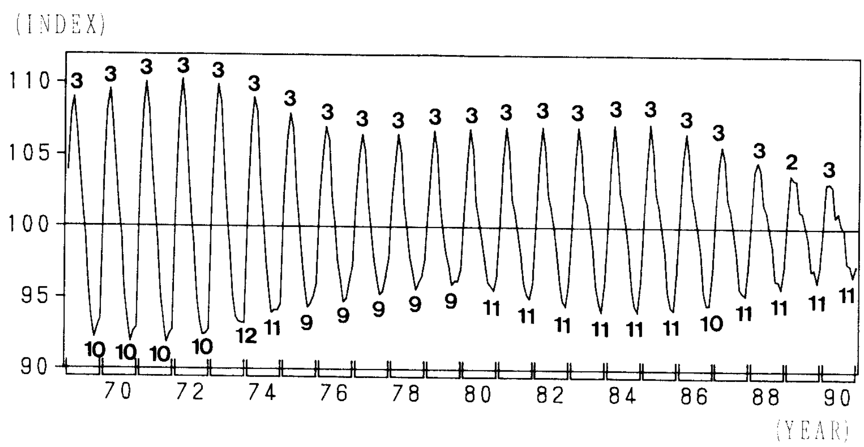

Fig. 8. Seasonal index of domestic lumber stock (Q65).

5. A classification of the seasonal index

As similarly in case of the price index, we try to categorize the quantitative variables from the viewpoint of the seasonal fluctuation. The same method introduced already in the previous paper is adopted also in this paper. However, the definition of measures of similarity is different. As the units of quantitative variables are different, the square Euclidean distance used in the previous paper is not well fitted as a measure. In this paper, the standardized square Euclidean distance is used as the measure of similarity. As shown already, the seasonal patterns of quantitative variables are stable compared with those of the price variables. However, additionally in this paper, we try to categorize the variables according to the period division used in case of the price analysis in the previous paper in order to compare the both results.

The dendrogram in the first half is shown in Fig. 9. Firstly, we can divide these quantitative variables into two groups. Group 1 contains the import quantity from U.S.A. & Canada and U.S.S.R. as well as the building construction started. The other variables are contained in group 2, but the import quantity from south sea countries is different from the other variables in this group 2, as it contains all the variables related to the domestic lumber production or the sawmill

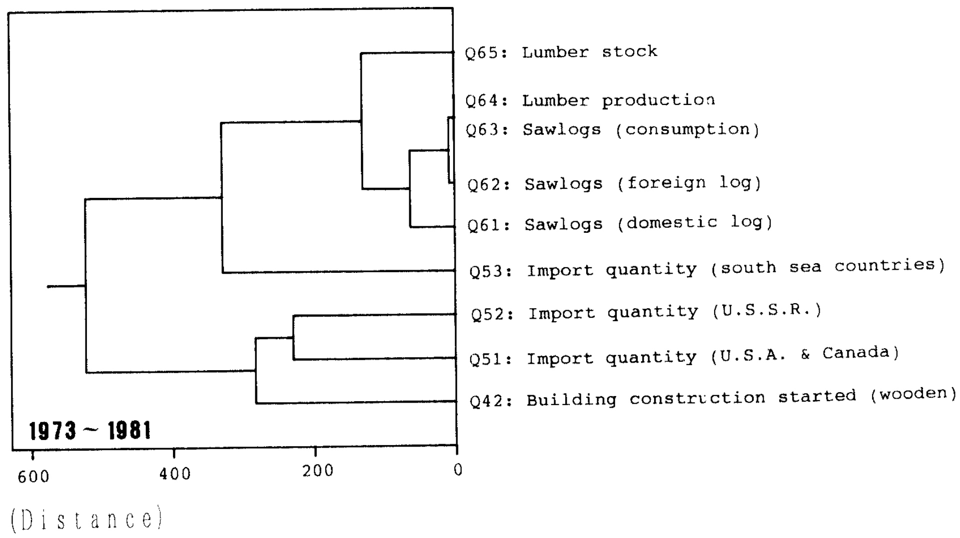

Fig. 9. Dendrogram of seasonal index of quantitative variables (1973–1981).

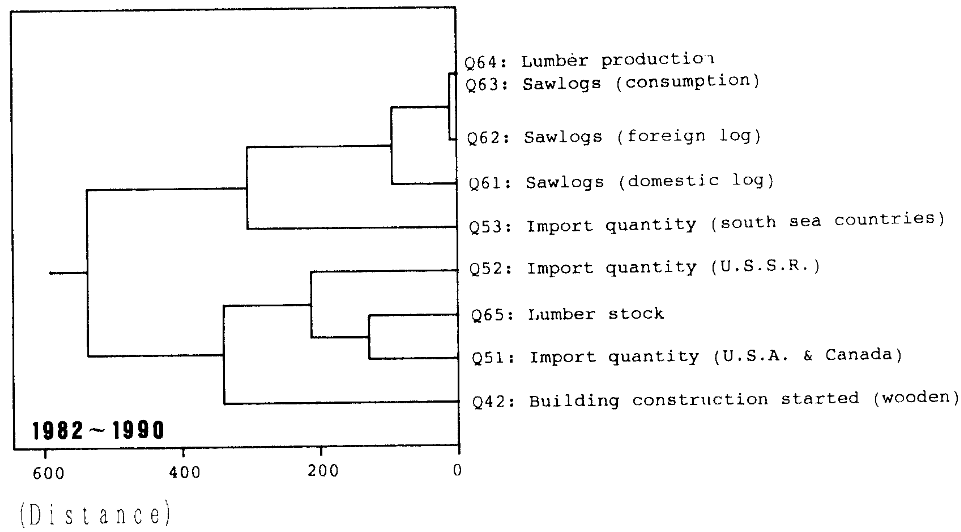

Fig. 10. Dendrogram of seasonal index of quantitative variables (1982–1990).

activities. As mentioned previously, the statistics on the wooden building construction started does not mean the real seasonal pattern of the lumber usage in the construction fields. We have to pay attention to this fact also in this figure.

The dendrogram in the second half is shown in Fig. 10. Almost the same dendrogram is shown. The different point from the result in the first period is the location of the variable on the lumber stock. In the second half, the lumber stock is located near the import quantity from U.S.A. & Canada and U.S.S.R.

Discussion

1. Construction activities

As shown in the previous paper, the seasonal index of wood, lumber and related products price has almost the same pattern as that of construction materials price. So, it is important for the understanding of the seasonality of timber price to analyze the seasonality of construction activities and construction materials movement. As we discussed the pattern of seasonal indexes of construction started already, we are going to refer to several topics related to the seasonality of construction activities.

As shown in Fig. 1, there is a strong seasonality in the construction activities, that is, the pattern of the peak and the bottom is clear and the amplitude is large. This figure applies only to the wooden construction started, but the result in case of all of the constructions started is almost the same. What causes the seasonality? As the construction activities are generally outdoor workings, so the climate and seasonal factor influence the activities. This reason seems to be the most important. However, recently, the rate of wooden construction to all the constructions in floor area basis has become less and less. In 1990, the ratio reaches to 31.6%. The proportion of the other structures is as follows: the proportion of steel frame and reinforced concrete is 12.3%, that of reinforced concrete is 21.3%, that of steel frame is 34.6%, that of block concrete is 0.1%, and that of the others is 0.1%. The construction made of steel and concrete has increased. Of course, there is a seasonality also in non-wooden construction, but it is supposed to be weaker than that in the wooden one.

In 1989, the proportion of the public investor to all investors is 8%. This rate is not so high, but the proportion is high in country area. And the public construction activities are changeable by policy. The public construction started is also important in these senses. To calculate the public work quarterly in value basis in fiscal year 1988, 1989 and 1990, the value of peak quarter (third quarter) is 1.94, 2.11, 2.04 times respectively as large as that of bottom quarter (first quarter). The same ratio on all constructions in the same period is 1.38, 1.38, and 1.32, respectively. Generally, the seasonal fluctuation of public construction is larger than that of private one. One of the reasons why large seasonality is occasioned lies in the budget system of Government. In 1950's and 1960's, such seasonal variations in construction activities were not so important problem, because the surplus labor existed. Recently in Japan, a labor shortage especially in the field of physical work has been one of the most important economic problems. The construction is one of the worst industries from the view point of the labor circumstances. "White paper on construction" in 1991 introduces the seasonality of labor demand and supply[14]. This labor shortage is one of the factors that require a levelling out. By using the monthly based statistics in value basis, the peak and the bottom months of the public construction started have been 'September' and 'February', respectively, since 1986. The value in the peak month is almost three times as much as in the bottom. It is needless to say that the ratio of month basis is greater than that of the quarter basis.

In this paper, we use only the construction movement as the demand factor. In 1989, the usage field of industrial wood is as follows: 48.5% is for lumber, 37.2% is for pulp and chips, 13.1% is for plywood, 1.2% is for the others. Recently the proportion of the processed usage is increasing. Processed goods have also characteristics as consumer goods. The seasonality of this type of demand supposed to be weaker than that of demand in construction field. The materials used in construction activities are one of the investment goods, so the range of the fluctuation is bigger than that of consumer goods in general. The increasing tendency in the proportion of the processed wood contributes the levelling out of seasonality.

2. Relationship between price series and quantitative series

We have discussed the seasonality of price series and quantitative series separately. As shown already, the relationship between these two seasonalities is not clarified enough.

Firstly, let's calculate the correlation matrix between variables P13, P21–P34, Q42 and Q51–Q64. The researching period is 1973–1981. The results are omitted on account of space consideration. All the absolute values of the correlation coefficient except the following one combination are less than 0.6: the one combination is Japanese cypress log price (P22) and the import quantity from U.S.S.R. (Q52). The correlation coefficient is 0.64. However, it is clear that there is no direct causal relationship between these two variables. Generally, the signs of correlation coefficient show negative. The variables showing a tendency to get positive sign are Japanese cypress log (P22) and Japanese cypress squares (P32) within price variables, timber import from U.S.S.R. (Q52) and lumber stock (Q65) within quantitative variables.

Although the correlation coefficient is a little low, in case of Japanese cypress, for both log and lumber, the seasonal movement seems to be exceptional. In general, lumber and related products made of Japanese cypress are dealt as lumber of good quality, realizing a higher price than the other species. U.S.S.R. is one of the countries that adopt the planned economy system, so the contract of import is different from other foreign timbers. The signs of the correlation coefficient between the stock variable and the price index have a tendency to get positive sign. It seems that the changes in inventory are caused by intended inventory investment, not by unplanned one.

Although the correlation coefficient between the other variables gets the negative sign in general, the correlation is weak. The weak negative correlation may exist in general between the seasonality of timber price index and that of the related quantitative index.

Next, we show the result of the same analysis in the second half (1982–1990). The variables used in this analysis is the same as shown in Fig. 9. It is the same result as above that there are many negative signs in correlation coefficient between the seasonal index of price indexes and that of quantitative ones. The absolute value of the correlation coefficient is less than 0.6 excepting one combination, that is, Japanese cedar log price (P21) and the import quantity from U.S.S.R. (Q52). However, the exceptional variables are different from the result in the first half. In this second half, the variables that get positive signs are as follows: construction materials (P13) and Japanese cypress squares (P32) within price series, Lauan import (Q53) and domestic sawlogs supply to sawmill (Q61) within quantitative series. As of Lauan, the limits to resources have been pointed out recently, and the main factor of price formation may change from the demand side to the supply side. Recently the timber import from U.S.S.R. is sluggish. Although there are a lot of reasons why the timber import from U.S.S.R. is not increasing, one of the reasons is the competition to the timber import from U.S.A. Within such competitive economic circumstances, the pattern of the import quantity from U.S.S.R. has been quite unchangeable.

The dendrogram of cluster analysis that try to categorize the price variables and the quantitative variables together is omitted as space is limited. Standardized square Euclidean distance is used as a measure of similarity because of the same reason shown in Fig. 9, or in Fig. 10. The researching period is divided into two periods, that is, 1973–1981 and 1982–1990. As the result, all of the price variables have similarity compared with the quantitative variables. The only exception is Lauan price in the first half. As already discussed, the absolute value of the correlation coefficient is low. And the direct relationship between the peak and the bottom months is not so clear, as you can understand in figures already shown. In addition, this cluster analysis confirms that the relationship between the seasonality of price fluctuation and that of quantitative one is very weak.

In Japan, the proportion of imported timber is increasing. Thus the import movement is one of the important factors for price fluctuation[9]. Mori[17] and Kishine[5] have reported the reverse relationship between the timber price and import quantity in 1970. We can point out that this relationship is not stable and has been weak recently[11].

Summary

Using time-series-analysis, we calculate the seasonal index of the quantitative variables assumed to be related to the timber price movement. The results are as follows:

1. The pattern of seasonality of construction started is almost fixed through the researching periods. The amplitude is also fixed. The peak month is 'April' or 'July', and the bottom month is 'January'. There can be no direct relationship between the seasonal index of construction started and that of construction materials price. (Fig. 1)

2. The pattern of seasonal index of import quantity may vary in accordance with the import countries. But the pattern of each import timber is almost fixed. The amplitude of the seasonal index is almost constant for the timber from U.S.S.R. and Lauan, but is changeable for the timber from U.S.A. and Canada. (Fig. 2–Fig. 4)

3. The seasonal pattern of variables on sawmill is quite fixed through the researching periods. Only the lumber stock movement has a different seasonality. (Fig. 5–Fig. 8)

4. The classification of the quantitative variables by cluster analysis is not so clear compared with that of the price variables. There is almost no similarity between the variables related to activities in sawmill and building construction started. (Fig. 9, Fig. 10)

5. A reverse relationship between the timber price and the import quantity was pointed out in 1970 from the view point of the seasonality. This relationship is not stable and has been weak recently.

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